EE8008 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

DETAILED SYLLABUS

OBJECTIVES:

To impart knowledge about the following topics:

- The concept of system identification and adaptive control
- Black-box approach-based system identification
- Batch and recursive identification
- Computer Controlled Systems
- Design concept for adaptive control schemes

UNIT I NON-PARAMETRIC METHODS

Non-parametric methods - Transient analysis - frequency analysis - Correlation analysis - Spectral analysis - Input signal design for identification

UNIT II PARAMETRIC METHODS

Least squares estimation – Analysis of the least squares estimate - Best linear unbiased estimate – Model parameterizations - Prediction error methods.

UNIT III RECURSIVE IDENTIFICATION METHODS

The recursive least square method - Model validation –Model structure determination - Introduction to closed loop system identification.

UNIT IV ADAPTIVE CONTROL SCHEMES

Introduction – Auto-tuning of PID controller using relay feedback approach – Types of adaptive control, Gain scheduling, Model reference adaptive control, Self–tuning controller – Design of gain scheduled adaptive controller – Applications of gain scheduling.

UNIT V MODEL-REFERENCE ADAPTIVE SYSTEM (MRAS) and SELF-TUNING REGULATOR (STR)

STR – Pole placement design – Indirect STR and direct STR – MRAC - MIT rule – Lyapunov theory – Relationship between MRAC and STR.

TEXT BOOKS:

1. T. Soderstrom and PetreStoica, System Identification, Prentice Hall International (UK) Ltd. 1989

2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009.

REFERENCES

1 L. Ljung, System Identification - Theory for the User, 2nd edition, PTR Prentice Hall, Upper Saddle River, N.J., 1999.

2 K. S. Narendra and A. M. Annaswamy, Stability Adaptive Systems, Prentice-Hall, 1989.

3 H. K. Khalil, Nonlinear Systems, Prentice Hall, 3rd edition, 2002.

4 William S. Levine, “Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.

5 S. Sastry and M. Bodson, Adaptive Control, Prentice-Hall, 1989