

NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI-620 015

M.Tech. DEGREE

(INDUSTRIAL ENGINEERING)

4 SEMESTER PROGRAMME

CODE: PR

SYLLABUS

FOR

CREDIT BASED CURRICULUM

OPERATIVE FOR STUDENTS OF 2006 -2007 ADMISSION



DEPARTMENT OF PRODUCTION ENGINEERING

JUNE 2006

M.Tech. INDUSTRIAL ENGINEERING

CURRICULUM 2006-2007 FOR FULL TIME STUDENTS (4 Semesters)

Curriculum Structure:

The total minimum credits required for completing the programme is 60

Semester I

CODE	COURSE OF STUDY	L	T	P	C
MA 611	Probability and Statistics	3	1	0	4
PR 651	Advanced Operations Research	3	0	0	3
PR 653	Analysis and Control of Manufacturing Systems	3	0	0	3
*****	Elective I	3	0	0	3
*****	Elective II	3	0	0	3
PR 659	Operations Management Lab.	0	0	4	2
		15	1	4	18

Semester II

CODE	COURSE OF STUDY	L	T	P	C
PR 652	Quality Engineering	3	0	0	3
PR 654	Modeling and Simulation	3	1	0	4
PR 656	Work Design and Ergonomics	3	0	0	3
*****	Elective III	3	0	0	3
*****	Elective IV	3	0	0	3
PR 658	Simulation Lab.	0	0	4	2
		15	1	4	18

Semester III

CODE	COURSE OF STUDY	L	T	P	C
PR 697	Project Work-Phase-I	0	0	24	12

Semester IV

CODE	COURSE OF STUDY	L	T	P	C
PR 698	Project Work-Phase-II	0	0	24	12

List of Electives :

CODE	COURSE OF STUDY	L	T	P	C
Elective I & II					
PR 663	Facilities Planning	3	0	0	3
PR 665	Value Engineering	3	0	0	3
PR 669	Project Management	3	0	0	3
MB 681	Financial Management	3	0	0	3
Elective III & IV					
PR 666	Supply Chain Management	3	0	0	3
PR 668	Total Quality Management	3	0	0	3
PR 672	Terotechnology	3	0	0	3
Or any other elective subject from any other department					

List of reserve Electives :

CODE	COURSE OF STUDY	L	T	P	C
PR 661	Sequencing and Scheduling	3	0	0	3
PR 662	Advanced Optimization Techniques	3	0	0	3
PR 664	Production Management Systems	3	0	0	3
PR 667	Enterprise Resource Planning	3	0	0	3
PR 670	Design & Analysis of Flexible Manufacturing Systems	3	0	0	3
PR 671	Computer-Aided Process Planning and Control	3	0	0	3
PR 674	E- Commerce	3	0	0	3

MA 611 PROBABILITY AND STATISTICS

Random variable – Two dimensional random variables – Standard probability distributions – Binomial, Poisson and Normal distributions - Moment generating function.

Special distributions – Uniform, Geometric, Exponential, Gamma, Weibull and Beta distributions – Mean, Variance, Raw moments from moment generating functions of respective distributions.

Sampling distributions – Confidence interval estimation of population parameters – Testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test.

Curve fitting - Method of least squares - Regression and correlation – Rank correlation – Multiple and partial correlation – Analysis of variance - One way and two way classifications – Time series analysis.

Basics concepts of reliability - Failure rate analysis – Reliability of systems – Series, Parallel – Maintenance - Preventive and corrective – Maintainability equation – Availability – Quality and Reliability.

REFERENCES

1. *BOWKER and LIBERMAN, Engineering Statistics, Prentice-Hall.*
2. *GUPTA, S.C. and KAPOOR, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons.*
3. *SPIEGEL, MURRAY R., Probability and Statistics, Schaum's series.*
4. *SPIEGEL, MURRAY R., Statistics, Schaum's series.*
5. *TRIVEDI K.S., Probability and Statistics with Reliability and Queueing and Computer Science Applications, Prentice Hall of India.*

PR 651 ADVANCED OPERATIONS RESEARCH

Linear programming- methods- Simplex method – Big M method – Two phase method – Special cases - Goal programming.

