UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Programme Name: B.Tech (GSE; GIE) **Semester : VI**
Course Name   : Statistical methods in Geosciences **Time   : 03 hrs**
Course Code   : GSEG 331-For GIE; GSEG 333-For GSE **Max. Marks: 100**
Nos. of page(s)   : 2
Instructions: Answer each question in separate page.

SECTION-A (5x4=20)		

Sl. No.	Briefly answer following	Marks	CO
Q1	Why variance of a sample population cannot be negative?	5	CO1
Q2	What is additive rule of probability?	5	CO2
Q3	Prove for a given event (A) probability (P) of $P(A)+P(A^c)=1$ Draw corresponding Venn Diagram.	5	CO2
Q4	Describe central limit theorem.	5	CO3

SECTION-B (10x4=40)		
Answer question 5 and any three from rest of the following.		

Q5	a. What is the difference between one tail test and two tail test in statistical hypothesis testing the terms of critical value selection for any significance level? b. What are the characteristics of "t" distribution?	5 + 5 = 10	CO2
Q6	Suppose you work in a TV news channel and has been assigned to make a survey on exit pole to predict election result before official declaration of the result. Describe how you will conduct your survey.	10	CO3
Q7	Over a long period, it has been observed that a given rifleman can hit a target on a single trial with probability equal to 0.8. Suppose he fires four shots at the target. a. What is the probability he will heat the target exactly twice? b. What is the probability he will heat the target only once?	5 + 5= 10	CO1
Q8	Labels on 1-gallon cans of paint usually indicate the drying time and the area that can be covered in one coat. Most brands of paint indicate that, in one coat, a gallon will be covered between 250 and 500 square feet, depending on the texture of the surface to be painted. One manufacturer however claims that a gallon of its paint will cover 400 square foot of area. To test this claim a random sample of ten 1-gallon cans of white paint were used to paint ten identical areas using the same kind of equipment. The actual areas (in square feet) covered by these 10 gallons of paint are given here: 310 311 412 368 447 376 303 410 365 350	10	CO3

	Do the data present sufficient evidence to indicate that the average coverage differs from 400 square feet? Present your evidence with 95% confidence level.		
Q9	An experimenter is convinced that her measuring instrument had a variability measured by standard deviation of 2. During an experiment, she recorded the measurements 4.1, 5.2, and 10.2. Do these data confirm or disprove the claim of the experimenter? Test appropriate hypothesis with 90% confidence level.	10	**CO3**

SECTION-C (20x2=40)
Answer question 10 and any one from rest of the following.

Q10	Find the least squares prediction line for the calculus grade data of the following considering Mathematics Achievement Test Score as independent variable and final calculus grade as dependent variable.	20	**CO2**

Student	Mathematics achievement test score	Final Calculus Grade
1	39	65
2	43	78
3	21	52
4	64	82
5	57	92
6	47	89
7	28	73
8	75	98
9	34	56
10	52	75

Q11	The variability in the amount of impurities present in a batch of chemical used for a particular process depends on the length of time the process is in operation. A manufacturer using two product lines 1 and 2 has made a slight adjustment to line 2, hoping to reduce the variability as well as the average amount of impurities in the chemical. Samples of $N_1 =25$ and $N_2 =25$ measurements from the two batches yield these means 3.2 (X_1) and 3.0 (X_2) and variances $S_1^2=1.04$ and $S_2^2=0.51$. Do the data present sufficient evidence to indicate that the process variability is less for line 2? Present the result with 95% confidence level.	20	**CO2**
Q12	a. What is autocorrelation and what is its importance in time series analysis? b. What is Type-I and Type-II error in statistical hypothesis testing? c. What is nugget, sill and span in a semivariogram?	10+5+5	**CO1**

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SECTION-A (5x4=20)

Sl. No.	**Briefly answer following**	**Marks**	**CO**
Q1	What is multiplicative rule of probability?	5	**CO1**
Q2	For a given sample population, variance is 36. Calculate the standard deviation.	5	**CO2**
Q3	Define Baye's rule.	5	**CO2**
Q4	What is complement of an event in terms of probability? Explain with proper Venn diagram.	5	**CO3**

SECTION-B (10x4=40)
Answer question 5 and any three from rest of the following.

Q5	For a hypothesis testing problem of t-test a researcher gets a test statistic value of 3.42 and the critical value is 2.33 for a corresponding significance level. From this information the researcher accept the Null hypothesis and makes a conclusion accordingly. If the researcher is making any statistical error? Explain with reasoning.	10	**CO2**
Q6	In a physical exercise program, it has been observed that average of 100m run time for women is 18 seconds. Whereas for men it is 14 seconds with 2 seconds standard deviation. Data obtained for men is from a sample size of 50 men. Does the data provides that 100m run time for women is significantly high that of men? Do the appropriate hypothesis testing and present your interpretation with 99% confidence level.	10	**CO3**
Q7	A brand of new energy drink can only be launched in market if it contains less than 5mg of tannin for a 250ml container can. For quality control purpose health department of government took seven samples from there production plant and found that the amount of tannin as follows 5.2 5.1 4.8 5.4 4.9 5.5 4.7 Does the data present sufficient evidence to pass the quality control test of government? Present your inference with proper hypothesis testing and confirm the result with 95% confidence level.	10	**CO1**
Q8	For a random sample of 25 observations from a normal population produced a	10	**CO3**

	sample variance equal to 21.4. Does this data provide sufficient evidence to indicate that population variance is more than 15? Do an appropriate hypothesis testing with 95% confidence level.		
Q9	For analysis of variance, describe experimental unit; factor; level; treatment and response.	10	**CO3**

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SECTION-C (20x2=40)
Answer question 10 and any one from rest of the following.

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Q10	Find the least squares prediction line for depth verses moisture content data of the following and predict soil moisture at depth of 40 ft. <table><tr><td>Sl No</td><td>Depth (ft)</td><td>Moisture (g water/100 g dried soil)</td></tr><tr><td>1</td><td>0.0</td><td>124.0</td></tr><tr><td>2</td><td>5.0</td><td>78.0</td></tr><tr><td>3</td><td>10.0</td><td>54.0</td></tr><tr><td>4</td><td>15.0</td><td>35.0</td></tr><tr><td>5</td><td>20.0</td><td>30.0</td></tr><tr><td>6</td><td>25.0</td><td>21.0</td></tr><tr><td>7</td><td>30.0</td><td>22.0</td></tr><tr><td>8</td><td>35.0</td><td>18.0</td></tr></table>	20	**CO2**
Q11	Given the data of atmospheric micro particle data (ppb) of Antarctica (n=8) and Greenland (n=9). <table><tr><td>Antarctica</td><td>Greenland</td></tr><tr><td>3.7</td><td>3.7</td></tr><tr><td>2.0</td><td>7.8</td></tr><tr><td>1.3</td><td>1.9</td></tr><tr><td>3.9</td><td>2.0</td></tr><tr><td>0.2</td><td>1.1</td></tr><tr><td>1.4</td><td>1.3</td></tr><tr><td>4.2</td><td>1.9</td></tr><tr><td>4.9</td><td>3.7</td></tr><tr><td>--------</td><td>3.4</td></tr></table> Do the two samples appear to be drawn from the same population and do your conclusions tend to be substantiate or refute the idea of atmospheric homogeneity? Draw your inference at 95% confidence level.	20	**CO2**
Q12	a. What are the characteristics of "z" distribution for a normal population? b. What are the required characteristics of a time series to perform an autocorrelation test? c. Draw idealized semivariograms showing Parabolic form; Linear form; Horizontal form; Nugget form.	10+5+5	**CO1**