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Total number of printed pages – 3

B. Tech
PEME 5405

Seventh Semester Examination – 2011

METROLOGY, QUALITY CONTROL AND RELIABILITY

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) Write down the advantages of wavelength standards.
 - (b) The constant failure rate of the fan is 0.0008 failures/hour. Calculate the MTTF of the electric fan.
 - (c) Define and distinguish between variable and attributes.
 - (d) What is the difference between accuracy and precision ?
 - (e) Differentiate between producer's risk and consumer's risk.
 - (f) Operating Characteristic curve.
 - (g) Define nominal size and basic dimension
 - (h) What do you mean by calibration ? Write the steps in performing it.
 - (i) Explain briefly selective fit and push fit.
 - (j) Enumerate the major requirements of gauge blocks.
2. (a) Define Metrology. What are the standards of measurements ? Explain in details. 6
- (b) A pressure indicator showed a reading as 42 bar on a scale range of 0.50 bar. If the true value was 41.4 bar, determine : 4
- (i) Static error
 - (ii) Static correction
 - (iii) Relative static error.
3. (a) Explain any two of the following methods employed for measuring straightness : 6
- (i) The wedge method

P.T.O.

- (ii) The level method
 - (iii) The auto-collimator method.
- (b) Describe signal to noise ratio (S/N) of static problem relating to the condition 4
- (i) Smaller – the - better
 - (ii) Normal – the - best
 - (iii) Larger - the - better
4. (a) Explain the differences between quality control and quality improvement. Describe the different stages of quality improvement. 6
- (b) Explain in detail about p and np chart. Find out the process average, UCL and LCL for both p chart and np chart. 4
5. (a) Discuss the emerging role of ISO 9000 standards in the global economy. Describe the key steps that an organization must go through so that the organization can be of ISO 9000 standard. 5
- (b) What do you mean by hypothesis testing ? Explain in detail. Define and explain Type I and Type II errors in the context of control charts. Are they related ? 5
6. (a) Explain in detail about single sampling and double sampling methods. Write down the advantages and disadvantages of acceptance sampling plan over 100% inspection. 4
- (b) What is the difference between Unilateral and Bilateral tolerance ? Which tolerance is more acceptable and why ? 4
- (c) Briefly describe what do you mean by AOQ and AOQL. 2
7. (a) Describe types of availability depending on time elements. 4
- (b) An electric circuit consists of 5 silicon transistor, 3 silicon diodes, 10 composition register and 2 ceramic capacitors connected in series configuration. The hourly failure rate of each component is given as :

Silicon transistor $\lambda_t = 4 * 10^{-5}$

Silicon diode $\lambda_d = 3 * 10^{-5}$

Composition resistor $\lambda_r = 2 * 10^{-4}$

Ceramic Capacitor $\lambda_e = 2 * 10^{-4}$

Calculate the reliability of the circuit for 10 hour, when components follow exponential distribution and Mean time between failures. 4

(c) During measurement of surface roughness the height of 10 successive peaks and valleys over datum line over a specified sampling length were found to be :

Peak	:	45	42	40	35	35 μm .
Valleys	:	30	25	25	24	18 μm .

Determine the R_z value of the Surface. 2

8. (a) What is the "best size wire"? Derive an expression for the best size wire in the terms of the pitch and angle of threads. 4
- (b) Write notes on analysis of variance [ANOVA]. 4
- (c) Describe the Bath-tub Curve. 2