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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Examination, July 2020

Program: M.Tech RE **Semester: II**
Course: Quality & Reliability Engineering **Max. Marks: 100**
Course Code: MERE 7008 **Attempt Duration: 24 Hrs.**
No. of Page/s: 3

This question paper has two section, Section A and Section B. **Section A** consist of multiple choice based questions. **Section B** consist of long answer based questions

Section A consist of multiple choice based questions and has the total weightage of 25%.

Section A will be conducted online on BB Collaborate platform. **Section B** consist of long answer based questions and has the total weightage of 75%. The questions for section B shall also appear in BB Collaborate

The maximum time allocated to **Section A** is one Hrs. **Section B** to be submitted within 24 hrs from the scheduled. No submission of Section B shall be entertained after 24 Hrs.

Section B should be attempted after **Section A**

The **section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)

Section – B (Attempt all the questions)
(5 × 15 marks)

Q 2. Describe the procedural steps in conduction a Failure Mode Effect Analysis with a suitable example. **CO3**

Q 3. Light bulbs are tested for their luminance, with the intensity of brightness desired to be within a certain range. Random samples of 5 bulbs are chosen from the output and their luminance values measured. The sample mean X and Range are found. After 30 samples, the following summary information is obtained:

$$\sum_{i=0}^{25} \bar{X} = 1000 \, , \, \sum_{i=0}^{25} \bar{R} = 250$$

The specifications are 90 ± 15 lumens.

(a) Find the $\overline{X}$ and $\bar{R}$ control limits

(b) Assuming that the process in control, estimate the process mean and process range.

(c) Find the process capability indices *Cp* and *Cpk* and comment on their values.

(d) If the target value is 90 lumens, find the capability indices *Cpm* and *Cpmk.*

(e) What proportion of the output is nonconforming, assuming a normal distribution of the quality characteristic?

(f) If the process mean is moved to 88 lumens, what proportion of the output is nonconforming? What are your proposals to improve process performance? **CO2**

Q 4. Describe elaborately the basic seven questions to be answered in implementing Reliability Centred Maintenance (RCM). **CO1**

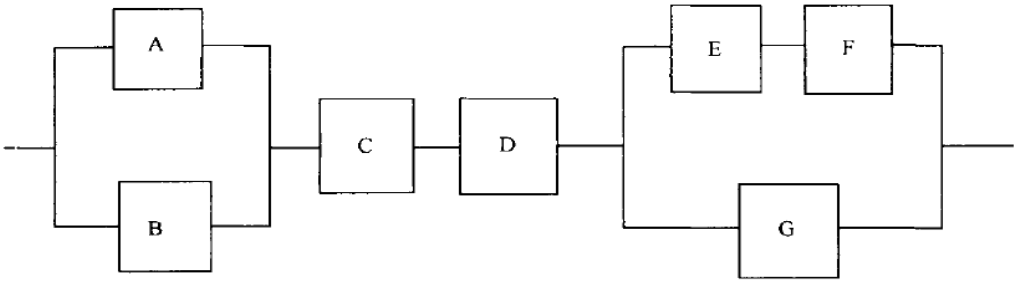
Q 5. a) Explain about the philosophy and the requirements of ISO 9000:2000. **CO4**

b) Is it feasible to increase productivity and reduce quality costs at the same time? **CO1**

Q 6. a) Describe the life cycle of a product. What probability distributions would you use to model each phase?

b) Consider the seven-component system shown in Figure. The reliabilities of the components are as follows: $R_A = 0.96$, $R_B = 0.92$, $R_C = 0.94$, $R_D = 0.89$, $R_E = 0.95$, $R_F = 0.88$, $R_G = 0.90$.

a) Find the reliability of the system. If you had a choice of improving system reliability by modifying any two components, how would you proceed?



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b) Assume that the time to failure for each component has an exponential distribution. The failure rates are as follows: $\lambda_A = 0.0005$/hour, $\lambda_B = 0.0005$/hour, $\lambda_C = 0.0003$/h, $\lambda_D = 0.0008$/hour, $\lambda_E = 0.0004$/hour, $\lambda_F = 0.006$/hour and $\lambda_G = 0.0064$/hour. Find the

reliability of the system after 1000 hours. What is the mean time to failure of the system? **CO3**