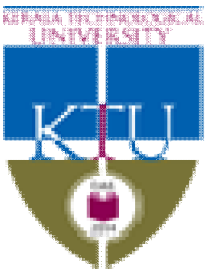
KERALA TECHNOLOGICAL UNIVERSITY



(THRISSUR CLUSTER - 07)

SCHEME AND SYLLABI

of

M. TECH.

in

MANUFACTURING SYSTEMS MANAGEMENT

OFFERING DEPARTMENT

PRODUCTION ENGINEERING

CLUSTER LEVEL GRADUATE PROGRAM COMMITTEE

1.	Dr Devdas Menon, Professor, IIT Madras, Chennai	Chairman
2	Principal, Government Engineering College Trichur, Thrissur	Convener
3	Principal, AXIS College of Engineering & Technology, East Kodaly, Murikkingal, Thrissur	Member
4	Principal, IES College of Engineering, Chittilapilly, Thrissur	Member
5	Principal, MET'S School of Engineering, Mala, Thrissur	Member
6	Principal, Royal College of Engineering & Technology, Akkikkavu, Thrissur	Member
7	Principal, Vidya Academy of Science & Technology, Thalakkottukara, Thrissur	Member
8	Principal, Thejus Engineering College, Vellarakkad, Erumappetty, Thrissur	Member
9	Principal, Universal Engineering College, Vallivattom, Konathakunnu, Thrissur	Member
10	Principal, Sahrdaya College of Engineering & Technology, Kodakara, Thrissur	Member

CERTIFICATE

This is to certify that

1. The scheme and syllabi are prepared in accordance with the regulation and guidelines issued by the KTU from time to time and also as per the decisions made in the CGPC meetings.
2. The suggestions/modifications suggested while presenting the scheme and syllabi before CGPC on 25.6.2015 have been incorporated.
3. There is no discrepancy among the soft copy in MS word format, PDF and hard copy of the syllabi submitted to the CGPC.
4. The document has been verified by all the constituent colleges.

Coordinator in charge of syllabus revision of the programme

(sd/-)

Dr. Satish K. P., Associate Professor,

Department of Production Engineering,

Government Engineering College Trichur, Thrissur

Principal of the lead college (sd/-)

Dr. K. P. Indiradevi, Principal,

Government Engineering College Trichur, Thrissur

Principals of the colleges in which the programme is offered

No	Name of the college	Principal's Name	Signature
1	Government Engineering College Trichur, Thrissur	Dr. K. P. Indiradevi	(sd/-)
2	Thejus Engineering College, Vellarakkad, Erumappetty, Thrissur	Dr. K. Satheesh Kumar	(sd/-)

(sd/-)

Date: Chairman

Place: Dr Devdas Menon, Professor, IIT Madras, Chennai

VISION and MISSION

VISION

To evolve into a centre of excellence pursuing high quality learning and research in the continuously emerging areas of manufacturing systems management, while maintaining a constant and continuous industry interaction

MISSION

To provide quality post graduate education in Manufacturing Systems Management and to transform the youth into personnel with sufficient managerial and technical - knowledge, skills and attitude, who in turn can become committed technical and managerial personnel for the social and economic well being of the Nation's manufacturing sector.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives are,

1. To mould the students with global standards, for successful career in manufacturing sector that meet the needs of industry.
2. To provide a firm grounding and motivating for a lifelong learning in the various aspects of manufacturing systems and their management consisting of operations, systems, processes, strategy, quality, safety, energy, information and product design
3. To provide knowledge related to collection and analysis of data and subsequent decision making consisting of strategic, tactical and operational decisions.
4. To provide a strong research base for doing research in the area of manufacturing and management and thereby finding solutions to real world problems of manufacturing organizations.
5. To provide adequate knowledge and skills for the design and development of products and processes which meet the current demand of the industry.
6. To develop multifaceted capabilities of advanced computing techniques for the design and analysis of manufacturing systems.
7. To impart awareness of professional ethics and codes of professional practice with commitment towards social responsibility and sustainable development.
8. To produce an innovative engineer-manager with real modern industrial problem solving capabilities who in turn can take up entrepreneurship capabilities.

PROGRAM OUTCOMES (POs)

Students of M.Tech (Manufacturing Systems Management) programme should at the time of their post graduation be in possession of:

1. Ability to apply mathematical and engineering knowledge to identify and solve real problems of manufacturing organizations.
2. Ability to analyse the problems of the manufacturing sector on contemporary issues and identify research opportunities and do research using proven methodologies.
3. Ability to design and develop solutions with regard to a productive manufacturing system or a product which fulfils customers real requirements through total quality management and intergraded product development approaches and managing its lifecycle.
4. Ability to conduct investigations on complex problems of manufacturing organisations by the use and analysis of data and experimental methods for improving productivity.
5. Capacity to understand the modern tools and their applications in advanced manufacturing systems, automation, and modeling of such systems and to attain an appropriate mastery of the knowledge, techniques, skills of the discipline
6. Understand the society and thereby the social responsibility of the engineer and execute their role as regards the manufacturing scenario.
7. Ability to create an environment friendly, ergonomically designed, safe workplace within a sustainable manufacturing system by assuring the reliability of equipments and optimal usage of valuable energy resources.
8. Understand of ethics and values of the profession and contribute towards the objectives of the organization.
9. Ability to do a multidisciplinary work as individual and as a team for formulating strategies and manage operations in a fully automated environment, supply chains quality, and enterprise resources.
10. Capacity to communicate effectively and professionally in both verbal and written
11. Develop innovative and entrepreneurial skills to manage a manufacturing organization independently by managing the other important functions consisting of projects, finance, marketing and human resources.
12. Graduate will be capable of self education and realize the value of lifelong learning by constantly adopting to the technological changes in manufacturing systems
13. Ability to critically observe the outcomes of a manufacturing organization, take corrective actions, through a process of independent and reflective learning

M.Tech MANUFACTURING SYSTEMS MANAGEMENT
(PRODUCTION ENGINEERING)

Program Credit Assignment

Credit requirements :- 64 to 68 credits depending on the stream of specialization

Normal Duration :- Regular: 4 semesters; External Registration: 6 semesters;

Maximum duration :- Regular: 6 semesters; External registration : 7 semesters.

Courses: Core Courses:- Either 4 or 3 credit courses; Elective courses: All of 3 credits

CREDITS AND EXAMINATION SCHEME

Semester 1 (Credits: 22)

Exam Slot	Course No:	Name	Hours per week			Internal marks	End Semester Exam		Total Marks	Credits
			L	T	P/D		Marks	Duration (hrs)		
A	07MA6021	Managerial Statistics	4	0	0	40	60	3	100	4
B	07PE6101	Advanced Manufacturing Systems	4	0	0	40	60	3	100	4
C	07PE6103	Advanced Operations Management	4	0	0	40	60	3	100	4
D	07PE6105	Total Quality Management	4	0	0	40	60	3	100	4
E	07PE61XX	Elective I	3	0	0	40	60	3	100	3
	07GN6001	Research Methodology	0	2	0	100	0	0	100	2
	07PE6107	Manufacturing Systems Management Lab	0	0	2	100	0	0	100	1
	07PE6117	Introduction to Seminar	0	0	1	-	-	-	-	-
		Departmental Assistance	-	-	6	-	-	-	-	-
	TOTAL		19	2	9	400	300		700	22

Electives –I

07PE6109 Industrial Robotics and Expert Systems

07PE6111 Advanced Materials for Manufacturing and Processes

07PE6113 Management Accounting and Financial Management

07PE6115 Safety Engineering and Industrial Hygiene

Semester 2 (Credits: 20)

