TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Ashwin

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	1 / I	Time	3 hrs.

Subject: - Applied Research Methodology and Statistics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any Five questions selecting Two from Group A and Three from Group B.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

Group A

1. a) Besides defining the research work, why it is necessary to find out its characteristics? What are the functions of definition and characteristics of the research work? [7]

   b) According to the criteria – topic, analysis and communication how quantitative and qualitative ways of doing things in research work are differentiated, explain with examples. [8]

2. a) Which part of the research work is supposed to start even before the research work itself and continues even after the duration of the research work. Mention the part of the research work and explain its functions. [7]

   b) What are the basic requirements to be fulfilled before the writing of a research proposal? Suggest a list of contents for a research proposal. [8]

3. a) Explain what is a research problem and determine the things to be considered when it is selected. [7]

   b) How variables are identified in a research work? What are the basic features and functions of the variables in a research work? Explain with examples. *[8]*

Group B

Pull out needed data for statistical functions from the tables provided.

4. a) Laden weight of commercial vehicles passing a section of a highway is normally distributed with mean of 15 tonnes and standard deviation of 5 tonnes. A vehicle is classified overloaded if its laden weight is more than 16 tonnes. Determine: [5]

      i) The Probability that a randomly selected commercial vehicle is overloaded.
      ii) The Probability that exactly 3 commercial vehicles out of 10 randomly checked commercial vehicles in this highway section would be overloaded.
      iii) The expected number of overloaded commercial vehicles out of the 10 randomly checked commercial vehicles in question 4.a.ii).

   b) Trucks passing a section of a highway were inspected one by one if they are equipped with seat belt or not. The probability that a randomly selected truck is without a seat belt is 0.3. [5]

      i) Determine the expected number of trucks to be inspected to identify a truck without seat belt for the first time.
      ii) Determine the probability that 2 or less trucks are to be inspected to identify a truck without seat belt for the first time.
      iii) 10 trucks are randomly selected and inspected independently. What is the probability that 2 out of the 10 trucks inspected are without seat belt if the total registered trucks in the city is 200 and 50 of them do not have seatbelts?

5. a) An hour video recording of a signalized pedestrian crossing on a busy mid-block section of an urban highway revealed that 40 pedestrians out of 100 randomly selected pedestrians violate the pedestrian signal. [4]

i) Make an estimate of the true proportion of pedestrian violation at the pedestrian crossing and estimate its standard error.

ii) Using this point estimate, determine the number of samples to be checked to keep the error in estimating the true proportion to less than 0.05 at 90% confidence level.

b) From the recording mentioned in question 5.a, waiting time of a sample of 25 pedestrians that violated the signal was measured and the mean pedestrian waiting time and its standard deviation was found to be 30 seconds and 20 seconds respectively. [6]

i) Construct a 90% two sided confidence bound on the mean waiting time of the pedestrians that violated the signal if the total number of violations during the recorded hour is 85.

ii) Determine the sample size of pedestrian violations to be observed to have the same interval length on the mean waiting time as in question 5.b.i) at confidence level of 95% assuming that the mean and standard deviation remain same. iii) Interpret your result in question 5.b.ii).

6. a) The diameter of machine –made gabion wire of 8 SWG (Standard Wire Gauge) from two different wire manufactures is being investigated. Two random samples of sizes $n_1 = 9$ and $n_2 = 9$ gabion wires from the two manufactures (1 and 2) were tested and sample mean diameters and sample variances of $\bar{X}_1 = 3.91$ mm, $S_1 = 0.02$ mm, $\bar{X}_2 = 3.89$ mm and $S_2 = 0.04$ mm respectively were observed. Assuming equal population variances and that the data drawn are from normal populations. [5]

i) Test if the data support the claim that the mean diameter from manufacturer 1 exceeds that of manufacturer 2? Use $\alpha = 0.05$.

ii) Find the p-value.

b) A quality control team is interested on the number damaged street lights in a box of 10 lights (X) and has inspected 75 such boxes of street lights. The following observations on X recorded.

