

## Model Question Paper-1 with effect from 2023-24 (CBCS Scheme)

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**Fourth Semester B.E. Degree Examination**  
**Mechanics and Measurement Systems for Robots**

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any FIVE full questions, choosing atleast ONE question from each MODULE.

Module-1			Marks	L	C
Q.1	(a)	What is direction cosine? Prove that summation of square of direction cosines equal to one with sketch.	10	L2	CO1
	(b)	Define Normal Stress and Shear Stress. Derive their relations in terms of components of stress.	10	L2	CO1
<b>OR</b>					
Q.2	(a)	Write short note on Linear elasticity and Bars with Cross Sections Varying in Steps	10	L1	CO1
	(b)	A metallic bar 300 mm x 100 mm x 40 mm is subjected to a force of 5 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions respectively. Determine the change in the volume of the block. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.25.	10	L3	CO1
<b>Module-2</b>					
Q.3	(a)	What is plane stress condition? Establish the relation.	10	L2	CO2
	(b)	For the state of stress at a point characterised by the following components. Determine the principal stresses and greatest shearing stress. $\sigma_{xx} = 9, \sigma_{yy} = 5, \sigma_{zz} = 4, \tau_{xy} = 6, \tau_{yz} = 2$ & $\tau_{zx} = 3 \text{ MPa}$ .	10	L3	CO2
<b>OR</b>					
Q.4	(a)	Explain the Stress acting on a plane inclined to the direction of the applied force with necessary sketches.	10	L2	CO2
	(b)	Explain with diagram the Mohr's circle for plane stress.	10	L2	CO2
<b>Module-3</b>					
Q.5	(a)	Find the torsion of circular bar in elastic perfectly plastic material under elastic-plastic and plastic yielding.	10	L1	CO3
	(b)	Explain any three factors influencing the torsion of circular shafts.	10	L3	CO3
<b>OR</b>					
Q.6	(a)	Define Column, Strut, Slenderness ratio, Buckling Load and Safe load in elastic stability of columns	10	L2	CO3
	(b)	What are the assumptions made in euler's column theory?	10	L2	CO3
<b>Module-4</b>					
Q.7	(a)	What are the objectives of metrology?	10	L1	CO4
	(b)	What are the characteristics of line and end standards?	10	L2	CO4
<b>OR</b>					
Q.8	(a)	Write a short note on Interchangeability & Selective assembly.	10	L2	CO4
	(b)	Calculate the limits of tolerance and allowance for 25mm shaft and hole pair designated by $H_8d_9$ .	10	L2	CO4

<b>Module-5</b>					
<b>Q.9</b>	<b>(a)</b>	Explain the generalized measurement system with block diagram.	<b>10</b>	<b>L1</b>	<b>CO5</b>
	<b>(b)</b>	Explain briefly Precision, Calibration, Sensitivity, Repeatability and Linearity.	<b>10</b>	<b>L2</b>	<b>CO5</b>
<b>OR</b>					
<b>Q.10</b>	<b>(a)</b>	Explain briefly four mechanical transducer with sketches.	<b>10</b>	<b>L2</b>	<b>CO5</b>
	<b>(b)</b>	Write a short note on Cathode ray oscilloscope.	<b>10</b>	<b>L2</b>	<b>CO5</b>

