Ref. No. : **Ex/PG/CTLE/T/128C/2024**

MASTER IN CONTROL SYSTEM ENGG FIRST YEAR SECOND SEMESTER - 2024

ADAPTIVE CONTROL SYSTEMS

Time: 3 hours Full Marks: 100

Answer any FIVE questions.

Answer all parts of a question in the sequential order.

1.a) Explain the various features of Adaptive Control Systems.

b) Explain with suitable block diagram, the principle of working of a generic adaptive control system.

[8+12=20]

2. Explain, with suitable functional block diagrams, the various adaptive control schemes that are found in the literature.

[20]

3. Write a note on Linear Parametric Modelling explaining why is it essential for the design of Adaptive Control Law?

[20]

4. With suitable block diagram, explain the Model Reference Adaptive Control design approach employing MIT Rule for a first order process with model uncertainty.

[20]

5. Derive a stable adaptive law for a single input single output system whose input-output model is parameterized and has one unknown parameter. Employ Gradient method.

[20]

6. Explain the factors that lead to instability phenomenon in Adaptive Control Systems.

[20]

[Turn over

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7. a) Explain the Certainty Equivalent Principle.

b) Derive the Model Reference Direct Adaptive Control Law for a scalar plant with uncertainty for regulation control. Employ Lyapunov method.

[4+16=20]

8. Write short notes on **ANY TWO** from the following:

a) Selection of the reference model in Model Reference Adaptive Control.

b) Direct versus Indirect Adaptive Control Approaches.

c) Various robustification techniques for adaptive control systems.

[10+10=20]