Duality analysis-sensitivity analysis-changes in right- hand side constants of constraints-changes in objective function co-efficient-adding a new constraints-adding a new variable.

Dual simplex method- Cutting plane algorithm- Branch and Bound technique-Zero-one implicit enumeration algorithm - applications of dynamic programming – Cargo loading model – Work force size model – Equipment replacement model – Inventory model.

Shortest path model – Maximal flow problem - Crashing of project network – Resource leveling & Resource allocation technique.

Unconstrained nonlinear algorithms-Constrained algorithms- Separable programming - Quadratic programming-Geometric programming-Stochastic programming.

REFERENCES

1. *Handy M. Taha, Operations Research, An introduction, 6th Prentice Hall of India, New Delhi, 2001*
2. *Don. T. Philips, A. Ravindram and J. Soleberg, Operations Research, Principles & Practice, John Wiley & sons, 1992.*
3. *Panneerselvam, R, "Operations Research", Prentice – Hall of India, New Delhi, 2002*

PR 653 ANALYSIS AND CONTROL OF MANUFACTURING SYSTEM

Production system –Forecasting and its types – Forecasting errors and tracking signals - Inventory costs

Terminology of Inventory systems – Inventory policies –Analysis of Static Deterministic Inventory Models

Aggregate Production Planning - Value stream management for lean office

Introduction to material requirements planning - Lot sizing – MRP Versus MRP II – Software structure of MRP – Re planning frequency in MRP

Introduction to Job Sequencing – n Jobs, One machine – n Jobs, Two machines – n Jobs, Three machines – n jobs - Two Jobs , M Machines – n jobs, M Machines – sequencing Jobs on Parallel Machines – Minimization of Setup costs - Travelling Salesman problem –Job shop scheduling – Assembly line balancing

REFERENCES

1. *Elsayed A. Elsayed and Thomas O. Boucher , “ Analysis and Control of Production Systems, Printice Hall Publ., 1994.*
2. *Monks J.G., “ Operations Management, John Wiley, 1992.*
3. *Buffa, E.S. and Sarin, R.K. ,” Modern production /Operations Management”, John Wiley & Sons, 1994.*

PR 659 OPERATIONS MANAGEMENT LABORATORY

OBJECTIVE: Practical Exposure on Operation Management Packages

1. Smart cam
2. Harvard project manager
3. Linear programming
4. Transportation
5. Project management
6. Facilities layout
7. Material requirement planning
8. Inventory management
9. Quality management
10. Job shop scheduling
11. Forecasting
12. CAFIMS

PR 652 QUALITY ENGINEERING

Basics of quality – process capability analysis – quality gurus and their philosophies – Quality standards – ISO 9000 series and 14000 series

Design of experiments – Anova analysis – Reliability – MTBF – MTTR

Acceptance sampling by variables and attributes – ASN – ATI – AOQL - IS2500 plans – MIL STD 105E

Control charts for variables and attributes - Taguchi methods, cases Concurrent engineering

Quality function deployment – FMEA – Quality circles - Total quality management –Kaizen.

REFERENCE

1. *Philips J.Ross, Taghuchi techniques for quality engineering, McGraw Hill, New York, 1998.*
2. *Douglas C.Montgomery, Introduction to statistical quality control, 2nd Edition , Jhon Wiley & sons, 1991.*
3. *E.L. Trant, and Leavensworth, Statistical Quality Control, Mcgraw Hill, 1984.*

PR 654 MODELING AND SIMULATION

Introduction to systems and modeling - discrete and continuous system - Limitations of simulation, areas of application - Monte Carlo Simulation. Discrete event simulation and their applications in queueing and inventory problems.

Random number generation and their techniques - tests for random numbers

Random variable generation –

Analysis of simulation data - Input modeling – verification and validation of simulation models – output analysis for a single model.