Exam Slot	Course No:	Name	Hours per week			Internal marks	End Semester Exam		Total Marks	Credits
			L	T	P/D		Marks	Duration (hrs)		
A	07PE6102	Modelling and analysis of Manufacturing Systems	3	0	0	40	60	3	100	3
B	07PE6104	Enterprise Resource Planning	3	0	0	40	60	3	100	3
C	07PE6106	Integrated Product Development	3	0	0	40	60	3	100	3
D	07PE61XX	Elective II	3	0	0	40	60	3	100	3
E	07PE61XX	Elective III	3	0	0	40	60	3	100	3
	07PE6108	Mini Project	0	0	4	100	0	0	100	2
	07PE6112	Computational Laboratory	0	0	2	100	0	0	100	1
	07PE6114	Seminar I	0	0	2	100	0	0	100	2
		Departmental Assistance	-	-	7	-	-	-	-	-
	TOTAL		15	0	15	500	300		800	20

Electives –II

07PE6116 Design and analysis of Experiments
07PE6118 Management Information Systems
07PE6122 Reliability Engineering
07PE6124 Multivariate Data Analysis

Electives –III

07PE6128 Industrial Marketing and Marketing Research
07PE6132 Ergonomics
07PE6134 Strategic Management
07PE6136 Markov Modelling and Queuing Theory

Semester 3 (Credits: 14)

Exam Slot	Course No:	Name	Hours per week			Internal marks	End Semester Exam		Total Marks	Credits
			L	T	P/D		Marks	Duration (hrs)		
A	07PE71XX	Elective IV	3	0	0	40	60	3	100	3
B	07PE71XX	Elective V	3	0	0	40	60	3	100	3
	07PE7101	Seminar II	0	0	2	100	0	0	100	2
	07PE7103	Master Research Project Phase I	0	0	14	G: 20, EC: 30	0	0	50	6
		Departmental Assistance	-	-	8	-	-	-	-	-
	TOTAL		6	0	24	230	120		350	14

Electives –IV

07PE7105 Reverse Engineering
07PE7107 Supply Chain Management systems
07PE7109 Simulation of Manufacturing Systems
07PE7111 Advanced Optimisation Techniques

Electives –V

07PE7113 Industrial Energy Management
07PE7115 Soft Computing Techniques
07PE7117 Advanced Maintenance Management
07PE7119 Cloud Manufacturing

Semester 4 (Credits: 12)

Exam Slot	Course No:	Name	Hours per week			Internal marks		External Expert	Total Marks	Credits
			L	T	P/D	G	EC			
	07PE7102	Master Research Project Phase II	0	0	22	30	40	30	100	12
		Departmental Assistance	-	-	8	-		-	-	-
	TOTAL		0	0	30	70		30	100	12

Academic Assessment/Evaluation

The University follows a continuous academic evaluation procedure. The Assessment procedure and corresponding weights recommended are as follows:-

For theory courses

i) Two internal tests, each having 15%
ii) Tutorials/Assignments/ Mini projects having 10%
iii) End Semester examination having 60%

All the above are mandatory requirements to earn credits. Students who have missed either the first or the second test can register with the consent of the faculty member and the Head of the Department concerned for a re-test which shall be conducted soon after the completion of the second test and before the end semester examination. The re-test will cover both the first and the second test course plans. If a student misses both the scheduled tests, there is no provision for any retests and zero marks will be given for each test. In case of serious illness and where the attendance is above 70% the Principal may permit the conduct of the tests for a student based on his application and other relevant medical reports. Such cases are to be reported to CGPC.

For Laboratory /Practical courses

i) Practical Records /outputs 40%
ii) Regular Class Viva-Voce 20%
iii) Final Test (Objective) 40%

07MA6021 MANAGERIAL STATISTICS

Credits: 4-0-0 : 4 **Year : 2015**

Pre-Requisites: B.Tech Level Mathematics

Course Objectives:

To equip the students to extract information from the data and to interpret the information and draw the conclusions

Syllabus

Probability and Random Variables, Correlation and Regression, Estimation Theory, Testing of Hypothesis, Design of Experiments and Multivariate Analysis

Course Outcome

At the end of course, the student will be able to:

- Extract information from the data
- Interpret the information and draw the conclusions

References:

1. Johnson, R.J., Miller & Freund's, "Probability and Statistical for Engineers", 6th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2002).
2. Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi (2001).
3. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury, Singapore (2002).
4. Dallas E Johnson et al., "Applied Multivariate Methods for Data Analysis", Thomson and Duxbury press, Singapore (1998).
5. Joseph F. Hair, Jr. et al. "Multivariate data analysis", Pearson Edn. 2007

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 - Probability and Random Variables Probability – Random variables - Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions – Moments – Moments generating functions and their properties –.	**9**	**15%**
Module 2 - Correlation and Regression Correlation, Regression - Partial and Multiple correlation – Partial and Multiple regression –	**10**	**15%**
FIRST INTERNAL TEST		
Module 3 – Estimation Theory Estimation of parameters using maximum likelihood estimator and method of moments	**9**	**15%**

Module 4 - Testing of Hypothesis Basic definitions of statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion.	**10**	**15%**
SECOND INTERNAL TEST		
Module 5 - Design of Experiments Analysis of variance – One way and Two-way Classifications – Completely randomized design – Randomised block design – Latin square design – 2 x 2 factorial design.	**9**	**20%**
Module 6 Multivariate Methods An overview of multivariate methods, Types of multivariate techniques – factor analysis.	**9**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6101 ADVANCED MANUFACTURING SYSTEMS

Credits 4-0-0 : 4 **Year : 2015**

Prerequisites :Basic Manufacturing Systems

Course Objectives

Objectives: The students will be exposed to the fundamental concepts and philosophy of advanced manufacturing. The paper will provide an overview of the different aspects and components of an advanced manufacturing system. This will serve as a basis for the subjects in the later semesters.

Syllabus

CAD/CAM and CIM, Automated process planning, CNC Systems, CNC Machines, Robotics, Data communications, Green and Agile manufacturing

Course Outcome

At the end of course, the student will be able to:

- Explain the fundamental concepts and philosophy of advanced manufacturing.
- Distinguish the different aspects and components of an advanced manufacturing system

Reference Books

1. David Bedworth et al., Computer Integrated Design and Manufacturing, McGraw Hill Book Co.
2. Radhakrishnan P., Computer Integrated Manufacturing, Dept. of Production Engineering, PSG College of Technology

3. Eric Teicholz & Joel Orr, Computer Integrated Manufacturing Handbook, McGraw Hill Book Co.
4. Ranky P.G., Computer Integrated Manufacturing, Prentice Hall of India
5. Mikell.P.Groover, Automation, Production systems and Computer Integrated Manufacturing, Pearson Education
6. Gibson P, Green Halgh G, Kerr. R. Manufacturing management Chapman & Hall
7. Jack M Wacker, Hand book of Manufacturing engineering, Marcel Deeker Inc, USA 1992

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 Introduction - evolution of CAD/CAM and CIM - scope of CIM - segments of generic CIM - computers and workstations - an overview of CIM software - product development through CAD and CAE - geometric modelling techniques - automated drafting - graphic standards - engineering analysis -optimization - principles of concurrent engineering	**9**	**15%**
Module 2 Automated process planning - general methodology of group technology - code structures variant and generative process planning methods - AI in process planning - process planning software -	**10**	**15%**
FIRST INTERNAL TEST		
Module 3 CNC technology - principle of numerical control - types of CNC machines - features of CNC systems - programming techniques - capabilities of a typical NC CAM software - integration of CNC machines in CIM environment - DNC - flexible manufacturing systems	**9**	**15%**
Module 4 Robotics and automated assembly - types of robots and their performance capabilities - programming of robots - hardware of robots - kinematics of robots - product design for robotized manufacturing - selecting assembly machines - feeding and transfer of parts - applications of robots in manufacture and assembly – sensors- automated quality control CAQC, CMM, in-process and post process metrology, flexible inspection systems	**10**	**15%**
SECOND INTERNAL TEST		
Module 5 Responsive manufacturing - technology issues –simulation of manufacturing systems – Introduction to STEP NC- product data management - database systems - management of technology	**9**	**20%**
Module 6 Green and Agile manufacturing – introduction – agility through group technology, concept of failure mode effect analysis - JIT,SMED,KANBAN,KAIZEN,FMEA,SCM- sustainable manufacturing systems	**9**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6103 ADVANCED OPERATIONS MANAGEMENT

Credits: 4-0-0 : 4 **Year : 2015**

Prerequisites : Basic Operations Management

Course Objectives

Advanced operations management is intended to introduce the new domains of operations management.

