University of Mumbai
Examination First Half 2022
Program: BE Mechanical Engineering
Curriculum Scheme: Rev-2019
Examination: TE Semester V
Course Code: MEC501and Course Name: **Mechanical Measurement and Control**

Time:3 hour   Max.Marks:80

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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

Q6.	Steady state error is
	a) $$e_{ss} = \lim_{s \to 0} \frac{s\,R(s)}{1 \pm G(s)H(s)}$$
	b) $$e_{ss} = \frac{s\,R(s)}{1 \pm G(s)H(s)}$$
	c) $$e_{ss} = \lim_{s \to 0} \frac{s}{1 \pm G(s)H(s)}$$
	d) $$e_{ss} = \lim_{s \to 0} \frac{s\,R(s)}{G(s)H(s)}$$
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)
A	Write differential equation for mechanical system as shown in **Fig.1**. Obtain an analogues electrical network based on force-current analogy **Fig.1**	
B	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**	
C	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