Simulation languages and packages - FORTRAN, C , C++, GPSS, SIMAN V, MODSIM III, ARENA, QUEST, VMAP - Introduction to GPSS – Case studies - Simulation of manufacturing and material handling system.

REFERENCES

1. *Jerry Banks and John, S. Carson II, 'Discrete – Event System Simulation', Prentice Hall Inc., New Jersey, 1984.*
2. *Geoffrey Gordon, 'System simulation', Prentice Hall, NJ, 1978.*
3. *Law, A.M. and W.D. Kelton, 'Simulation modelling analysis', McGraw Hill, 1982.9*

PR 656 WORK DESIGN AND ERGONOMICS

Introduction to work study - Productivity – scope of motion and time study - Work methods design.

Motion study-process analysis – process chart – flow diagram – assembly process chart – man and machine chart – two handed process chart - Micro motion and memo motion study.

Work measurement and its methods.

Work sampling – Determining time standards from standard data and formulas - Predetermined motion time standards – work factor system – methods time measurement, Analytical Estimation. Measuring work by physiological methods – heart rate measurement – measuring oxygen consumption– establishing time standards by physiology methods.

Motion economy- Ergonomics practices – human body measurement – layout of equipment – seat design - design of controls and compatibility – environmental control – vision and design of displays. Design of work space, chair table.

REFERENCES

1. Barnes, Raeph.m., “*Motion and Time Study – Design and Measurement of Work* “, John Wiley &sons, New York, 1990.
2. Mc.Cormick, E.J., “*Human Factors in Engineering and Design*”, Mc.Graw Hill.
3. ILO, “*Introduction to Work study* “, Geneva, 1974.

PR 658 SIMULATION LAB.

1. GENERAL SYSTEM MODELING AND SIMULATION IN ARENA
2. MANUFACTURING MODELING AND SIMULATION IN QUEST
3. MANUFACTURING MODELING AND SIMULATION IN GPSS
4. USE OF OM EXPERT FOR QUEUING MODELS
5. SINGLE SERVER QUEING IN C LANGUAGE
6. INVENTORY MODELING USING C LANGUAGE
7. COMPUTER AIDED FACTORY INTEGRATED MANAGEMENT SYSTEM
8. RANDOM VARIATE GENERATE USING C
9. ROBOT WORK CELL SIMULATION

PR 663 FACILITIES PLANNING

Facilities requirement - need for layout and its types.

Plant location analysis –simple problems in single facility location models, network location problems.

Layout design - Design cycle – computer algorithms – ALDEP, CORELAP, and CRAFT.

Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing

Material handling design - handling equipment types , selection and specification, containers and packaging.

REFERENCES

1. *Tompkins, J.A. and J.A. White, Facilities planning, John Wiley, 1984.*
2. *Richard Francis, L. and John A. White, Facilities layout and location, an analytical approach, Prentice Hall Inc 1984.*
3. *James Apple. M., Plant layout and Material handling, John Wiley, 1977.*

PR 665 VALUE ENGINEERING

An overview of value engineering (VE) - Definition, Concepts and approaches of value analysis and engineering – evaluation of VE.

Evaluation of function, Problem setting system, problem solving system, setting and solving management-decision – type and services problem, evaluation of value.

Results accelerators, Basic steps in using the systems

Value analysis - Understanding the decision environment, Effect of value analysis on other work in the business.

VE Team, Co-ordinate, designer, different services, definitions, construction management contracts, value engineering case studies, Effective organization for value work, function analysis system techniques-FAST diagram.

REFERENCES

1. *Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990.*
2. *Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd Edn., 1972*
3. *Tufty Herald, G. "Compendium on Value Engineering", The Indo American Society, 1st Edn., 1983.*

PR 669 PROJECT MANAGEMENT

Project development cycle - Objectives of investment decision making – Technical analysis.

Materials and inputs – production technology – product mix – plant capacity – location and site – machinery and equipment – structures and civil works – project charts and layouts.

