CC5008 PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEM

DETAILED SYLLABUS

OBJECTIVE

- To develop an understanding of the use and benefits of modeling and simulation in manufacturing systems design and operation.

- To develop an understanding of techniques to assess factory performance and identify areas for improvement.

- To develop an understanding of techniques to assess and manufacturing performance.

- To develop an understanding of techniques to enable responsive manufacturing systems.

- To provide the students with knowledge of a set of tools to enable them to assess the performance of a manufacturing facility

UNIT I MANUFACTURING SYSTEMS & CONTROL

Automated Manufacturing Systems - Modelling - Role of performance modelling – simulation models- Analytical models. Product cycle - Manufacturing automation - Economics of scale and scope - input/output model - plant configurations. Performance measures - Manufacturing lead time- Work in process -Machine utilization - Throughput – Capacity - Flexibility - performability - Quality. Control Systems - Control system architecture - Factory communications - Local area networks - Factory net works - Open systems interconnection model - Net work to network interconnections - Manufacturing automation protocol - Database management system.

UNIT II MANUFACTURING PROCESSES

Examples of stochastic processes - Poisson process Discrete time Markov chain models - Definition and notation - Sojourn times in states - Examples of DTMCs in manufacturing - Chapman - Kolmogorov equation - Steady-state analysis. Continuous Time Markov Chain Models - Definitions and notation - Sojourn times in states - examples of CTMCs in manufacturing - Equations for CTMC evolution - Markov model of a transfer line. Birth and Death Processes in Manufacturing - Steady state analysis of BD Processes - Typical BD processes in manufacturing.

UNIT III QUEUING MODELS

Notation for queues- Examples of queues in manufacturing systems - Performance measures- Little's result - Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns - Analysis of a flexible machine center.

UNIT IV QUEUING NETWORKS

Examples of QN models in manufacturing - Little's law in queuing networks - Tandem queue- An open queuing network with feed back - An open central server model for FMS - Closed transfer line - Closed server model - Garden Newell networks.

UNIT V PETRI NETS

Classical Petri Nets - Definitions - Transition firing and reachability - Representational power- properties - Manufacturing models. Stochastic Petri Nets - Exponential timed Petri Nets - Generalized Stochastic Petri Nets - modelling of KANBAN systems - Manufacturing models.

REFERENCES

1. Gupta S.C., & Kapoor V.K., "Fundamentals of Mathematical Statistics", 3rd Edition, Sultan Chand and Sons, New Delhi, 1988.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, New Jersey, 1982.
3. Viswanadham, N and Narahari, Y. "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi, 1994