Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BPHARM – SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 220001 **Date: 12-01-2013**

Subject Name: Applied Mathematics (Biostatistics)

Time: 10:30 am – 01:30 pm **Total Marks: 80**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Enumerate the various methods of sampling. Discuss any two methods with suitable examples. **06**

(b) A population is divided into 4 strata consisting of 30, 40, 50 and 70 items. From each stratum a random sample is drawn. Sample values are given in the following table. Estimate the population mean and total of the population. **05**

Stratum No.	Stratum Size	Sample Size	Sample Values
1	30	3	2, 7, 9
2	40	4	3, 4, 8, 5
3	50	5	8, 6, 3, 7, 1
4	70	7	4, 9, 5, 10, 3, 6, 12

(c) In a laboratory experiment two random sample gave the following result. **05**

Sample	Size	Sample mean	Sum of squares of deviations from the mean
1	10	15	90
2	12	14	108

Test the equality of sample variance at 5% level. [$F_{9,11,0.05} = 2.90$]

Q.2 (a) Following are the values of production of bulk drug A in tons by two companies. Calculate the correlation coefficient and give your comment on result obtained. **06**

Company	Values of production of bulk drug A (tons)							
1	10	11	14	14	20	22	16	12
2	12	14	15	16	21	26	21	15

(b) What do you mean by correlation? Distinguish between positive, negative and zero correlation? **05**

(c) Obtain the two lines of regression for the following data. **05**

Sales of Diclowin tablets (No.)	190	240	250	300	310	335	300
Adv. Expenditure (in Rupees)	5	10	15	20	20	30	30

Q.3 (a) Explain following: **06**

[1] Type I and Type II error

[2] Null hypothesis and Alternative hypothesis
[3] Level of significance

(b) A random sample of 25 tablets from a batch gives a mean ingredient content of 37 mg and standard deviation of 7mg. Test the hypothesis that mean ingredient content in the population mean is 40mg. [t_{24}=1.711] **05**

(c) A Contract Research Organization conducted a pharmacokinetic study in 12 human volunteers. The maximum concentration of the therapeutic agent in plasma (C_{max}) was studied after administration of a new formulation and an established formulation. The data are given below. **05**

Established formulation (C_{max}) µg/ml	5.6	6.9	5.8	5.8	6.0	5.6
New formulation (C_{max}) µg/ml	9.6	5.7	7.8	8.5	9.4	7.9
Established formulation (C_{max}) µg/ml	7.1	5.8	5.1	5.7	5.9	4.8
New formulation (C_{max}) µg/ml	8.4	13.7	26.9	21	17.5	19.6

Test whether there is statistical significance of difference between the two formulations. [$t_{11,0.05}$=2.20]

Q.4 (a) [1] Explain Chi-square test for goodness of fit. **06**
[2] Explain Regression and lines of regression.

(b) A controlled experiment was conducted to test the effectiveness of a new drug. Under this experiment 300 patients were treated with new drug and 200 were not treated with drug. The results of the experiment are given below: **05**

Particulars	Cured	Condition worsened	No effect
Treated with the drug	200	40	60
Not treated with the drug	120	30	50

Use χ^2 test and comment on the effectiveness of the drug. [$\chi^2_{2,0.05}$ = 5.991]

(c) Two regression lines involving variables x and y are y = 5.6 +1.2x and x = 12.5 + 0.6y. Find the means of x and y and the correlation coefficient between x and y. **05**

Q.5 (a) Define ANOVA. Discuss the major assumptions of ANOVA. Explain the ANOVA for one – way classification. **06**

(b) The determination of C_{max} of drugs in µg/ml at three different formulations A, B and C was the subject of recent experiment. Four different subjects chosen at random from a group were used for this purpose. The data recorded are given in the following table. **05**

Subject	A	B	C
1	29	11	15
2	17	4	9
3	34	6	27
4	40	9	25

Carry out the two – way ANOVA and test at 5% level of significance that [1]

there is no significant difference among the subjects and [2] there is no significant difference among the maximum plasma concentrations of the three formulations A, B and C. [$F_{3,6,0.05}$= 4.76 and $F_{2,6,0.05}$= 5.14]

(c) Enlist various types of Non-parametric test. Discuss advantages and disadvantages of Non-parametric test. **05**

Q. 6 (a) Write a note on WILCOXON Signed Rank Test and Kruskal – Wallis (H – test) test. **06**

(b) To test the effectiveness of the new diet pill, nine randomly selected subjects were weighed before went on the pill for six months. Their weights in kilograms before and after the program were recorded as under **05**

Subject	1	2	3	4	5	6	7	8	9
Initial weight	80	82	75	90	98	87	100	107	103
Final weight	79	83	75	81	95	86	101	105	100

Apply Wilcoxon signed rank test to test the hypothesis. Table values for n=8 is 3.

(c) Dissolution is compared for three experimental batches with the following results (each point is the time in minutes to 50% dissolution for a single tablet): **05**

Batch 1	15	18	19	21	23	26
Batch 2	17	18	24	20		
Batch 3	13	10	16	11	9	

Is there a significant difference among batches? Use Kruskal- Wallis test [$\chi^2_{2,0.05}$ = 5.991].

Q.7 (a) Explain the following terms in relation to Experimental design in clinical trials. **06**
[1] Cross over design
[2] Carry over effect or residual effect
[3] Wash out period

(b) Discuss Parallel design. Differentiate parallel and cross over design. **05**

(c) Discuss types of distributions with examples. **05**

****