Syllabus

Manufacturing Strategy, World class manufacturing, System design, facility location , layout, cellular manufacturing, FMS. MRP I, Capacity requirements planning, overview of MRP II and ERP, JIT Manufacturing and Kanban

Course Outcome

At the end of course, the student will be able to

- Explain the new domains of operations management.
- Apply methodologies of operations management for decision making

References

1. William J Stevenson, Operations management, Tata McGraw Hill
2. S N chary, Production and Operations Management, Tata McGraw-Hill
3. R Panneerselvam, Production and Operations Management, PHI Learning pvt Ltd
4. Norman Gaither, Greg Frazier, Operations management, South Western, CNGAGE Leaning
5. Lee Krajewsky etal., Operations Management, Processes and Value chains, Prentice Hall of India
6. Adam and Ebert, Production and Operations Management, Prentice Hall
7. Srinivasan, G., Quantitative Models in Operations and Supply Chain Management, PHI Learning Private Limited, New Delhi, 2010.
8. Mahadevan, B., Operations Management, Theory and Practice, second edition, Pearson Education, 2010.
9. Nicholas, J.M., Competitive Manufacturing Management, Tata McGraw Hill Education Private Limited, New Delhi, 2007.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
MODULE 1 Manufacturing strategy – competitiveness, strategy and productivity – Strategy formulation process – strategic options – SWOT Analysis – world class manufacturing practices – Operations strategy in global economy	**9**	**15%**
MODULE 2 System design – product and service design – process design issues – strategic capacity planning for products and services – facility location – factors affecting location	**10**	**15%**
FIRST INTERNAL TEST		

MODULE 3 Layout – demerits of products and process layout – cellular manufacturing – flexible manufacturing and automated material handling systems	**9**	**15%**
MODULE 4 Planning and control of operations – strategies for aggregate production planning – resources planning – materials requirements planning – MRP System – Capacity requirements planning – manufacturing resources planning (MRP II) – Enterprise resources planning	**10**	**15%**
SECOND INTERNAL TEST		
MODULE 5 Just in time and lean operations – Elements of JIT manufacturing – Lot size reduction – Kanban production information system - push and pull scheduling – JIT as a business philosophy	**9**	**20%**
MODULE 6 Elements of lean production-Introduction to agile manufacturing	**9**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6105 TOTAL QUALITY MANAGEMENT

Credits: 4-0-0 : 4 **Year: 2015**

Prerequisites : Basics of Quality Management

Course Objectives

The survival of a manufacturing organisation depends exclusively on its ability to provide Quality products to its customers. In this context TQM plays a very important role and it provides a set of tools, techniques, principles and practices for managing quality. This course aims to provide a comprehensive knowledge in the area of TQM starting from the basic concepts to advanced concepts of TQM.

Syllabus

Basic concepts of TQM, Principles and Practices, Quality Gurus, Basic and advanced tools, Statistical quality Control, Six sigma quality, Quality costs, performance measures, QFD, Kaizen, Taguchi Quality Engineering, ISO 9001, Business Excellence Models

Course Outcome

At the end of course, the student will be able to:

- Discuss the importance of TQM in Manufacturing Systems
- Explain all the basic concepts and advanced concepts of TQM.
- Evaluate and apply the a set of tools, techniques, principles and practices for managing quality

References

1. Dale H Besterfield, Total Quality Management, Pearson Education
2. Kanishka Bedi, Quality Management, Oxford Higher education
3. The Essence of Total Quality Management – Bank ,J; Prentice Hall

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Basic Concept of TQM – TQM as a business strategy – Contributions of quality Gurus Deming, Juran, Crosby, Ishikawa and Feigaunbaum — Concepts of Leadership, Customer satisfaction, Employee involvement, continuous improvement and Supplier partnership.	**9**	**15%**
Module 2 Basic Tools and techniques – Quality Control Tools – Statistical process Control – Control Charts Process capability – Six Sigma Quality – DMAIC methodology – Management Tools	**10**	**15%**
FIRST INTERNAL TEST		
Module 3 Performance measures – Quality costs – Direct costs and Indirect costs – Defectives and its significance – Traditional model and emerging model of Cost of quality	**9**	**15%**
Module 4 Quality Function deployment – Kaizen – Benchmarking – Taguchi's Quality Engineering	**10**	**15%**
SECOND INTERNAL TEST		
Module 5 Quality standards and Business Excellence models – ISO 9001 Quality management systems – Elements, procedures and Quality audits – CII-Exim Bank Award Model – Rajeev Gandhi national quality Award Model – Malcolm Baldrige Criteria – Deming Prize	**9**	**20%**
Module 6 Software Quality management – Capability maturity model – Information Technology applications	**9**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6109 INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

Credits: 3-0-0 : 3 **Year 2015**

Prerequisites :Basics of Robotics and Expert Systems

Course Objectives

This course will provide exposure about the robots and expert systems which are the two main components of an advanced manufacturing system. This exposure will help the student in selection, design and simulation of robots and expert systems.

Syllabus:

Introduction and Robot Kinematics, Robot sensors, Robot drives and control, Robot Cell Design and Application, Methods of Robot Programming, Artificial intelligence.

Course Outcome

At the end of course, the student will be able to:

- Explain about the robots and expert systems which are the two main components of an advanced manufacturing system.
- Select, design and simulate robots and expert systems.

References

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", Mc Graw Hill, 1987.
2. Yoram Koren," Robotics for Engineers'", Mc Graw-Hill, 1987.
3. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
4. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
5. Deb, S.R."Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
7. Timothy Jordanides et al,"Expert Systems and Robotics ", Springer –Verlag, New York, May 1991.

Web References

http://www.ifr.org/gallery/type.htm

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1. Introduction and Robot Kinematics Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.	**7**	**15%**

Module 2. Robot sensors Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Robot drives and control Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.	**7**	**15%**
Module 4 Robot Cell Design and Application Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Methods of Robot Programming Robot Programming, Artificial Intelligence and Expert Systems - Characteristics of task level languages lead through programming methods – Motion interpolation.	**7**	**20%**
Module 6. Artificial intelligence Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6111 ADVANCED MATERIALS FOR MANUFACTURING AND PROCESSES

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : Basic Material science and Manufacturing Process

Course Objectives

To give exposure to newer materials used in manufacturing, exposure to the advanced techniques used in manufacturing and to enable the student to select the appropriate process according to the materials used

Syllabus

Conventional materials, metal matrix composites, Powder metallurgy and applications, nano materials, special metal removal processes, surface structure and properties

Course Outcome

At the end of course, the student will be able to:

- Familiarise with newer materials used in manufacturing
- Discuss the advanced techniques used in manufacturing
- To analyse and select the appropriate process according to the materials used

References

1. Serope Kalpakjian and Steven R Schmid – Manufacturing Engineering and Technology, Addison Wesley Longman (Singapore) Pvt. Ltd., New Delhi, 2000
2. L Carl Love – Welding Procedures and Applications, Prentice Hall Inc., 1993
3. H M T – Production Technology, Tata McGraw Hill Publishing Co., 2002
4. R W Heine, C R Loper and P C Rosenthal – Principles of Metal Casting, Tata McGraw Hill Publishing Co., 1991

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 Introduction – conventional materials, limitation, need for composites, classification and characteristics of composites, resin matrices, reinforcements, other constituents of fibre, fibre reinforced plastics,	**7**	**15%**
Module 2 Ceramics and metal matrix composites – manufacturing of metal matrix composites, solid and liquid state processing – testing of composites – applications	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Introduction to powder metallurgy (P/M) processes – design considerations for P/M tooling – types of compaction – sintering at different atmospheres – liquid phase sintering – secondary processes –	**7**	**15%**
Module 4 P/M applications specifically to cutting tool, bearing and friction materials – nano materials and their applications.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Special material removal processes – chemical machining, electro chemical machining, electrical discharge machining wire EDM, water jet machining – high speed machining – micro machining- casting of non-ferrous metals	**7**	**20%**
Module 6 Surface structure and properties – surface coatings, hard facing, thermal spraying, vapour deposition, ion implantation, hot dipping – coating of cutting and forming tools	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6113 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT

Credits: 3-0-0: 3 **Year : 2015**

Prerequisites: Basic Financial Management

Course Objectives

To provide basic knowledge about the costs related to the various resources that have been deployed and the impact of the decisions on the performance of the enterprise, give an exposure to various concepts of financial management and accounting and to understand financial management as a business language

Syllabus

Financial Accounting, Working capital management, Cost Accounting , Budgeting, Financial Management and decisions

Course Outcome

At the end of course, the student will be able to:

- Comprehend the costs related to the various resources that have been deployed and the impact of the decisions on the performance of the enterprise
- Explain the various concepts of financial management and accounting.

