

University of Mumbai
Examination First Half 2022

Program: BE Mechanical Engineering

Curriculum Scheme: Rev-2019

Examination: TE Semester V

Course Code: MEC501 and Course Name: **Mechanical Measurement and Control**

Time: 3 hour

Max.Marks: 80

| Q.1 | Choose the correct option for following questions. All the Questions are compulsory and carry equal marks |
|-----------|--|
| Q1. | Drift is defined as |
| Option A: | Variation in input of the instrument with respect to desired input |
| Option B: | smallest change in input quantity which can be measured with an instrument |
| Option C: | Variation in output of the instrument from the desired value for given input |
| Option D: | degree of closeness with which a reading is repeated again and again |
| Q2. | A voltmeter has a uniform scale with 100 divisions. The full-scale reading is 10 V and could be read upto 1/10 of a scale division with some degree of certainty. It's resolution is |
| Option A: | 0.1 V |
| Option B: | 0.02 V |
| Option C: | 0.001 V |
| Option D: | 0.01 V |
| Q3. | McLeod gauge |
| Option A: | can be used for pressure below 0.1×10^{-3} torr |
| Option B: | gives continuous output |
| Option C: | is sensitive to condensed vapours that may be present in the sample of the gas whose pressure is being measured |
| Option D: | can not be used as standard for vacuum measurement |
| Q4. | NO GO gauges are designed |
| Option A: | for maximum shaft limit and minimum hole limit |
| Option B: | for maximum hole limit and minimum shaft limit |
| Option C: | for maximum hole and shaft limit |
| Option D: | for minimum hole and shaft limit |
| Q5. | The average height from a mean line of all ordinates of the surface, regardless of sign, is the |
| Option A: | RMS value |
| Option B: | Rz value |
| Option C: | Ra value |
| Option D: | Rm value |

| | |
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| Q6. | Steady state error is a) $e_{ss} = \lim_{s \rightarrow 0} \frac{s R(s)}{1 \pm G(s)H(s)}$ b) $e_{ss} = \frac{s R(s)}{1 \pm G(s)H(s)}$ c) $e_{ss} = \lim_{s \rightarrow 0} \frac{s}{1 \pm G(s)H(s)}$ d) $e_{ss} = \lim_{s \rightarrow 0} \frac{s R(s)}{G(s)H(s)}$ |
| Option A: | A |
| Option B: | B |
| Option C: | C |
| Option D: | D |
| Q7. | The transient response of control system is |
| Option A: | Response is a function of input |
| Option B: | response is a function of time |
| Option C: | response remains constant with time |
| Option D: | Response is zero |
| Q8. | The analogous electrical component for angular displacement in mechanical system in F-I analogy |
| Option A: | Charge |
| Option B: | Flux |
| Option C: | Resistance |
| Option D: | capacitance |
| Q9. | The order of a system is represented by The Routh-Hurwitz criterion cannot be applied when the characteristic equation of the system contains any coefficients which is : |
| Option A: | Negative real and exponential function |
| Option B: | Negative real, both exponential and sinusoidal function of s |
| Option C: | Both exponential and sinusoidal function of s |
| Option D: | Complex, both exponential and sinusoidal function of s |
| Q10. | Surface texture depends to a large extent on |
| Option A: | material composition |
| Option B: | type of manufacturing operation |
| Option C: | skill of the operator |
| Option D: | accuracy of measurement |

Q2 Solve any Two Questions out of Three (10 marks each)

Write differential equation for mechanical system as shown in Fig.1. Obtain an analogues electrical network based on force-current analogy

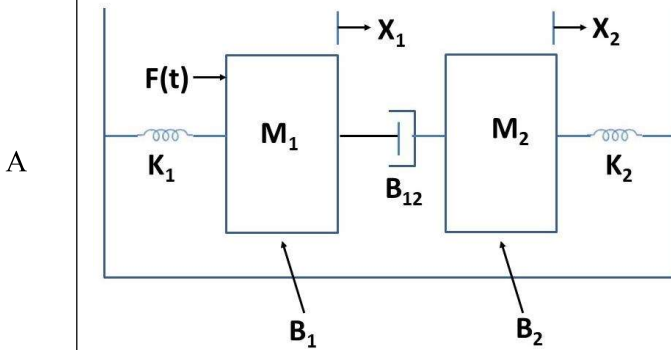


Fig.1

Illustrate the working principle of L.V.D.T with neat sketch for displacement measurement. For the LVDT output in Fig.2, determine, accuracy, precision, drift and percentage sensitivity

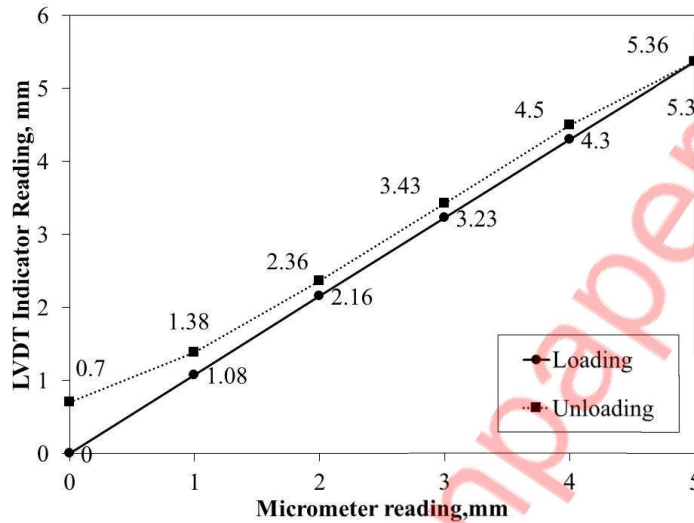


Fig.2

Derive necessary expression to calculate the best wire diameter With the help of suitable diagram explain three wire method used in screw thread measurement.

Q3 Solve any Four out of Six (5 marks each)

| | |
|---|---|
| A | Explain Principle, construction and working of Parkinson's Gear Tester |
| B | Explain Laser Interferometer with neat sketch. |
| C | What do you mean by waviness and roughness |
| D | With respect to surface roughness parameters explain the following terms i) Ra ii) Rz iii) RMS |
| E | Define gauge factor for strain gauge and write expression of it |
| F | Explain routh criterion for stability with example |

| Q4. | Solve any Two Questions out of Three | 10 marks each |
|-----|---|---------------|
| A | For a particular unity feedback system $G(s) = \frac{64(S + 2)}{S(S + 0.5)(S^2 + 3.2S + 64)}$ Sketch the Bode Plot, Find ω_{gc} , ω_{pc} , GM and PM. Comment on stability. | |
| B | A unity feedback system characterised by an open loop transfer function $G(s) = \frac{K}{S(S+10)}$ Determine the gain K, so that the system will have a damping ratio of 0.5. for this value of K determine settling time, peak overshoot, and time to peak overshoot for unit –step input. | |
| C | What is encoder? With a neat sketch explain working of an incremental and absolute optical encoder. Explain in detail with example | |