GUJARAT TECHNOLOGICAL UNIVERSITY

B. Pharmacy Sem-II examination June 2009

Subject code: (220001) **Subject Name: Applied Mathematics (Biostatistics)**

Date : 08/06/09 **Time : 11:30am-2:30pm**

Total Marks: 80

Instructions:

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

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Q-1 **A** What is correlation? Distinguish between positive, negative and zero correlation. **04**

B The following data gives the age and blood pressure (B.P.) of 10 women. **05**

Age	56	42	36	47	49	42	60	72	63	55
(B.P.)	147	125	118	128	145	140	155	160	149	150

i) Find the correlation coefficient between age and blood pressure.

ii) Determine least square regression equation of blood pressure on age

Estimate the blood pressure of women whose age is 45 years.

C A Beer's law plot is constructed by plotting ultraviolet absorbance vs. concentration, with following result: **04**

Concentration (x)	1	2	3	5	10
Absorbance (y)	0.10	0.36	0.57	1.09	2.05
XY	0.10	0.72	1.71	5.14	20.50

i) Calculate slop and intercept

ii) An unknown has an absorbance of 1.65. What is the concentration?

D Obtain the rank correlation coefficient between Fasting blood glucose level and systolic blood pressure in 10 diabetic patients. **03**

Sr. no of patients	1	2	3	4	5	6	7	8	9	10
Fasting blood glucose level(mg/dl)	90	92	98	112	120	121	126	132	143	145
Systolic blood pressure (mmHg)	136	140	142	130	148	135	150	170	145	165

Q-2 **A** What is analysis of variance? **01**

B What are the major assumptions of ANOVA? **03**

C Eight laboratories were requested to participate in experiment whose objective was to compare the dissolution rates of two generic products and standard product. The purpose of the experiment was to determine. **07**

i) If the product had different rates of dissolution.

ii) To estimate the laboratory variability and test for significance difference among laboratories. Carry out two-way ANOVA for the given data and give your conclusion

Laboratory	1	2	3	4	5	6	7	8
Generic A Tablet	89	93	87	80	80	87	82	68
Generic B Tablet	83	75	75	76	77	73	80	77
Standard Tablet	94	78	89	85	84	84	75	75

(From the F distribution table- $F_{2,14}$= 3.74,$F_{7,24}$=2.43 and $F_{14,24}$= 2.13 at 5%level of significance)

D The hemoglobin level of three group of children fed on three different diets are given in **05**

the following table. Test the means of these three groups differ significantly.

Table: Hemoglobin level (%) of children fed with three different diets.

Sr. no.	1	2	3	4	5	6	7	8	9	10	11	12
Group I	11.6	10.3	10.0	11.5	11.8	11.8	12.1	10.8	11.9	10.7	11.5	_
Group II	11.2	8.9	9.2	8.8	8.4	9.1	6.3	9.3	7.8	8.8	10.0	9.7
Group III	9.8	9.7	11.5	11.6	10.8	9.1	10.5	10.0	12.4	10.7	_	_

(From F distribution table $F_{2,30} = 3.32$ at 5%level of significance

Q-3 **A** Explain the following terms related to testing of hypothesis. **04**

i) Null hypothesis
ii) Alternate hypothesis
iii) Level of significance
iv) Standard error.

B A clinical research center of Zydus Cadila pharmaceutical conducted a pharmacokinetic study in 12 human volunteer. The maximum therapeutic concentration of drug in plasma(C_{max}) was studied after administration of new formulation and established formulation. **06**

Established formulation (C_{max})mcg/ml	5.6	6.9	5.8	5.8	6.0	5.6	7.1	5.8	5.1	5.7	5.9	4.8
New formulation (C_{max}) mcg/ml	9.6	5.7	7.8	8.5	9.4	7.9	8.4	13.7	26.9	21.0	17.5	19.6

Test whether there is statistical significance of difference between the two formulations. ($t_{11,0.05}$=2.20 at 5% significance level)

C The following data shows the blood pressure reduction (in mmHg) caused in 10 animal by a new antihypertensive compound. Test the hypothesis that blood pressure reduction for population in 15 mm Hg. ($t_{9,0.05}$=2.262 at 5% significance level) **06**

Blood pressure reduction (mm Hg.)	15	18	14	8	20	12	17	21	16	18

Q-4 **A** Enumerate the experimental designs in clinical trials? Discuss in detail about any one experimental design. **08**

B Explain following terms with reference to experimental designs in clinical trials. **08**

i) Wash out period ii) Carry over effect
iii) Replicate design iv) Crossover Design

Q-5 **A** What is type I and type II errors. **04**

B Discuss in brief chi square test or goodness of fit. **03**

C Two granulation were prepared by different procedure Seven different random samples of powdered mix of equal weight (equal to weight Of Final Dosage from) were collected from each batch and assayed for active pharmaceutical ingredient. The test is to be performed at the 5% level. (From F distribution table $F_{6,0.05}$=5.8) **05**

Granulation A	20.6	20.9	20.6	20.7	19.8	20.4	21.0
Granulation B	20.2	21.5	18.9	19.0	21.8	20.4	21.0

D A certain drug is claimed to be effective in curing colds. In experiment on 500 person with cold, half of them were given the drug and half of them were given sugar pill. The **04**

patient's reaction to the treatment is recorded in following table. On the basis of these data conclude that there is significance difference in the effect of drug and sugar pill. The test is to be performed at the 5% level
(Critical value of Chi square $\chi^{2=}$ 5.99 at 2 d.f.)

Treatment	Consequence			
	Helped	Reaction	No effect	Total
Drug	150	30	70	250
Sugar pill	130	40	80	250
Total	230	70	150	500

Q-6 **A** Enumerated the various methods of sampling and discuss in detail about any two methods with suitable examples. **08**

B What are the advantages of and characteristics of the sample? **03**

C Differentiate between the sampling with replacement and without replacement **02**

D A population consists of five numbers 2,3,6,8.11. consider all possible size of two which can be drawn with replacement from this population. Calculate the standard error of sample mean **03**

Q-7 **A** What arte the advantages of nonparametric tests **03**

B Write note on followings (any two) **06**

i) Wilcoxon signed rank test ii) Kruskal wallis test iii) Wilcoxon rank sum test.

C A Bioavailability study was conducted in which two products were compared (A and B formulation) . The peak blood concentrations were as follows; Use Wilcoxon signed rank test to determine if there is a difference among formulation. (Critical value for T at P= 0.05 for 12 pairs from table = 11) **04**

Subject	1	2	3	4	5	6	7	8	9	10	11	12
A	2.5	3.0	1.25	1.75	3.5	2.5	1.75	2.25	3.5	2.5	2.0	3.5
B	3.5	4.0	2.5	2.0	3.5	4.0	1.5	2.5	3.0	3.0	3.5	4.0

D In the study of cerebrovascular disease, patient from 3 socioeconomic backgrounds were thoroughly investigated. One characteristic measures was diastolic blood pressure (mmHg).Is there any reason to believe that the 3 groups differ with these characteristics? **03**

(Table value of $\chi^{2=}$ 5.99 at d.f.=k-1=2 and alpha = 0.05)

Group A	100	103	89	78	105	
Group B	92	97	88	84	90	95
Group C	81	102	86	83	99	

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