References:

1. Bhattacharya, S.K. and John Deardon, "Accounting for Management – Text and Cases", Vikas Publishing House, New Delhi, 1996.
2. Charles, T.Horn Green – "Introduction to Management Accounting", Prentice Hall, New Delhi, 1996.
3. James, C.Van Horne, "Fundamental of Financial Management", Pearson Education, 12th Edition, 2002.
4. Pandey, I.M., "Financial Management", Vikas Publishing House, New Delhi, 8th Edition, 2004.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1. Financial Accounting Salient features of Balance sheet and Profit & Loss Statement, Cash Flow and Fund Flow Analysis	**7**	**15%**

Module 2. Working Capital Mangement Working Capital management, Inventory valuation, Financial Ratio analysis – Depreciation	**7**	**15%**
FIRST INTERNAL TEST		
Module 3. Cost Accounting Cost accounting systems: Job costing, Process costing, Allocation of overheads, Activity based costing, differential cost and incremental cost, Variance analysis.	**7**	**15%**
Module 4. Budgeting Requirements for a sound budget, fixed budget-preparation of sales and production budget, flexible budgets, zero base budgeting and budgetary Control.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Financial Management Investment decisions – Capital Investment process, types of investment proposals, investment appraisal techniques – pay back period method, Accounting rate of return, net present value method, internal rate of return and profitability index method.	**7**	**20%**
Module 6 Financial Decisions Financial decisions: Cost of Capital – Capital structure – Dividend Policy – Leasing.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6115 SAFETY ENGINEERING AND INDUSTRIAL HYGIENE

Credits: 3-0-0 : 3 **Year 2015**

Prerequisites : Basic concepts and safety and industrial hygiene

Course Objectives

To impart an awareness about the importance of safety in industrial operations and to understand various techniques available for ensuring safety in industries

Syllabus

Safety, Housekeeping, accident and its prevention, Hazards, HAZOP analysis, Environmrntal management Systems, Fire and Fire safety, safety engineering, guarding of hazards

Course Outcome

At the end of course, the student will be able to:

- Discuss the importance of safety in industrial operations
- Apply the various techniques available for ensuring safety in industries

References:

1. Gupta R.S., Handbook of fire technology,Orient Longman
2. James D.,Fire Prevention Handbook, Butterworths,london 1996
3. N.V. Krishnan, Safety in industry, Jaico publishing house
4. Welding institute, U.K., Health and Safety in welding and Allied processes, high Tech. Publishing ltd.,London
5. John V.Grimaldi and Rollin H. Simonds,Safety management, All India Travellers Book, Seller,New Delhi

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Importance of safety in industrial operations- House keeping, safety standards in industry, Protection devices, accident precautions -	**7**	**15%**
Module 2 Safety information systems-Accident information and reporting-safety performance and reporting-safety education and training.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Hazards-physical-chemical-electrical-biological-ergonomic hazards-risk analysis-map method-tabular method-fault tree analysis-HAZOP analysis -	**7**	**15%**
Module 4 OSHA standards of safety- Environmental management systems and ISO 14001	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Fire protection systems-Fire chemistry-industrial fire protection system-water sprinkler-fire hydrant, alarm and detection system-explosion protection system-suppression system-carbon dioxide system foam system-halon system-portable extinguisher	**7**	**20%**
Module 6 Safety in engineering industry-safety in metal working machinery-principles of machine guarding- Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07GN6001 RESEARCH METHODOLOGY

Credits: 0-2-0 : 2 **Year : 2015**
Prerequisites : Nil

Course Objectives

The main objective of the course is to provide a familiarization with research methodology and to induct the student into the overall research process and methodologies. This course addresses:

- The scientific research process and the various steps involved
- Formulation of research problem and research design
- Thesis preparation and presentation.
- Research proposals, publications and ethics
- Important research methods in engineering

As a tutorial type course, this course is expected to be more learner centric and active involvement from the learners are expected which encourages self study and group discussions. The faculty mainly performs a facilitator's role.

Syllabus

Overview of research methodology - Research process, scientific method, research design process.
Research Problem and Design - Formulation of research task, literature review, web as a source, problem solving approaches, experimental research, and ex post facto research.
Thesis writing, reporting and presentation -Interpretation and report writing, principles of thesis writing- format of reporting, oral presentation.
Research proposals, publications and ethics - Research proposals, research paper writing, considerations in publishing, citation, plagiarism and intellectual property rights.
Research methods – Modelling and Simulation, mathematical modeling, graphs, heuristic optimization, simulation modeling, measurement design, validity, reliability, scaling, sample design, data collection methods and data analysis

Course Outcome

At the end of course, the student will be able to:

- Discuss research methodology concepts, research problems, research designs, thesis preparations, publications and research methods.
- Analyze and evaluate research works and to formulate a research problem to pursue research
- Prepare a thesis or a technical paper, and present or publish them
- Apply the various research methods followed in engineering research for formulation and design of own research problems and to utilize them in their research project.

REFERENCE BOOKS

1. C. R. Kothari, Research Methodology, Methods and Techniques, New Age International Publishers
2. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan, Management Research Methodology, Integration of principles, Methods and Techniques, Pearson Education
3. R. Panneerselvam, Research Methodology, PHI Learning
4. Deepak Chawla, Meena Sondhi, Research Methodology–concepts & cases, Vikas Publg House
5. J.W Bames, Statistical Analysis for Engineers and Scientists, McGraw Hill, N.York
6. Schank Fr., Theories of Engineering Experiments, Tata Mc Graw Hill Publication.
7. Willktnsion K. L, Bhandarkar P. L, Formulation of Hypothesis, Himalaya Publication.
8. Fred M Kerlinger , Research Methodology
9. Ranjit Kumar, Research Methodology – A step by step guide for beginners, Pearson Education
10. John W Best, James V Kahan – Research in Education , PHI Learning
11. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co Ltd
12. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes
13. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
14. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
15. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
16. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
17. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047- 0,2006
18. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers..
19. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing
20. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
21. Dr. K P Mohandas, A guide to academic research, Sanguine Publishers
22. Additional suitable web resources
23. Guidelines related to conference and journal publications

Course Plan

Modules	**Contact hours**	**Int. Exam Marks %**
Module 1 Overview of Research Methodology Research concepts – meaning – objectives – motivation - types of research –research process – criteria for good research – problems encountered by Indian researchers - scientific method - research design process – decisional research	5	10%

Module 2 Research Problem and Design Formulation of research task – literature review – methods – primary and secondary sources – web as a source – browsing tools -formulation of research problems – exploration - hypothesis generation - problem solving approaches-introduction to TRIZ(TIPS)- experimental research – principles -Laboratory experiment - experimental designs - ex post facto research - qualitative research	5	10%
FIRST INTERNAL TEST		
Module 3 Thesis writing, reporting and presentation Interpretation and report writing – techniques of interpretation – precautions in interpretation – significance of report writing – principles of thesis writing- format of reporting - different steps in report writing – layout and mechanics of research report - references – tables – figures – conclusions. oral presentation – preparation - making presentation – use of visual aids - effective communication	4	10%
Module 4 Research proposals, publications, ethics and IPR Research proposals - development and evaluation – research paper writing – layout of a research paper - journals in engineering – considerations in publishing – scientometry-impact factor- other indexing like h-index – citations - open access publication -ethical issues - plagiarism –software for plagiarism checking- intellectual property right- patenting case studies	5	10%
SECOND INTERNAL TEST		
Module 5 Research methods – Modelling and Simulation Modelling and Simulation – concepts of modelling – mathematical modelling - composite modelling – modelling with – ordinary differential equations – partial differential equations – graphs heuristics and heuristic optimization - simulation modelling	5	10%
Module 6 – Research Methods – Measurement, sampling and Data acquisition Measurement design – errors -validity and reliability in measurement - scaling and scale construction - sample design - sample size determination - sampling errors - data collection procedures - sources of data - data collection methods - data preparation and data analysis	4	10%
THIRD INTERNAL TEST		

Internal continuous assessment: 100 marks

Internal continuous assessment is in the form of periodical tests and assignments. There are three tests for the course (3 x 20 = 60 marks) and assignments (40 marks). The assignments can be in the form of seminar, group tasks, case studies, research work or in a suitable format as decided by the teacher. The assessment details are to be announced to students at the beginning of the semester by the teacher.