X	FREQUENCY
0	40
1	24
2	11

Use 5% significance level to test whether the binomial distribution provides an adequate model for the data. [5]

7. a) Fit a regression model for number of fatalities (y) as a function of vehicle km travelled (x) to analyze the linear relationship between the two variables using following monthly information. [5]

Month	Vehicle KM Travelled (Millions)	Fatalities
1	244	28
2	227	26
3	260	29
4	255	33
5	269	34
6	274	35
7	283	35
8	277	36

b) *Perform a test for the significance of regression carried out in question 7.a. using ANOVA approach with* $\alpha = 0.05$. [5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Jestha

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Research Methodology and Statistics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *Attempt any Five questions selecting Two from Group A and Three from Group B.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

Group A

1. a) In a computer analogy if 'Present situation or a problem' is in the "Input" box and 'Engineering research' in the "Process" box, what would be in the "Output" box? Give a definition of 'Research' and use this model to explain with an example. [7]

   b) Give a research topic, suggest at least one literature reference, put it in a defined format and mention which format it is. [8]

2. a) In which stage and at what step within it 'The construction of tool' in research work is conducted? Explain with examples. What are the tools that could be used in engineering research works? [7]

   b) Suggest a research topic, explain why it should be considered as a 'research work' and under which type of research it is according to the classifications. [8]

3. a) What are the two basic functions of writing literature review and how they are materialized? [7]

   b) Use examples to illustrate the use of both qualitative and quantitative methods in engineering research works. [8]

Group B

Pull out needed data for statistical functions from the tables provided.

4. a) A class III highway is designed for a "50 years storm" that is for a storm of rainfall amount having return period of 50 years. Assuming that storm occurs once in a year. [5]

   i) Determine the probability that the design rainfall amount will be exceeded for the first time on the fifth year after completion of the construction of the highway.

   ii) Determine the probability that the first such rainfall amount will occur within fifth year of completion of construction of construction of the highway.

   iii) Determine the probability that exactly one such rainfall amount will occur in 5 years period.

   b) The service stations along a national highway are located according to Poisson process with an average of 1 service station in 5 km. [5]

   i) What is the probability that there is at least one service station in the next 5 km of the highway?

   ii) What is the probability that there is no service station in the next 10 km of the highway?

   iii) What is the probability that there are 15 or less service station in the next 100 km of the highway?

$P(X \geq 5) = p(1-p)^{x-1}$

$\frac{e^{-\lambda} \lambda^x}{x!}$ $\lambda = 1$

$1 - P(x \leq 5)$

5. a) A research engineer for a street light manufacturer is investigating life of a new type of street lamp and has tested 50 lamps out of the 200 lamps manufactured to the end of the life. The sample mean and the standard deviation are 10000 and 2000 hours respectively. [6

i) Construct a 90% two-sided confidence interval on the mean lamp life.

ii) Construct a 95% two-sided confidence interval on the mean lamp life.

iii) Compare your results in 5.a (i) and (ii).

b) In question 5.a, [4]

i) Estimate the standard error of sample mean.

ii) What should be the sample size n if we want to halve the length of the interval found for the confidence level of 95% in question 5.a (ii).

6. a) A lab manager is testing two brands of penetrometer needles. Following includes the penetration values observed on 8 bitumen samples with needle of each brand under standard loading condition. [6]

Sample	PENETRATION VALUES	
	BRAND 1	BRAND 2
1	85	90
2	40	42
3	105	102
4	65	65
5	50	54
6	80	82
7	95	95
8	110	105

i) Do the data provide sufficient evidence to conclude that the two brands result different mean penetration values? Use level of significance of 0.05.State necessary assumption for the test.

ii) Find the P-value for the test.

b) Vehicle ownership records of a city show 60% of vehicle owners have only one vehicle, 28% have two vehicles and the rest 12% have three of more vehicles. A researcher conducted a survey on 384 vehicle owners of the same city, selected randomly and observed following frequency.

VEHICLES OWNED	OBSERVED FREQUENCY
One	217
Two	113
Three or more	54

Does the observed frequency fit to the expected frequency as per the vehicle ownership records of the city? Use level of significance of 0.01. [4]

7. a) A study on average distance required for stopping vehicles revealed following set of data observed for 10 cars at varying speeds. [5]

CAR	SPEED (km/h)	STOPPING DISTANCE (m)
1	40	14
2	8	2
3	96	34
4	48	14
5	16	4
6	72	23
7	24	5
8	64	21
9	72	27
10	32	6

i) Fit a simple linear regression model relating stopping distance (y) as a function of speed of vehicle (x) using least squares.

