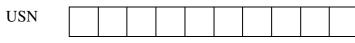
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ModelQuestionPaper-1witheffect from2023-24(CBCS Scheme)



Fourth Semester B.E. Degree Examination

Mechanics and Measurement Systems for Robots

TIME: 03Hours

Max. Marks: 100

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

| | | Module–1 | Marks | L | С |
|----------|------------|---|-------|----|-----|
| 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 |
| OR | | | | | |
| 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 $E = 2 \times 10^5$ N/mm ² and Poisson's ratio = 0.25. | 10 | L3 | CO1 |
| | • | Module–2 | | | |
| 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. $\sigma_{xx} = 9$, $\sigma_{yy} = 5$, $\sigma_{zz} = 4$, $\tau_{xy} = 6$, $\tau_{yz} = 2$ & $\tau_{zx} = 3$ MPa. | 10 | L3 | CO2 |
| | • | OR | | | |
| 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 |
| | | | | | |
| 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 |
| OR | | | | | |
| 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 |
| | | Module-4 | | | |
| <u> </u> | (a) | What are the objectives of metrology? | 10 | L1 | CO4 |
| Q.7 | (b) | What are the characteristics of line and end standards? | 10 | L2 | CO4 |
| OR | | | | | |
| 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 |

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