B.E. MECHANICAL ENGINEERING 3RD YEAR 2ND SEM. EXAMINATION, 2017

MECHANICAL MEASUREMENT AND INDUSTRIAL STATISTICS

Time: Three hours   Full Marks: 100

Answer any FIVE questions

(Tables of z, t, F and Chi-square distributions can be used)

1a) The weights of a component follow normal distribution and it has been observed that 1500 components are below 50 Kg and 800 components are above 80 Kg out of a total of 8000 components. How many components have weights between 40 Kg and 75 Kg ?   (12)

b) What do you mean by process capability index ? Explain its significance with reference to process performance.   (2+6)

2a) What do you mean by 'Null Hypothesis' and 'Alternate Hypothesis' ? What are the errors involved in testing of hypothesis ?   (8)

b) The following experimental data shows the tensile strength (in kg/mm^2) of certain material:

25.8, 25.5, 25.2, 24.3, 26.4, 25.6, 24.6, 26.8, 25.4, 23.6

Can it be concluded that tensile strength of the material is more that 25 kg/mm^2 with α = 5% ? Determine the 95% confidence interval of true tensile strength of the material.   (12)

3a) Define the term 'Reliability' mathematically.   Show that, $\lambda(t) = \frac{f(t)}{R(t)}$

The notations bear the usual meanings   (4+7)

b) Explain the significance of Weibull failure parameters.   (9)

4a) Explain the exponential failure law. Show that the failure rate remains constant for components following exponential failure law.   (3+5)

b) The times to failure of 10 components are as follows (in days):   (12)

1250, 835, 1330, 990, 1055, 1185, 880, 1210, 1395, 1090

Assume two parameter Weibull distribution and use analytical method to estimate the values of failure parameters. Also calculate the reliability and failure rate of the component for a specified time period of 850 days.

[Turn over

5a) Five components having same and constant failure rate 'λ' are connected to form a standby system with 2-operating unit and 3-standby unit. Derive the expression for system reliability and MTTF for the system. Assume perfect switching device. (12)

b) Explain how to determine the failure parameters using Weibull graph paper. (8)

6a) What are 'main effect' and 'interaction' with reference to factorial experiments. (6)

b) Perform analysis of variance and estimate percent contribution of main effects and interaction for the data given in the following table: (14)

	B1	B2	B3
A1	30, 32	38, 40	44, 48
A2	24, 26	36, 37	30, 28

7a) Derive the expression of system reliability for k - out of − m system. (6)

b) Use chi-square test to fit the following data into a linear model.

X	24	35	42	56	60	72
Y	30	45	60	74	90	106

Assume level of significance as 5%. (14)

8 . Write short notes on the followings (any four): (4 x 5)

a) Testing of hypothesis

b) Median rank

c) Confidence level

d) Two tailed test

e) Confidence interval

g) ANOVA

h) Test statistics