PROD/PC/B/T/225/2024

B.E. PRODUCTION ENGINEERING - SECOND YEAR - SECOND SEMESTER

INSPECTION AND PRODUCT CONTROL

Time : **Three hours** Full marks: **100**

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

1.(a) With proper dimensions and examples, differentiate between clearance fit, transition fit and interference fit. (5×10)

(b) Mention the steps required to reduce surface roughness of a machined component.

(c) In a typical manufacturing unit, what are the assignable causes present leading to production of excessive dimensionally defective components?

(d) State the role of Ishikawa's fish-bone diagram as an effective statistical quality control tool.

(e) How a mechanical-optical comparator differs from a mechanical comparator? Enumerate the specific applications of pneumatic comparators.

(f) State how the principle of light interference helps in measuring surface flatness of a machined component.

(g) Between hole-based and shaft-based systems, which one is preferred and why? Provide a typical nomenclature (numerical representation) of a transition fit.

(h) Being a production engineer, highlight the steps to be adopted to increase Cp value of a manufacturing process.

(i) How does a production engineer minimize the sources of error during measurement?

(j) Draw any coordinate measuring machine. Why its probe is called as 'touch and trigger' probe?

2. Identify the specific instruments along with their technical specification to measure the following features:
(i) Hole diameter 1.01 mm, (ii) Included angle of a dovetail slot, (iii) Conicity error of a through hole, (iv) Shaft diameter 70.00±0.01 mm, (v) Internal taper angle. (10)

3. Mention five application areas of C chart in manufacturing industries. What are the limitations of X-bar and R charts? (10)

4. Determine the GO and NOGO dimensions of standard gauges to control the production of 70 mm. shaft and hole pairs of H_8e_9 fit as per I.S. specifications given as below: (10)
(i) 70 mm. lies in the diameter step of 50 and 80 mm.
(ii) Fundamental deviation of 'e' type shaft is $-11\ D^{0.41}$
(iii) Wear tolerance = 10% of the gauge tolerance.

5. An electrical circuit contains 3 resistors in series. From the past records, the following data on the resistors are available: (10)

Resistor	Mean resistance (ohm)	Standard deviation (ohm)
1	125	3
2	200	4
3	600	12

What percent of the circuits would meet the specifications on total resistance of 930±30 ohms? (Given the areas under the standard normal distribution curve for 2.69 and -1.92 are 0.9964 and 0.0274 respectively).

6. Based on the following data, develop the corresponding sequential sampling plan: Population size = 1000, Sample size = 50, Acceptance number = 2, Producer's risk = 5%, Consumer's risk = 20%, Average quality level (AQL) = 10% and Lot tolerance percent defective (LTPD) = 30% (10)

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7. Describe how computer vision system helps in on-line product inspection. Also state its various applications. (10)

8. With neat sketches, describe the working principles of (a) flow velocity type of pneumatic comparator and (b) Tomlinson surface meter. (10)