Costing - Financial and economic appraisal of single project – multiple projects and constraints – method of ranking – mathematical programming approach – LP, ILP and goal programming model.

Portfolio theory and capital asset pricing model approaches to risk analysis - Network techniques for project management – PERT, CPM.

Introduction to Software Project Management (SPM) - Software Metrics – Software quality – Risk management in SPM- Emerging issues.

REFERENCE

1. Choudhury, S., 'Project management', Tata McGraw Hill, 1988.
2. Prasanna Chandra, 'Project Management', Tata McGraw Hill, 1986.
3. Walker Royce, Software project management, Addison Wesley, Pearson Education.

MB 681 FINANCIAL MANAGEMENT

Role of financial management

Capital and inventory management

Capital budgeting

Financing decision

Risk analysis

REFERENCE

1. Van horne, J.C., "Fundamentals of financial management", PHI, 1997.
2. Prasanna chandra, "Financial Management theory and practice", TMH, Vth edition, 2001.
3. I.M.pandey, "Financial Management – theory and practice", Vikas publishing Hina 2002.

PR 666 SUPPLY CHAIN MANAGEMENT

Introduction to logistics – factors affecting logistics-network design.

Supply process – distribution management – factors of supply chain – Product life cycle management in SC – supply chain redesign.

Logistics organization-logistics information systems-topology of SC.

Collaborative product commerce – supply chain optimization-Decision making in SC.

Applications of SCM – ware house management system – product data management – E – Commerce – Reverse logistics – Cases in Paper industry – Furniture industry.

REFERENCES

1. *David Simchi – Levi & Philip Kaminsk, Designing and Managing the supply chain, McGraw-Hill Companies Inc., 2000.*
2. *Monczka / Trend / Handfiled, Purchasing and Supply chain management, Thomson south- western college publishing, 2000.*
3. *B.S. Sahay, Supply chain management for global competitiveness, Macmillan India Ltd, Delhi, 2000.*

PR 668 TOTAL QUALITY MANAGEMENT

Concepts of quality systems - The total quality management system – Characteristics of the total quality management system.

The task of quality organization - organizing principles – Structural total quality organization

Introduction to iso9000 standards - ISO 9000 series - Failure costs – appraisal costs – prevention cost – avoidable and unavoidable cost.

Quality audit – policies and objectives audit of quality plans – audit of execution Vs plans – product auditing – audit methodology – quality rating – audit reporting.

Vendor relations – objectives and activities - vendor qualification process – vendor quality surveys – Vendor quality improvement – vendor quality rating and evaluation .

REFERENCES

1. *Rose ,J.E., “Total Quality Management “,Kogan page Ltd ,1993*
2. *Juran, J.M.&Gryna,F.M.,”Quality Control Handbook”,Prentice Hall publications.*
3. *Feignbaum, “Total Quality Control”.*

PR 672 TERO TECHNOLOGY

Probability concepts – Probability distributions – density and distribution functions for uniform, exponential, razeligh, weibull, normal distribution - Non-maintained systems – Reliability definition and its important – method of improving reliability redundancy techniques – failure data analysis

Reliability models- Hazard models – constant, linearly increasing and Weibull models- estimating of reliability, failure density and MTTF for hazard models.

Maintenances systems and economics of reliability - Maintainability and availability concepts, MTBF, MTTR, MTBM & MDT repair hozard rate, maintainability and availability functions and their mathematical expressions

Maintenance and spares management - preventive replacement- individual breakdown replacement policy - individual preventive replacement policy - preventive group replacement.

Condition based maintenance - advantages and disadvantages - vibration monitoring - vibration parameters - vibration instruments

REFERENCES

1. *Srinath.L.S., "Reliability Engineering", Affiliated East West Press Pvt. Ltd.,1991.*
2. *Collact, "Mechanical Fault Diagnosis & condition monitoring",1977.*
3. *Balagurusamy.E., "Reliability Engineering", Tata Mcgraw Hill Publishing Company, New Delhi,1984.*

PR 661 SEQUENCING AND SCHEDULING

Single machine models - Scheduling function and theory – scheduling problem: objectives, constraints – pure sequencing – performance measures, sequencing theorems - SPT, EDD sequence – minimization of mean flow time, mean tardiness etc – branch and bound algorithm –assignment model.