07PE6107 MANUFACTURING SYSTEMS MANAGEMENT LABORATORY

Credits: 0-0-2 : 1 **Year : 2015**

Prerequisites : Basic Computing skills

Course Objectives

Manufacturing organisations use a number of computer software tools for managerial decision making related to their operations management related issues. By undergoing this lab course it is aimed to acquire familiarisation with some advanced software tools used in manufacturing organisations.

Syllabus

Familiarisation of various softwares used in manufacturing sytems for 3D modelling, automation and Quality Mangement

Course Outcome

At the end of course, the student will be able to:

- Apply and evaluate the computer software tools adopted in the manufacturing system for design and managerial decision making related to CAD/CAM, Automation and Quality Management
- Apply these software tools in real-time manufacturing process for design and decision making

Experiments

Familiarisation and application of the following tools and software for solving manufacturing systems management related problems

- 3D modelling using CAD software
- Assembly using CAD software
- NC code generation using CAM Software
- Study of fluid control valves and actuators
- Design of pneumatic circuits for automation
- Design of electro pneumatic circuit for automation
- Process control using control charts through spread sheet/statistical software
- Acceptance sampling decisions using OCC and AOQL generated using statistical software
- Determination of process capability indices and sigma level of process

Internal Continuous Assessment (Maximum Marks-100)

i)	Practical Records /outputs	40%
ii)	Regular Class Viva-Voce	20%
iii)	Final Test (Objective)	40%

07PE6117 INTRODUCTION TO SEMINAR

Credits: 0-0-1 : 0 **Year : 2015**

Prerequisites : Nil

Course Objectives
To develop the capability of the student to present a technical topic. Also to impart a basic training to a student to face audience and present ideas.

Course Outcome
At the end of course, the student will be able to:
- Identify a technical topic, prepare and make a presentation

Course Plan

Students are required to identify a technical topic and are to be encouraged to make presentations.

07PE6102 MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : Basics of manufacturing system models

Course Objectives
To acquaint the student with the various methods of modelling and analysis of manufacturing systems.

Syllabus

Manufacturing Systems and Models, Assembly Lines, Scheduling, Flexible Manufacturing Systems, Material Handling and AGV Systems and Ware Housing – Storage and Retrieval Systems

Course Outcome
At the end of course, the student will be able to:
- Apply the various methods of modelling and analysis of manufacturing systems

References:
1. Ronald G. Askin and Charles R. Standridge, "Modeling and analysis of manufacturing systems" John Wiley & Sons, Inc. 2000
2. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
3. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc., 1991.
4. Kalpakjian, "Manufacturing Engineering and Technology", Addison-Wesley Publishing Co., 1995.
5. Taiichi Ohno, Toyota, "Production System Beyond Large-Scale production", Productivity Press (India) Pvt.Ltd., 1992.

Web Reference
http://www.engineeringtalk.com/news/lvd103.htm

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1. Manufacturing Systems and Models Introduction to manufacturing models- types and principles of manufacturing system, manufacturing models - types and uses- physical models, mathematical models, model uses, model building	**7**	**15%**
Module 2. Assembly Lines Introduction- line balancing algorithms- COMSOL Random sequence generation, Ranked positional weight heuristics, optimal solutions- practical issues - mixed models – sequencing- unpaced lines-	**7**	**15%**
FIRST INTERNAL TEST		
Module 3. Scheduling Shop scheduling with many products, Order release, flow shop sequencing – single and two machine flow shops- job shop scheduling- Dispatching rules and Schedule generation	**7**	**15%**
Module 4. Ware Housing – Storage and Retrieval Systems Introduction – ware house components – ware house design, stacking pattern, location in ware houses – dedicated storage, open storage, class base storage, storing complementary items- Order picking – forming pick list, pick sequencing	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Flexible Manufacturing Systems Introduction - Components of FMS – Machines, Part movement system, work stations, system controller. Planning and control hierarchy- System design, system set up, scheduling and control. Flexible assembly system.- Group technology – principles, coding schemes, assign machines to groups- production flow analysis, binary ordering algorithm. Assigning parts to machines	**7**	**20%**
Module 6 Material Handling and AGV Systems Introduction- types, principles of material handling – Equipment selection, conveyor analysis, closed loop conveyor- AGV systems – Design and operation of AGV, vehicle requirements analysis- pallet sizing and loading	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6104 ENTERPRISE RESOURCES PLANNING

Credits: 3-0-0: 3 **Year : 2015**

Prerequisites :Advanced Operations Management

Course Objectives

Modern organisations are having their operations in different countries and their customers are also spread across the world. ERP deals with the management of such organisations. ERP envisages a coordinated system spanning through all functions and operations of the organisations. This course provides a basic understanding of ERP, design and operation of ERP systems in the organisation.

Syllabus

Enterprise resources planning, MRP II, Systems and technology background, ERP life cycle, designing of ERP systems, Implementation of ERP systems and training

Course Outcome

At the end of course, the student will be able to:

- Discuss the management of such organisations who envisages a coordinated system spanning through all functions and operations of the organisations spread over different locations.
- To get a basic understanding of ERP, design and operation of ERP systems in the organisation.

References.

1. Garg, V. K., and Venkitakrishnan, N.K., Enterprise Resource Planning: Concepts and Practice, Prentice – Hall of India Private Limited, New Delhi, 1998.
2. O'Leary, D.E., Enterprise Resources Planning Systems: System, Life cycle, Electronic Commerce and Risk, John Wiley & Sons, 2001.
3. Ptak, C.A., and Eli, S., ERP Tools, Techniques and Applications for Integrating the Supply Chain, St. Lucie Press/ APICS Series on Resource Management, 2000.
4. Wallace, T.F., and Kremzar, M.H., ERP: Making it Happen: The Implementer's Guide to Success with Enterprise Resource Planning, John Wiley & Sons, 2001.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Introduction to Enterprise Resource Planning (ERP) – History of ERP – Requirements generation to Material Requirement Planning (MRP) –	**7**	**15%**
Module 2 Closing the MRP loop – Manufacturing Resources Planning (MRP II) – Just – In – Time to Lean manufacturing – ERP – Internet's impact on ERP – Supply chain management.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Systems and technology background – ERP systems background – ERP data input – ERP output capabilities – Reengineering – How does ERP create value – Why investigate ERP systems.	**7**	**15%**

Module 4 ERP Life Cycle – Deciding to go ERP – Choosing an ERP system – Designing ERP systems – Should prune processes or ERP software be changed – Choosing standard model – Artifacts and processes	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Implementing ERP systems – Big bang versus phased – After going live – training	**7**	**20%**
Module 6 ERP and electronic commerce – ERP Risks – Successes and failures.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6106 INTEGRATED PRODUCT DEVELOPMENT

Credits: 3 – 0 -0 : 3 **Year : 2015**

Prerequisites : Basics of Product design and developemnt

Course Objecives
To build an awareness on modern product development process. To acquaint the student with the application of IT and computer technology for integrating various domains.