ii) Find the fitted value of y corresponding to x = 10 and the associated residual.

b) Perform a test for the significance of regression carried out in question 7. (a) using ANOVA approach with a = 0.05. [5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Magh

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Applied Research Methodology & Statistics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions selecting **Two** from **Group A** and **Three** from **Group B**.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary figures are attached herewith.***
- ✓ *Assume suitable data if necessary.*

Group A

1. a) Define research work and use computer analogy to explain it in 'Transportation Engineering Research'.
   b) Suggest a research topic to solve the problem of traffic accidents on highways of Nepal and identify the variables involved in the research work.
2. a) Distinguish between quantitative and qualitative methods using different criteria.
   b) Suggest a topic for research in 'Transportation' and list the contents of its research proposal.
3. a) Explain the physical meaning of 'Variables' in a research work. How they are determined in a research work.
   b) Use an example to show how conceptual framework is derived from theoretical framework n literature review.

Group B

4. a) The time between arrivals of taxis at Tribhuvan International Airport follows exponential distribution with a mean of 20 minutes.
   (i) What is the probability that a passenger has to wait more than one hour for a taxi?
   (ii) Determine the length of the interval of time in minutes such that the probability of arrival of at least one taxi during the interval is 0.90.
   (iii) What is the probability that more than two taxis arrive within an hour?
   b) The operational life T of road graders from a manufacturer is known to have a normal distribution with a mean life of 1500 hr and standard deviation of 20hr.
   (i) What is the probability of a machine of malfunctioning in less than 900 hr of operation?
   (ii) 75% of the road graders are malfunctioning in less than x hrs. Determine the value of x?
   (iii) Suppose that five road graders are used in a highway project. What is the probability that more than one of them will malfunction in less than 900 hr of operation? Assume statistical independence between the conditions of the machines.
5. a) In inspecting the quality of soil compaction in a highway project, 10 out of 50 specimens inspected do not pass the CBR requirement.
   (i) Make an estimate of the actual proportion of embankment that will be well compacted to the CBR requirement and estimate the standard error of the point estimator of the proportion.
   (ii) Using the point estimate obtained in i for the preliminary sample of 50 specimens, determine how many specimens must be tested to be 95% confident that the error in estimating the true value of the proportion is less than 0.075?

b) For a certain car model, the number of miles driven before the car fails is assumed to be normally distributed. A sample of 15 cars out of the 200 cars manufactured were tested to the end of the life in a road test. The sample mean and standard deviation were reported to be 12000 miles and 1000 miles respectively.

(i) Construct a 95% two-sided confidence interval on the mean number of miles.

(ii) Construct a 95% lower-confidence bound on the mean number of miles and compare your results with that of i

(iii)An engineer reported a confidence interval of (11346 miles, 12653 miles) but neglected to specify the level. What is the confidence level of this interval? [6]

6. a) Monthly earnings of semi-skilled workers in two cities are being investigated. A random sampling survey is conducted and following results are observed:

City	Sample size	Mean monthly earning (Rs)	Standard deviation (Rs)
A	14	2224	80
B	12	2272	120

(i) Test if the mean monthly earnings in two cities are different. Use 5% level of significance.

(ii) State the necessary assumptions for the test. [5]

b) A Study is being made on payment failures. Pavement failures in 212 areas of different annual temperature classified as cold, warm and hot were checked and classified into four failure types as shown in the table.

Temperature	Failure types			
	A	B	C	D
Cold	41	20	12	16
Warm	31	11	9	14
Hot	15	17	16	10

(i) Conduct a hypothesis test to check if the temperature of the area and the pavement failure types are related at α=0.1.

(ii) Find the P-value for the test. [5]

7. a) A survey of the effect of fare increase on the loss in ridership for transit systems was carried out and the following data were obtained.

Fare increase (%)	Loss in ridership (%)
5	1.5
35	12
20	7.5
15	6.3
4	1.2
6	1.7
18	7.2
23	8
38	11.1
8	3.6
12	3.7
17	6.6
17	4.4
13	4.5
7	2.8
23	8

(i) Fit a simple linear model relating loss in ridership (y) as a function of fare increase (x) using least squares.

(ii)What is the estimate of expected loss in ridership when the fare increase is 25%. [5]

b) Perform a test for the significance of regression carried out in 7.1 using ANOVA approach with $\alpha = 0.05$. [5]

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	171		30
		Time	3 hrs.