Parallel machine models - Independent jobs Minimizing makespan.

Flow shop models - Johnson's problem – Extension of Johnsons's rule for 3 machine problem – Jackson's method – algorithm – Palmer's method.

Job shop models – dynamic job shop simulation.

Other models - Scheduling of intermittent production: Resource smoothing – Giffler Thomson algorithm – Branch and Bound method – Scheduling of continuous production - Line balancing.

REFERENCES

1. *Michael Pinedoo, Scheduling: theory, algorithms and systems, Prentice Hall, New Delhi, 1995.*
2. *King, J.R. Production planning and control, Pergamon International Library, 1975.*
3. *Kenneth R.Baker, Introduction to sequencing and scheduling, John Wiley and Sons, 1974.*

PR 662 ADVANCED OPTIMISATION TECHNIQUES

Classical optimization - Optimal problem formulation, Single value and multi-variable optimization algorithms- Elimination & search methods.

Non-linear programming - One-dimensional minimization - Kuhn-Tucker conditions, constrained and unconstrained optimization techniques and its characteristics.

Integer linear and non-linear programming, Geometric programming.

Multi criteria mathematical programming problems, solution methods.

Non-traditional optimization - Genetic algorithms - Simulated annealing.

REFERENCES

1. *Kalyanmoy Deb, Optimization for Engineering design – algorithms and examples. PHI, New Delhi, 1995.*
2. *S.S.Rao, Optimization theory and applications, Wiley Eastern Ltd., 1979.*
3. *Garfinkel, R.S. and Nemhauser, G.L., Integer programming, John Wiley & Sons, 1972.*

PR 664 PRODUCTION MANAGEMENT SYSTEMS

Manufacturing systems - CIM and production management –Job shop production, batch production, mass production.

Introduction to MRP and MRP II –Evolution from MRP to MRP II –Lot sizing in MRP systems – Lot for lot method, economic quantity method, periodic order quantity method, part period balancing, Wagner – Whitin approach –How to choose lot sizing policy.

Just In Time (JIT) - KANBAN System –Types of KANBAN cards.

Introduction to optimized production technology (OPT) - OPT philosophy improvement tools –Requirement and assumptions of OPT.

Total Quality management system –Quality system Management – ISO 9000 series – Quality circles –Concepts – Formation & Implementation.

REFERENCES

1. *Browne, Hairnet & Shimane, “Production Management – A CIM Perspective”, Addison Wesley Publication Co., 1989.*
2. *Orlicky, J., “Materials Requirement Planning: The new way of life in production and Inventory Management”, McGraw Hill, 1975.*
3. *Schonlenger , R.J., “ Japanese Manufacturing techinques: 9 Hidden lessons simplicity “, The Free Press , 1982.*

PR 667 ENTERPRISE RESOURCE PLANNING

ERP: An Overview - Benefits of ERP - ERP and Related Technologies - Business Process Reengineering (BPR).

Data Warehousing - Data Mining - On-line Analytical Processing (OLAP) - Supply Chain Management.

ERP Implementation - ERP Implementation Lifecycle - Implementation Methodology - Vendors, Consultants and Users - Contracts with Vendors, Consultants and Employees - Project Management and Monitoring.

Business Modules in an ERP Package - ERP Market - ERP-Present and Future - Turbo Charge the ERP System.

Enterprise Integration Applications (EIA) - ERP and E-Commerce - ERP and Internet - Future Directions in ERP.