Syllabus

Product development process, product development organisation, integration of product development phases ,product life cycle, tools for integration and digital manufacturing

Course Outcome

At the end of course, the student will be able to:

- Discuss modern product development process.
- Apply information technology and computer technology for integrating various domains.

References

1. Product Development and design for manufacturing John W. Priest and Jose M. Sanchez – Marcel Dekker Inc.
2. Product Design and Development, by Karl T. Ulrich and Steven D. Eppinger, 3rd Edition, McGRAW-Hill, 2003.
3. PDM: Product Data Management, by Rodger J. Burden.
4. Andrew Kusaik, "Concurrent Engineering: Automation Tools and Technology", Wiley, JOhn and Sons Inc., 1992.
5. CAD/CAM Theory and Practice Ibrahim Zeid, McGraw-Hill Science/Engineering/Math; 1 edition (1991)

Course Plan

Modules	Contact hours	Sem. Exam Marks %
MODULE 1 **PRODUCT DEVELOPMENT PROCESS** Introduction - Product Development in the changing global world- stages of product development – early design, detailed design, prototyping, and manufacturing, servicing, discard /recycle	**7**	**15%**
MODULE 2 PRODUCT DEVELOPMENT ORGANIZATION Product development organization – Concurrent engineering - Definition – CE Design Methodologies – CE organization – collaborative product development - co-design - Requirement definition- product requirement and definition	**7**	**15%**
FIRST INTERNAL TEST		
MODULE 3 INTEGRATION OF PRODUCT DEVELOPMENT PHASES CAD/CAM data exchange – data exchange standards, IGES, STEP ISO - Product data management – Concept – function – 3 tire architecture- product structure – Unified modelling language for product structure	**7**	**15%**
MODULE 4 PRODUCT LIFE CYCLE Product lifecycle – definition - Types of integration- file transfer, middle ware, and database- System Integration – CAD – PDM integration, Integration approaches - feature based integration, Meta data based integration	**7**	**15%**
SECOND INTERNAL TEST		
MODULE 5 TOOLS FOR INTEGRATION IT enabled product development, Web based PDM architecture, . Internet Standards HTML,XML. Visualisation of CAD data, VRML Information system development – Object oriented approach, UML class diagram, usecase diagram, component diagram	**7**	**20%**
MODULE 6 **DIGITAL MANUFACTURING** Definitions – Functions in Digital manufacturing- Manufacturing simulation and validation – Design for manufacturing, function, aesthetics, environment – reuse, recycle and remanufacture	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6116 DESIGN AND ANALYSIS OF EXPERIMENTS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : Managerial statistics

Course Objectives

Design of experiments plays a vital role in manufacturing organisations for arriving at optimal combinations of operational parameters. This course covers fundamental aspects pertaining to design of experiments

Syllabus

Introduction, Factorial Experiments, Special Experimental Designs, Orthogonal Experiments and Robust Design

Course Outcome

At the end of course, the student will be able to:

- Determine the optimal combinations of operational parameters in manufacturing organisations.
- Apply the fundamental aspects pertaining to design of experiments

REFERENCES:

1. Phillip J.Rose, "Taguchi techniques for quality engineering", McGraw Hill, 1996.
2. D.C. Montgomery, "Design and Analysis of experiments", John Wiley and Sons, 2003.
3. Nicolo Belavendram, "Quality by Design: Taguchi techniques for industrial experimentation", Prentice Hall, 1995.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 - Introduction Planning of experiments, terminology, ANOVA rationale, basics of quality by design, loss function.	**7**	**15%**
Module 2 - Factorial Experiments Single factor and multi factor experiments, tests on means, EMS rules. 2K and 3K designs, Yate's algorithm.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 - Special Experimental Designs Latin square design, confounding, fractional factorial design, nested designs.	**7**	**15%**

Module 4 - Orthogonal Experiments Comparison of classical and Taguchi's approach, Selection and application of orthogonal arrays for design, Conduct of experiments, collection and analysis of simple experiments	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Orthogonal experiments Modifying orthogonal arrays, multi response data analysis.	**7**	**20%**
Module 6 Robust Design Variability due to noise factors, classification of quality characteristics and parameters, objective functions, parameter design, optimization using S/N ratios, attribute data analysis.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6118 MANAGEMENT INFORMATION SYSTEMS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites: Basics of MIS

Course Objectives

To provide knowledge on different types of Information systems and their applications in industry.

Syllabus

Concepts of MIS. Approaches to MIS, Computer evolution, hardware, software, data communication, network topologies, decision making, system development, decision support systems, data warehousing, data mining, quality assurance models and functional applications

Course Outcome

At the end of course, the student will be able to:

- Distinguish different types of Information systems
- Apply information systems in industry.

References:

1. Jerome Kanter – Managing with Information
2. Gordon B. Davis and Alson – Management Information Systems
3. Robert C Murdick Joel E Ross and James R Clagget – Information Systems for Modern management
4. Henry c Lucas Jr. – The Analysis Design and Implementation of Management Information Systems.
5. Kickson and Wheterbe – Management Information Systems.

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module – 1 The Concept of MIS - Role of MIS - Characteristic of MIS - Functional Subsystems - Activities Subsystems Pre-requisites of MIS-Contemporarily Approaches to MIS-Technical Approach, Behavioral Approach,-Socio-technical Approach, Technical Approach-Information as Strategic Resource-Use of Information for Complete Advantage.	**7**	**15%**
Module – 2 Evolution of Computers-Computer Hardware-Generation of Computers-Complete Categories - Software - System Software, Application Software-Data Communication - Data Processing-Transaction Processing-Data Processing Modes-Data Transmission-Functions of Telecommunication-Communication-Transmission Channel- Characteristic of Communication Channel- Network - Topologies, Types of Networks, OSI, TCP/IP-Internet - Internal, External, ISDN - Multimedia-IT Enabled Services - SPO, Call Centers, MT, GIS-Information.	**7**	**15%**
FIRST INTERNAL TEST		
Module – 3 Management-Decision Making - Decision Types, Decision Making Process,-Decision Making Tools, Principle of Rationality, Principle of Logic & Interaction-Decision Making Models - Classical Model, Administrative-Model, Herbert, Simon Model-Information - Sources of Information, Types of Information, Information requirements, Techniques for Assessing-Information Requirements - Systems Analysis and Design-System- Types, Characteristics-Control- Control Process, Requirements of Good Control-System, Control System-Law of Requisite Variety-Systems Development-System Analysis, System Design, System Implementation, System Development Process-System Development Life Cycle-Rapid System Development Tools - Prototyping, CASE Tools, Object Oriented Systems	**7**	**15%**
Module – 4 Decision Support System-The Decision Support System - Components, Characteristics, Structure -Group Decision Support System-Configuration, Features-Executive Information System / Executive Support System-Definition, Characteristic, Capabilities, Benefits-Expert System-Artificial intelligence Database Management System-DBMS Components-Database Model.	**7**	**15%**
SECOND INTERNAL TEST		

Module 5 Data Warehousing & Data Mining-Data Warehousing Definition, Structure / Architecture-Data Mining - Information Security and Control-Information System Security Threats-External & Internal Threats Information System and Quality-Quality Assurance-Software Quality Assurance-Management Role in Software Quality Assurance -Quality Assurance Methods - Quality Profile Model, Construction Quality Model	**7**	**20%**
Module 6 Tick IT, Initiative-Functional applications of MIS -Stores & Purchase Management-Accounts Payable System-Inventory Management-Production Management System -Marketing Service System-Applications in Service Sector-MIS Application in Service Industry-Airlines, Hospital, Banking.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6122 RELIABILITY ENGINEERING

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites: Managerial Statistics

Course Objectives

To provide a basic knowledge ofthe various concepts of reliability engineering and to give an exposure to the techniques for reliability assessment, prediction, design and testing which are essential for product management.