Subject: - Applied Research Methodology and Statistics *(CE822)*

2074?

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions selecting **Two** from **Group A** and **Three** from **Group B**.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

Group A

1. a) What are the basic features of 'Literature Review' in a research work and at what stage of research work it is to be conducted? What is the approximate duration of time taken by the literature review in comparison with the time allocated for the whole research work? [7]

   b) Give examples of or identify independent and extraneous variables for the research work on the following topic: [8]

   "The problem of traffic jam at twin bridge area of Thapathali Kathmandu".

2. a) How 'Research' is different from other 'Studies'? Explain with examples. [7]

   b) Nepal is to be divided into zones according to the allowable maximum longitudinal gradient in highways. List two research questions and also formulate the research objectives related to the task mentioned. [8]

3. a) What are the steps to follow in writing a 'Research Proposal'? List the contents of a research proposal. [7]

   b) Cite a paper from a journal and write a brief note on its abstract. [8]

Group B

4. a) A shipment of 20 digital voice recorders contains 5 that are defective. If 10 of them are randomly chosen for inspection, what is the probability that 2 of the 10 will be defective? Also find the mean and variance of the distribution. [5

   b) Suppose the highway safety division wants to investing of the safety of a dangerous intersection. Past police records indicate a mean of fire accidents per months at this intersection. Find the probability of accidents. [5

   i) $P(0 < x \leq 3)$

   ii) More than 3 per month

   iii) $P(2 \leq x \leq 3)$

5. a) An industrial engineer has found that the standard household light bulbs produced by a certain manufacturer have a useful life that is normally distributed with a mean of 250 hours and a variance of 2500. What is the probability that a randomly selected bulb from this production process will have a useful life? [5]

   i) In excess of 300 hours?
   ii) Between 190 and 270 hours?
   iii) Not exceeding 260 hours?

   b) The following measurements show the respective height in inches of 10 fathers and their eldest sons: [5]

Height of father:	66	67	63	71	69	65	62	70	61	72
Height of son:	65	68	66	65	70	67	67	71	62	63

   Obtain the regression line of son's height on father's height and estimate the height of son when his father is found to be 70 inches high.

6. a) Assume that the population of human body temperature has a mean of 98.6° F, as is commonly believed. Also assume that the population standard deviation is 0.62°F. If a sample of size n = 106 is randomly selecting, find the probability of getting a mean of 98.2° F or lower. [5]

   b) A research worker wishes to estimate the mean of a population by using sufficiently large sample. The probability is 0.95 that the sample mean will not differ from the true mean by more than 25% of the standard deviation. How large a sample should be taken? [5]

7. a) The target thickness for silicon wafers used in a certain type of integrated circuit of 245 μm. A sample of 50 wafers is obtained and the thickness of each one is determined, resulting in a sample mean thickness of 246.18 μm and a sample standard deviation of 3.60 μm. Does the data suggest that true average wafer thickness is something other than the target value? Test at 0.01 level of significance. [5]

   b) The specifications for a certain kind of ribbon call for a mean breaking strength of 180 pounds. If 5 pieces of the ribbon (randomly selected from different rolls) have a mean of 169.5 pounds with a standard deviation of 5.7 pounds, test whether the mean breaking strength of the lot may be taken less than 180 pounds at the 0.01 level of significance. [5]

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Part	I / I	Pass Marks	30
		Time	3 hrs.

Subject: - Applied Research Methodology and Statistics

2073?

Candidates are required to give their answers in their own words as far as practicable.
*Attempt any **Five** questions selecting **Two** from **Group A** and **Three** from **Group B**.*
*The figures in the margin indicate **Full Marks**.*
Necessary tables are attached herewith.
Assume suitable data if necessary.

Group A

a) Distinguish between theoretical and conceptual frameworks in a literature review. While developing a theoretical framework, in how many types the information collected in literature review are classified? Describe with examples. [7]

b) In several places of Nepal, construction of roads has disturbed the natural courses of surface and subsurface water flows causing drinking water resources to dry up in a number of villages. Suggest a research topic to study the phenomenon and draw up a research plan for it. [8]

a) What are the differences between qualitative and quantitative approaches in research work? Which one is relatively more suitable in transportation engineering? [7]

b) Show with an example, how the information from a book and that from a paper, published in a journal are different in their nature and uses. [8]

a) What is hypothesis in a research work and what are its functions? Explain with an example. [7]

b) For the research work on the following topic: [8]

"Selection of an alignment of road from the alternatives given"

List two research questions and also formulate the research objectives related to them.

