Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Total No. of Pages : 02

Total No. of Questions : 08

PHD (Mech. Engg)
RESEARCH METHODOLOGY (MECH. ENGG.)

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT question.
2. Each question carry TWENTY marks.

Q1 a) Give a brief description, on the steps in formulation of a research problem. (10)

b) Clearly differentiate between sampling and non-sampling errors. Discuss the methods to measure and manage sampling errors. (10)

Q2 a) Describe the various techniques of data collection and explain the appropriateness of each technique with the type of research problem. (10)

b) What are the common software tools used for the analysis and modelling?. (10)

Q3 Four different, though supposedly equivalent entrance quiz were administered to each of 5 students. The following scores are obtained:

	Student 1	Student 2	Student 3	Student 4	Student 5
Quiz A	72	70	56	66	81
QuizB	80	69	53	67	89
QuizC	83	58	50	69	85
QuizD	70	64	59	76	92

Perform a two way analysis of variance to test at level of significance α = 0.01whether it is reasonable to treat the 4 quizzes as equivalent (20)

Q4 The following are the average weekly losses of correlated worker hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation:

Before : 45 73 46 124 33 57 83 34 26 17

After : 36 60 44 119 35 51 77 29 24 11

Use the 0.05 level of significance to conduct a paired test whether the safety program is effective. Also find a 90% confidence interval for the mean improvement in lost worker-hours. Interpret the result obtained. (20)

Q5   The following data on the ages and incomes of 5 executives working for the same company and the number of years they went to the college :

Age in years	Years In college	Income in Rs.
X1	X2	Y
37	4	71,200
45	0	66,800
38	5	75,000
42	2	70,300
31	4	65,400

Fit an equation of the form $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2$ to the given data, and use it to estimate how much on the average an executive working for his company will make if he is 44 years old and has had 6 years of college. Obtain a plot of residuals vs. predicted values and give your comments.   (20)

Q6   a) What is hypothesis testing? Discuss in brief the various steps to be followed in testing hypothesis. Also explain the significance of hypothesis testing in analysing data. (10)

b) What is the relationship between level of significance and level of confidence? How acceptance and rejection zones are decided? Draw a diagram to support your answer.
                                                                (10)

Q7   a) What is the significance of report writing? Discuss in brief the various steps in writing research report   (10)

b) What do you mean by dissertation? What are the objectives and significance of dissertation?   (10)

Q8   Write Short notes on the following :

a) Techniques of writing a patent

b) Non sampling errors

c) Paired comparison method

d) chi- square test   (20)