Syllabus

Reliability and its management- failure statistics, reliability and hazard rates-hazard, failure and reliability functions from empirical data-reliability prediction- fault analysis- reliability design and testing

Course Outcome

At the end of course, the student will be able to:

- Explain the concept of reliability engineering
- Assess the reliability of existing systems
- Predict the reliability of systems
- Design systems for reliability
- Conduct reliability life testing

References:

1. A. K. Gupta, "Reliability, Maintenance and Safety Engineering, 2009
2. L. S. Srinath, "Reliability Engineering", 2009
3. E. Balagurusamy, " Reliability Engineering", 2009
4. Rowland Caplan, "A Practical Approach to Reliability", 1982
5. Govil A,K., "Reliability Engineering", 1989. /
6. Carter A.D,S, "Mechanical Reliability", 1989.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 - Reliability and its management Definition of reliability - definition of failure –reliability concepts and patterns of failure–Reliability management –reliability for system effectiveness	**7**	**15%**
Module 2 - Failure Statistics, reliability and Hazard rates Introduction-failure data-derivation of reliability function-the expected life-failure rate and hazard function-reliability and hazard function for distribution functions-product life and hazard models	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 –Hazard, failure and reliability functions from empirical data Hazard , failure and reliability functions from empirical data- model selection for component failures- methods of generic failure rate determination-failure analysis	**7**	**15%**
Module 4-Reliability prediction Reliability prediction based on exponential distribution-reliability prediction during design based on Weibull distribution- method of reliability prediction-system reliability models	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Fault Analysis FMECA analysis-tribological analysis-ferrographs-failure mechanisms-Markov decision process-master logic diagrams	**7**	**20%**
Module 6 ReliabilityDesign and testing Design for reliability-design process-assessment methodology-stress strength time models-reliability of the system-reliability based design-reliability allocation-reliability effort function-reliability growth-selection of components to improve system reliability- reliability life testing-burn-in test-acceptance test	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6124 MULTIVARIATE DATA ANALYSIS

Credits: 3-0-0 : 3 **Year 2015**

Prerequisites : Managerial Statistics

Course Objectives

Today manufacturing organizations must be more productive and profitable. An essential requirement for this is effective knowledge creation and management. Multivariate techniques are popular because they enable organizations to create knowledge and thereby improve their decision making. Multivariate analysis refers to all statistical techniques that simultaneously analyze multiple measurements on individuals or objects under investigation. The objective of this course is to give an overall coverage of application various multivariate techniques in managerial decision making.

Syllabus

Preparation for multivariate analysis, factor analysis, dependence techniques, multiple regression, discriminant analysis, MANOVA, conjoint analysis, interdependence techniques, cluster analysis, multidimensional scaling, correspondence analysis, structural equation modelling and confirmatory factor analysis

Course Outcome

At the end of course, the student will be able to:

- Discuss how Multivariate techniques are enabling organizations to create knowledge and thereby improve their decision making
- Identify and choose a suitable multivariate technique for analyzing data depending on the objective of the research
- Apply the various multivariate methodologies which could be used for engineering and management research through data analysis.

Text Book

Joseph F Hair, Willian C Black, Barry J Babin, Rolph E Anderson, Ronald L Thatham, Multivariate Data Analysis, Pearson Education.

References

1. Richard A. Johnson & Dean W. Wichern: Applied Multivariate Statistical Analysis. Prentice Hall.
2. T. W. Anderson: Introduction to Multivariate Statistical Analysis. Wiley
3. C. R. Rao: Linear Statistical Inference and its Applications. Wiley.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Introduction to multivariate analysis - Preparing for multivariate analysis – Examining your data – graphical examination – missing data – outliers – testing assumptions – factor Analysis – factor analysis decision process	**7**	**15%**

Module 2 Dependence techniques – Multiple regression analysis – Decision process for multiple regression analysis – Multiple discriminant analysis and logistic regression – Decision process for discriminant analysis – Logistic regression	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Multivariate analysis of variance- Decision process for MANOVA – Conjoint analysis – managerial uses – designing of conjoint analysis experiment	**7**	**15%**
Module 4 Interdependence techniques – Cluster analysis – Cluster analysis decision process – Multidimensional scaling and correspondence analysis – Decision framework for perceptual mapping – Correspondence analysis – decision framework	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Structural equation modeling – similarity to dependence and interdependence techniques – Developing a modeling strategy – Stages in structural equation modeling	**7**	**20%**
Module 6 Confirmatory factor analysis – SEM stages for testing measurement theory – illustration of CFA – SEM: Testing a structural model – stages in testing structural theory.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6128 INDUSTRIAL MARKETING AND MARKETING RESEARCH

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : nil

Course Objectives

Marketing is the link between society's material requirements and its economic patterns of response. This subject imparts a market oriented thinking which is a necessity in today's competitive world. It gives an exposure to various aspects o marketing management viz. environment, consumer behaviour, product management, pricing, promotion and placing decisions.

Syllabus

Understanding Marketing Management, Researching and Selecting Target Markets, Product Design product lines, Pricing Strategies,Market Placing and Promotion Strategies

Course Outcome

At the end of course, the student will be able to:

- Understand the concept of marketing as the link between society's material requirements and its economic patterns of response.
- Distinguish the various aspects of marketing management viz. environment, consumer behaviour, product management, pricing, promotion and placing decisions.

References:

1. Philip Kotler., "Marketing Management Analysis, Planning, Implementation and Control", Prentice Hall of India Pvt. Ltd., 7th edition, New Delhi, 1992.
2. Rajan Saxena, "Marketing Management", Tata McGraw Hill Publication Co.
3. Ramanuj Majumdar. "Marketing Research", Wiley Eastern Ltd, 1991.
4. Stanton & William., "Fundamentals of Marketing", McGraw Hill, Tokyo, 1995.
5. Boyd & Kapoor., "Readings in Marketing Management", McGraw Hill Book Co. Ltd., 1989. .
6. EkzelM. J. &WalkarB. J. "Marketing", McGraw Hill, 1997. I'

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 - Understanding Marketing Management Core concept - marketing concept - selling concept and marketing process – marketing mix, analyzing market opportunities, designing marketing strategies, planning marketing programmes, organizing, implementing and controlling the marketing effort, marketing planning, current marketing situation, opportunity and issue analysis, action programmes, profit and loss statement.	**7**	**15%**
Module 2 - Researching and Selecting Target Markets Concepts in demand measurement, estimating future demand, market segmentation, general approach to segmenting a market, patterns of market segmentation, market segmentation procedures, base for segmenting customer markets and industrial markets, market targeting - evaluating the market segments, selecting the market segments.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 - Product Design New product development, effective organizational arrangements. Idea generation, idea screening, concept development and testing, product development, market testing, commercialisation. consumer adoption process, product life cycle - introductory stage, growth stage, maturity stage and decline stage.	**7**	**15%**
Module 4 Product lines and Pricing Strategies Managing product lines, brands and packaging, product mix decisions, product line decisions. brand decisions, packaging and labelling decisions, managing service businesses and ancillary services - classification of services, marketing strategies for service firms, managing product support services, pricing strategies and programs - setting the price. Adapting the price, initiating and responding to price changes	**7**	**15%**
SECOND INTERNAL TEST		

Module 5- Market Placing strategies Nature of marketing channels, channel design decision, channel management decisions, channel dynamics, channel co-operation, conflict and competition retailing, wholesaling and distribution systems, nature and importance of retailing. Types of retailers, wholesaling, physical distribution.	**7**	**20%**
Module 6 Market Promotion Strategies The communication process, steps in developing effective communication, measuring promotion results, managing the sales force, designing the sales force, principles of personal selling.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6132 ERGONOMICS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites: Work study

Course Objectives

To study the relation between man and his environment, occupation, equipment, apply anatomical, physiological, psychological knowledge to solve the problems arising between man and machine interface, to manage the products for optimizing their performance

Syllabus

Human performance and ergonomics, workspace deisgn, anthropometry, design of equioments and design of environment

Course Outcome

At the end of course, the student will be able to:

- Understand the relation between man and his environment, occupation, equipment
- Apply anatomical, physiological, psychological knowledge to solve the problems arising between man and machine interface.
- Analyse the concepts to manage the products for optimizing their performance