Group B

Pull out needed data for statistical functions from the tables provided.

a) If the probability is 0.05 that a certain wide-flange column will fail under a given axial load, what is the probability that among 16 such columns, [5]

(i) At least four will fail
(ii) At the most two will fail.

b) An office switchboard receives telephone calls at a rate of three calls per minute on average. Find the probability of receiving, [5]

(i) No call in one minute interval
(ii) At least two calls in five minute interval

5. a) The mean elongation of a steel bar under a particular tensile load has been established to be normally distributed with parameters $\mu = 0.06$", and $\sigma = 0.008$".assuming the same distribution applies to new bar, find the probability that the mean elongation falls,

   (i) Above 0.08
   (ii) Between 0.05" and 0.7"

   b) Measurements of resistance R to the motion of a train at different speeds gave the following results:

V (miles / hour)	10	20	30	40	50
R (lb / ton)	8	10	15	21	30

   Fit a least square regression equation.

6. a) Assume that the population of human body temperatures has a mean of 98.6°F, as commonly believed. Also assume that the population standard deviation is 0.62°F. If a sample of size n = 106 is randomly selected, find the probability of getting a mean of 98.2°F or lower.

   b) During a water shortage, a water company randomly sampled water meters in order to monitor daily water consumption on a particular day, a sample of 30 meters showed a sample mean of $\bar{x} = 240$ gallons and sample standard deviation s = 45 gallons. Find a 90% confidence interval for the mean water consumption for the population.

7. a) The breaking strength cables, produced by a manufacturer have mean 815 kg and standard deviation 45 kg. By a new technique in the manufacturing process it is claimed that the mean breaking strength 840 kg. Can we support the claim at 0.01 level of significance?

   b) A random sample of sixteen values from a normal population showed a mean of 41.5 inches and the sum of the square of deviations from this mean equal to 135 square inches. Show that the assumption of a mean of 43.5 inches for the population is not reasonable at 5% level of significance.

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INSTITUTE OF ENGINEERING

Examination Control Division

2072 Chaitra

Exam.			
Level	M.Sc.	Regular	
Programme	Transportation	Full Marks	60
Year / Part	I / I	Pass Marks	30
		Time	3 hrs.

Subject: - Applied Research Methodology and Statistics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any* ***Five*** *questions selecting* ***Two*** *from* ***Group A*** *and* ***Three*** *from* ***Group B.***
- ✓ *The figures in the margin indicate* ***Full Marks.***
- ✓ *Assume suitable data if necessary.*

GROUP A

1. a) What are the points to consider before deciding to go for quantitative or qualitative approach in a research work? List and describe them. *(7)*
   b) Formulate a hypothesis to accommodate a research work on *"The fuel crisis in transportation due to the recent trade embargo clamped on Nepal"*, suggest alternative hypothesis to it and also mention the factors influencing them. *(8)*

2. a) Give the characteristics and the types of hypotheses of a research work. Explain with examples how they help the research work. *(7)*
   b) For a research work on the following topic give examples to identify independent, dependent and extraneous variables: *(8)*
   "Traffic congestion problem on the twin Bagmati bridges at Thapathali"

3. a) Distinguish between theoretical and conceptual frameworks in a literature review. While developing a theoretical framework in how many types the information collected in literature review are classified? Describe with examples. *(7)*
   b) For the research work on the following topic: *(8)*
   "Selection of an alignment of road from the alternatives given"
   List two research questions and also formulate the research objectives related to them.

GROUP B

Pull out needed data for statistical functions from the tables provided.

4. a) A shipment of *20* digital voice recorders contains *5* that are defective. If *10* of them are randomly chosen for inspection, what is the probability that *2* of the *10* will be defective? Also find the mean and variance of the distribution. *(5)*
   b) At a checkout counter customers arrive at an average of *1.5* per minute. Find the probability that: *(5)*
      i) At most four will arrive in any given minute
      ii) At least three will arrive during an interval of two minutes.

