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# B.M.S. College of Engineering, Bengaluru-560019

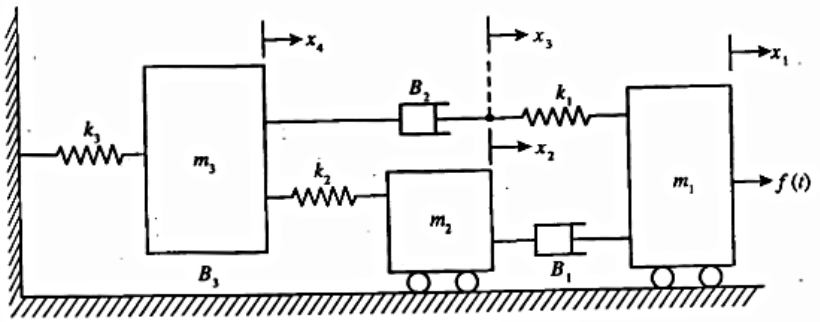
**Autonomous Institute Affiliated to VTU**

## September / October 2024 Supplementary Examinations

**Programme: B.E.** **Semester: VI**
**Branch: Mechanical Engineering** **Duration: 3 hrs.**
**Course Code: 20ME6DCCOE** **Max Marks: 100**
**Course: Control Engineering**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|---|
| 1 | a) | | With examples, discuss the principle of open loop and closed loop systems. | *CO1* | *PO 1* | **08** |
| | b) | | Derive the expression for Transfer Function of field-controlled DC motor. | *CO2* | *PO1* | **08** |
| | c) | | Discuss the requirements of a good control system. | *CO1* | *PO1* | **04** |
| | | | **OR** | | | |
| 2 | a) | | Write the differential equations for the mechanical system shown in fig. 1   Fig.1 | *CO2* | *PO1* | **10** |
| | b) | | Obtain the state space model for $n^{th}$ order differential equation. | *CO2* | *PO2* | **10** |
| | | | **UNIT - II** | | | |
| 3 | a) | | Derive an expression for the first order response for unit step input. | *CO3* | *PO1* | **10** |
| | b) | | Deduce the positional, velocity and acceleration errors for type 0, type 1 and type 2 unity feedback system. | *CO3* | *PO1* | **10** |
| | | | **OR** | | | |
| 4 | a) | | Discuss the various standard input signals used to predict system behavior. | *CO3* | *PO1* | **10** |

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|---|---|---|---|---|---|---|
| | | b) | Applying Routh Hurwitz criterion, examine the stability of the system $S^4 + 2S^3 + 11S^2 + 18S + 18 = 0$ | *CO4* | *PO2* | **10** |
| | | | **UNIT - III** | | | |
| | 5 | | Construct the Root Locus and comment on stability of the system for a unity feedback system with transfer function $G(S) = \frac{K}{S(S+4)(S^2+4S+20)}$ | *CO4* | *PO2* | **20** |
| | | | **UNIT - IV** | | | |
| | 6 | | Draw the Bode plot and determine gain margin, phase margin, gain cross over frequency and phase cross over frequency for a system having open loop transfer function GH(S) = $\frac{10}{S(1+S)(1+0.02S)}$ | *CO5* | *PO2* | **20** |
| | | | **UNIT - V** | | | |
| | 7 | a) | Draw Polar plot of G(S) = $\frac{12}{S^2(S+1)(S+2)}$ | *CO4* | *PO1* | **08** |
| | | b) | Sketch the Nyquist diagram and ascertain the stability of a system G(S)H(S) = $\frac{100}{(1+2S)}$ | *CO4* | *PO2* | **12** |

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