REFERENCES

1. *Alexis Leon, ERP Demystified, Tata McGraw–Hill Publishing company limited, New Delhi, 2002*
2. *Brady, Enterprise Resource Planning, Thomson Learning, 2001*
3. *S.Sadagopan, ERP: A managerial Perspective, Tata McGraw-Hill publishing company Limited, New Delhi 1999.*

PR 670 DESIGN AND ANALYSIS OF FLEXIBLE MANUFACTURING SYSTEMS

Flexible manufacturing system and its Subsystems - Group technology – justification of FMS

Planning problems of FMS - Long range planning of flexible manufacturing systems - planning phases in the operation of a flexible manufacturing system. Problems in the economic evaluation of a flexible manufacturing system.

Models for the performance evaluation of an FMS configuration - Decision models for the design of a FMS - Routing optimization - Capacity optimization - Equipment optimization

Decision models for the design of a FMS-Classification of decision problems and models in the selection of the optimal FMS configuration-quantifiable goals of the configuration planning. Routing optimization: Routing optimization with an unlimited number of pallets.

Decision models for pre-release planning in FMS – Batching - assignment of operations and machines: The Whitney and Gaul approach–The Bastos approach –A hierarchical approach – The Kuhn approach – Integrated batching and operation / machine assignment.

REFERENCES

1. *Horst Tempelmeier and Heinrich Kuhn, "Flexible Manufacturing Systems", John Wiley & Sons, inc., 1993.*
2. *Visvanathan Narahari, "Performance modeling of Automated manufacturing systems", PHI, New Delhi, 1996.*
3. *Andrew Kusiak, "Intelligent Manufacturing Systems", Prentice Hall, 1990.*

PR 671 COMPUTER AIDED PROCESS PLANNING AND CONTROL

Process Planning - part design representation – Engineering design – design drafting – Computer aided design – CAD input/output devices – Geometric modeling for Process planning.

Group technology coding and its types

Process engineering – experiment based planning – machinist handbook – and decision trees – process capability analysis.

Variant process planning – preparatory stage – production stage – family formation – data base structure – search procedure – plan editing – parameter selection.

Generative approach – forward and backward planning – input format – CAD modes – decision logic – decision tree – artificial intelligence.

REFERENCES

1. *Tien-Chien Chang and Richard A. Wysk, 'Introduction to automated process planning system', Prentice – Hall, 1985.*
2. *Mikell, P. Groover, 'CAD/CAM', Prentice – Hall, 1985.*
3. *Khabal Taraman, 'CAD/CAM integrates and innovation', Computer and Automated systems association of SME, 1989.*

PR 674 E-COMMERCE

E-commerce Technology: Principles – Potential – Data Warehousing – Temporal Coherency – Networking Infrastructure – Software Tools – IP, TCP HTTP, HTML – Cryptography – Consumer Interface Technologies – OALP & Data mining – Case studies.

E-commerce: Effect on job, growth, trade, international co-operation – Tax problems - Application of E-commerce in different sectors – service, industry, domestic etc., - multidisciplinary approach to E-commerce – Software's – case studies.

E-commerce Management: Net Centrism – Navigation – Digital Design – Web Metrics – Business models – Hyper Markets – Intelligent Agents – Auctions – Design, Protocol – Case Studies.

Channel conflict management: Security and Encryption – Abuse and Netiquette – Internet Governance – Economics of E Commerce – Equilibrium price – Electronic Marketing – Taxing – E business – Road map for success – case studies.

E-commerce – Legal Issues: Software Intellectual property law – Contract law for E-commerce, Warranties and New Products – Cyber law issues – Privacy and Transborder flows, Fraud – Security of Information and Risks – Electronic Highway Robbery – Consumer Protection – Case Studies.

REFERENCES

1. *Kalakota & Whinston, Frontiers of Electronic Commerce, Addison Wesley, 2001.*
2. *Efraim Turbon, Jae Lee, David King, H. Michael Chung, Electronic Commerce, A Managerial Perspective, Pearson Education Asia, 2001.*
3. *Napier, Judd, Rivers and Wagner, Creating a winning E-Business, Thomson Learning, 2000.*