5. a) Scores on a trade school entrance examination exhibit the characteristics of a normal distribution with mean and standdard deviation of *50* and *5* respectively. *(5)*
      i) What proportion of the scores on this examinationwould be greater than *60*?
      ii) What proportion of the scores on this examinationwould be less than *45*?
      iii) What proportion of the scores on this examinationwould be between *35* and *65*?

b) Ten steel wires of diameter *0.5 mm* and length *2.5 m* were extended in a laboratory by applying vertical forces of varying magnitudes. Results are as follows: (5)

Force (kg) x	*15*	*19*	*25*	*35*	*42*	*48*	*53*	*56*	*62*	*65*
Increase in length (mm) y	*1.7*	*2.1*	*2.5*	*3.4*	*3.9*	*4.9*	*5.4*	*5.7*	*6.6*	*7.2*

Estimate the parameters of a simple linear regression model with force as explanatory variable.

6. a) A manufacturer of fuses calims that with a *20 %* overload the fuses will blow in *12.40 minutes* on the average. To test the claim, a sample of *20* of the fuses was subjected to a *20 %* overload, and the time it took them to blow had a mean of *10.63 minutes* and a standard deviation of *2.48 minutes*. If it can be assumed that the data constitute a random sample from normal population, do they tend to support or refute the manufacturer's claim? (5)

b) The proportion of defective chips found in the manufacturing process of *100* items taken as random from a production line is *0.1*. Construct interval estimate of the true process proportion defective of each of the following level of significance: (5)

i) *99 %*

ii) *90 %*

7. a) A trucking firm is suspicious of the claim that the average lifetime of a certain tires is at least *28,000 miles*. To check the claim, the firm puts *40* of these tires on its trucks and gets a mean lifetime *27,436 miles* with a standard deviation of *1,348 miles*. What can it conclude if the probability of α is to be at most *0.01*. (5)

b) The average numbers of articles produced by two machines per day are *200* and *250* with standard deviation of *20* and *25* respectively on the basis of records of *25* days production. Can both the machines be regarded as equally efficient at *1%* level of significance? (5)

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	**Regular**		
Level	M.Sc.	**Full Marks**	60
Programme	Transportation	**Pass Marks**	30
Year / Part	I / I	**Time**	3 hrs.

Subject: - Applied Research Methodology & Statistics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions selecting **Two** from **Group A** and **Three** from **Group B**.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary*
- ✓ ***Necessary table attached herewith.***

GROUP A

1.

1.1. What are the characteristics of a research work? Explain how they are applicable to a research work in transportation engineering. *(07)*

1.2. Give two potential research questions, related to transportation engineering, that would fall under each of the following areas and explain their relationship with the areas: *(08)*

a) People
b) Problems
c) Programs
d) Phenomena

2.

2.1. What are the differences between qualitative and quantitative approaches in research work? Which one is relatively more suitable in transportation engineering? *(07)*

2.2. What is evidence-based research and explain how a transportation engineering related Ministry or Department can be convinced that evidence-based research might benefit them. *(08)*

3.

3.1. What are research hypotheses and explain how the research variables are related with them. *(07)*

3.2. Suggest a research area in transportation engineering for which qualitative research approach is more suitable. *(08)*

GROUP B

Pull out needed data for statistical functions from the tables provided.

4.

4.1. Out of *800* families with *4* children each, how many families would be expected to have: *(05)*

a) Two boys and two girls?
b) At least one boy?
c) No girl?
d) At the most two girls?

Assume equal probabilities for boys and girls.

4.2. Assume that the probability of an individual caol miner being killed in a mine accident during a year is *1/2400*. Use appropriate statistical distribution to calculate the probability that in a mine employing *200* miners there will be: *(05)*

a) At least one one fatal accident
b) Exactly two fatal accidents
c) At least two fatal accidents in a year

5.

5.1. A sample of *100* dry battery cells tested to find the length of life produced mean *12* hours and standard deveiation *3* hours. Assuming the data to be normally distrbuted, what percentage of battery cells are expected to have life: *(05)*

a) More than *15* hours?

b) Less than *6* hours?

c) Between *10* and *14* hours?

5.2. From the following data obtain the two regression equations: *(05)*

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

6. Estimate the value of y which should correspond on an average to $x = 6.2$.

6.1. In an election *55 %* of the registered voters favour a certain candidate. If we take a random sample of *400* voters, what is the probability that, based on a sample prooportion, we will predist the wrong winner? *(05)*

6.2. The foreman of *ABC* mining company has estimated the average quantity of iron ore extracted to be *36.8* tons per shift and the sample standard deveiation to be *2.8* tons per shift, based upon a random selection of *4* shifts. Construct a *90* percent confidence interval around this estimate. *(05)*

7.

7.1. Suppose we are interested in a population of *20* industrial units of the same size, all of which are experiencing excessive labor turnover problems. The past records show that the mean of the distribution of annual is *320* employees, with a standard deviation of *75* employees. A sample of *5* of these industrial units is taken at random which gives a mean of annual turnover as *300* employees. Is the sample mean consistent with the population mean? Test at *5 %* level of significance. *(05)*

7.2. Memory capacity of *9* students was tested before and after training. State at *5* percent level of significance whether the training was effective from the following scores: *(05)*

Student	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Before	*10*	*15*	*9*	*3*	*7*	*12*	*16*	*17*	*4*
After	*12*	*17*	*8*	*5*	*6*	*11*	*18*	*20*	*3*

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Pulchowk Campus, Institute of Engineering
EG 612 CE Applied Research Methodology and Statistics

Instructor: Dr. Rojee Pradhananga **Date: 1st September 2023**

Internal Assessment (Time: 1 hour 15 minutes, Full marks: 20)
(Please use statistical tables/charts when necessary)

Attempt all questions:

Q1. Pedestrian crossings along an urban section of a highway are located according to a Poisson process with an average of 5 crossings in 1 km length.

i. What is the probability that there is at least one pedestrian crossing in the next 200m of the highway?
ii. Determine the interval length of the highway such that the probability that there will be no crossing in this interval is 0.9.
iii. What is the probability that there are 25 or more pedestrian crossings in the next 5 km of the highway?

(2pt+2pt+2pt)

Q2. Motorcycle helmet usage survey on a highway revealed that only 80 drivers out of 100 randomly selected drivers use the helmet.

i. Make an estimate of the true percentage of the motorcycle drivers that uses the helmet and estimate its standard error.
ii. Construct a 90% upper confidence bound on the true percentage of drivers that uses the helmet.

(2pt+2pt)

Subject *Introduction to Applied Research Methodology*
Test *Minor I*
Chapters *1, 2 and 3*
Date *September 09, 2023* / 2080-05-23

A

This question paper comprises three questions. Attempt, not excluding Q No 1, any two questions. Assume appropriate data, if missing. Figures inside parentheses show the marks allocated to the questions.

1.

1.1. Outcome of 'research' is judged by:
a) Input *b)* Quality of output *c)* Process *d)* Qualification of the researcher

1.2. The variables chosen in quantitative and qualitative methods are based upon, respectively
a) Description and Measurement *b)* Classification and Measurement *c)* Description and Classification *d)* Measurement and Description

1.3. Conceptual framework in literature review comes from
a) Body of knowledge *b)* Theoretical frame work *c)* From the review of selected literature *d)* Write-up of literature review

1.4. From philosophical point of view, using computer analogy, 'mind' is in _____ level
a) Process *b)* Input *c)* Output *d)* Post output

1.5. One of the characteristics of 'research' is, 'it has to be empirical', which means: it should be
a) Relevant
b) Verifiable
c) Based upon evidences
d) In logical order

1.6. According to the classification of researches 'Quantitative research' falls under the perspective of
a) Application
b) Objectives
c) Inquiry mode
d) Methodology

1.7. One of the approaches mostly used in engineering researches is:
a) Ethnographic
b) Qualitative
c) Naturalistic
d) Positivistic

(7.0)

2.

2.1. Choose an area of research in transportation engineering and identify a topic. Explain the framework procedure, novelty and universality in it to ensure that the topic has been identified correctly. ***(4.0)***

2.2. Use the three criteria –Approach, Purpose and Variables to differentiate quantitative and qualitative methods used in research works. Give examples to support the shown differences. ***(4.0)***

3.

3.1. Draw a neat sketch of three stage eight step model of research and explain them. ***(4.0)***

3.2. Why and how examples are selected in research works. Explain the features of the examples in research works. ***(4.0)***

Subject	*Introduction to Applied Research Methodology*
Test	*Minor 1*
Chapters	*1, 2 and 3*
Date	*September 09, 2023*

B

This question paper comprises three questions. Attempt, not excluding Q No 1, any two questions. Assume appropriate data, if missing. Figures inside parentheses show the marks allocated to the questions.

1.

1.1. 'Research' and 'Understanding', respectively relate to:
a) Asking and Raising questions *b)* Raising and Asking questions *c)* Believing and Finding statements *d)* Finding and Believing statements

1.2. Hook and Chain methods in development of context in a work, respectively, relates to:
a) Linking sequentially the given set of list and linking the list in parallel to a set of sequences
b) Linking the given set of list in parallel to a set of sequences and linking the list sequentially
c) Putting the given set of list in random and putting the set of list in alphabetical order
d) Putting the given set of list in alphabetical order and putting the set of list in random

1.3. Which one from the following criteria is <u>not</u> of qualitative method
a) Rationalism in philosophy
b) Unstructured approach
c) Less in number and small in size, examples
d) Descriptive variables

1.4. Literature review is the process undertaken in
a) Pre research work stage only
b) Post research work stage only
c) Planning stage of research work only
d) All stages of research work including pre and post stages

1.5. First practical step in research work is
a) Construction of tool
b) Writing proposal
c) Selection of examples
d) Conceptualization of research design

1.6. In three stage eight step model, stage three is with _____ steps.
a) One
b) Two
c) Three
d) Four

1.7. Which of the following characteristics is <u>not</u> in journal papers
a) To the topic
b) Updated
c) Timely published
d) Well organized and fully covered

(7.0)

2.

2.1. Use computer analogy to explain how human beings learned to do the research in the present sense of its meaning. ***(4.0)***

2.2. After the proposal for a research work is approved what are the materials used for further works. How these materials are collected and collated and what are the tools used for these processes. ***(4.0)***

3.1. What problems have to do with research works, how they are formulated in a research work? Explain the link and process. ***(4.0)***

3.2. With mode of inquiry as criteria, classify research works and explain the tools that are used to justify the classification. ***(4.0)***

Applied Research Methodology Minor Test 2020

1. From philosophical point of view, using computer analogy, 'mind' is in ——— level
   a) Input b) Process c) Output d) Postoutput
2. One of the characteristics of 'research' is, 'it has to be empirical', which means it should be
   a) Relevant b) Verifiable
   c) Based upon evidences d) In logical order
3. According to the classification of researches 'Quantitative research' falls under the perspective of
   a) Application b) Objectives c) Inquiry mode d) Methodology
4. One of the approaches mostly used in engineering researches is
   a) Ethnographic b) Qualitative c) Naturalistic d) Positivistic
5. Which one from the following criteria is not of qualitative method
   a) Rationalism in philosophy b) Unstructured approach
   c) Less in number and small in size, examples d) Descriptive variables
6. Literature review is the process undertaken in
   a) Pre research work stage only b) Post research work stage only
   c) Planning stage of research work only d) All stages of research work including pre and post stages
7. First practical step in research work is
   a) Construction of tool b) Writing proposal
   c) Selection of examples d) Conceptualization of research design
8. In three stage eight step model, stage three is with ——— steps
   a) One b) Two c) Three d) Four
9. Which of the following characteristics is not in journal papers
   a) To the topic b) Updated
   c) Timely published d) Well organized and fully covered
10. What is conceptual frame framework in literature review and how it is developed?
11. Suggest a research topic and consider a definition of research to justify its appropriateness as research topic

A

bject *Applied Research Methodology*
t *Minor*
apters *1 and 2*
e *July 29, 2017*
mpt any two questions. Assume appropriate data, if missing. Figures inside parentheses show the marks cated to the questions.

1.1. What are the three stages of research work? Give the steps involved in each stage and explain in brief. *(3.5)*
1.2. Take the topic chosen for the research work in the assignment and check it against the characteristics of the research work. *(4)*

2.1. What are the recognized criteria to classify research? Give the classifications as per the criteria. *(3.5)*
2.2. Take a definition of research work and check it against the topic chosen for the research work in the assignment. *(4)*

3.1. Why it is necessary to construct a theoretical framework in literature review, how it is done and what the framework will end up as, in a research work. *(3.5)*
3.2. For the topic chosen in the assignment, determine which one of the two – quantitative or qualitative - methods is better and explain why. *(4)*