References

1. Martin Helander, “A guide to Ergonomics of Manufacturing”, TMH, 1996.
2. Bridger, R.S., “Introduction to Ergonomics”, McGraw Hill, 1995.
3. McCormick, J., “Human Factors in Engineering and Design”, McGraw Hill, 1992.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Introduction and Human performance - Interdisciplinary nature of ergonomics, modern ergonomics.	**7**	**15%**
Module 2 Information input and processing, factors affecting human performance, physical work load and energy expenditure, heat stress, manual lifting.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Work Space Design - Anthropometry, Workspace designs for standing and seated workers,	**7**	**15%**
Module 4 Arrangement of components within a physical space, interpersonal aspect of workplace design.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Design of Equipments - Ergonomic factors to be considered, design of displays and controls, design for maintainability	**7**	**20%**
Module 6 Design of Environment - Illumination – climate – Noise – motion	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6134 STRATEGIC MANAGEMENT

Credits: 3 -0-0 : 3 **Year 2015**

Prerequisites : Principles and Functions of Management

Course Objectives

The success of a manufacturing organisation depends on its ability to identify and analyse its, Organisational strengths and weakness, together with environmental opportunities and threats, and formulate and implement suitable strategies. This course on strategic management aims to provide concepts related to corporate strategy, analysis of organisation and its environment, formulation of suitable strategies and its implementation along with certain strategic enablers.

Syllabus

Concepts of corporate strategy, corporate governance, social responsibility, SWOT Analyis, Formats to analyse strengths and weakness, Strategy formulation, generic strategies, diversification, integration, Portfolio analysis, strategy implementation, strategy audit, strategic enablers, technology management, knowledge management, R & D and innovation, creativity and information technology

Course Outcome

At the end of course, the student will be able to:

- Understand the concepts related to organisation strategy,
- Analyse an organisation and its environment,
- Formulate suitable strategies and implement them
- Identify and understand the strategic enablers which help an organisation to achieve its objectives.

References:

1. R Srinivasan , Strategic Management – The Indian Context, Third Edition – Prentice Hall of India Private limited
2. A Nag, Strategic Management, Analysis Implementation and Control, Vikas Publishing House Pvt Limited
3. Fred R David, 2007, Strategic Management, Concepts and Cases, Prentice Hall, Eleventh Edition
4. Michael A Hitt, R Duane Ireland, Robert E. Hoskisson, 2001, Strategic Management – Competitiveness and Globalization, South Western, Thomson Learning, Ch. 5487
5. Paul Joyce, Adrian Woods, Strategic Management – A Fresh approach to developing skills, Knowledge and creativity, Kogan page Limited, UK
6. David, Strategic Management, Pearson Education
7. IGNOU Study Materials, MS-91, Advanced Strategic Management, Block – Strategic Enablers

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 Basic Concepts of corporate strategy – Mission – Vision – Objectives – goals - The Seven S Framework – Corporate governance – Board of Directors – Top management -CEO – Corporate Social Responsibility – Social Audit - philanthropy	**7**	**15%**
Module 2 SWOT - External Environmental Analysis – Environmental scanning – competition analysis – Generic Strategies – impact of opportunities and threats – Internal Corporate analysis – various Formats to analyse strengths and weaknesses	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Strategy formulation – Strategic factors analysis – Strategic alliances – Diversification – Expansion – Integration – Portfolio analysis – functional strategy	**7**	**15%**
Module 4 Strategy implementation – mergers and acquisitions – TQM – MBO – Evaluation and control – strategy audit	**7**	**15%**
SECOND INTERNAL TEST		

Module 5 Strategic Enablers – Technology Management – technology life cycle – technology transfer- Technology forecasting – Knowledge Management – knowledge types and sources – knowledge creation – KM framework –	**7**	**20%**
Module 6 R&D – development of R&D strategy – Innovation and Creativity – factors influencing – Innovative organisations – Information technology – Infrastructure and Architecture – E Business	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars, case presentations or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6136 MARKOV MODELLING AND QUEUING THEORY

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites :Operations Research

Course Objectives

This course is a thorough treatment of Markov Chain and Markov Models of the systems. It also deals with essential queuing theory and application of Markov models in the analysis of queuing networks.

Syllabus

Stochastic Process, Markov models, queuing networks, Single Class & Multi-class Queuing Network, Time Delays and Blocking in Queuing Networks::

Course Outcome

At the end of course, the student will be able to:

- Understand Markov Chain and Markov Models of the systems.
- Apply the essential queuing theory and application of Markov models in the analysis of queuing networks.

References:

1. Ronald W. Wolff, Stochastic Modeling and The Theory of Queues, Prentice-Hall International.
2. Peter G. Harrison and Naresh M. Patel, Performance Modeling of Communication Networks and Computer Architectures, Addison-Wesley.
3. Gary N. Higginbottom, Performance Evaluation of Communication Networks, Artech House.

4. Anurag Kumar, D. Manjunath, and Joy Kuri, Communication Networking: An Analytical Approach, Morgan Kaufman Publ.
5. D. Bertsekas and R. Gallager, Data Networks, Prentice Hall of India.
6. Ross, K.W., Multiservice Loss Models for Broadband Telecommunication Networks, Springer-Verlag.
7. Walrand, J., An Introduction to Queuing Networks, Prentice Hall.
8. Cinlar, E., Introduction to Stochastic processes, Prentice Hall.
9. Karlin, S. and Taylor, H., A First course in Stochastic Processes, 2nd edition Academic press.

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 Stochastic Processes: Renewal Processes - Reward and Cost Models, Poisson Process; Point Processes; Regenerative Processes; Renewal Theorems.	**7**	**15%**
Module 2 Markov Models: Discrete Time Markov Chain - Transition Probabilities, Communication Classes, Irreducible Chains; Continuous Time Markov Chain - Pure-Jump Continuous-Time Chains, Regular Chains, Birth and Death Process, Semi-Markov Processes.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Single Class & Multi-class Queuing Networks: Simple Markovian queues; M/G/1 queue; G/G/1 queue; Open queuing networks; Closed queuing networks	**7**	**15%**
Module 4 Mean value analysis; Multi-class traffic model; Service time distributions; BCMP networks; Priority systems.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Time Delays in Queuing Networks: Time delays in single server queue; Time delays in networks of queues;	**7**	**20%**
Module 6 Blocking in Queuing Networks: Types of Blocking; Two finite queues in a closed network; Aggregating Markovian states	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE6108 MINI PROJECT

Credits: 0-0-4 : 2 **Year : 2015**

Prerequisites :nil

Course Objectives

To train students in identification, analysis, finding solutions and execution of live engineering and managerial problems. It is also aimed to enhance the capabilities of the students for group activities.

Course Outcome

At the end of course, the student will be able to:

- Identify, plan, analyse and generate solutions to live engineering and managerial problems.
- Enhance their capabilities to work as a member of a group.

Course Plan

Individual students are required to choose a topic of their interest. The subject content of the mini project shall be from emerging / thrust areas, topics of current relevance having research aspects or shall be based on industrial visits. Students can also choose live problems from manufacturing organisations as their mini project. At the end of the semester, the students should submit a report duly authenticated by the respective guide, to the head of the department.

Mini Project will have internal marks 50 and Semester-end examination marks 50. Internal marks will be awarded by respective guides as per the stipulations given below.

Attendance, regularity of student (20 marks)

Individual evaluation through viva voce / test (30 marks)

Total (50 marks)

Semester end examination will be conducted by a committee consisting of three faculty members. The students are required to bring the report completed in all respects duly authenticated by the respective guide and head of the department, before the committee. Students individually will present their work before the committee. The committee will evaluate the students individually and marks shall be awarded as follows.

Report = 25 marks

Concept/knowledge in the topic = 15 marks

Presentation = 10 marks

Total marks = 50 marks

07PE6112 COMPUTATIONAL LABORATORY

Credits:0-0-2 : 1 **Year : 2015**

Prerequisites : Modeling of manufacturing systems

Course Objectives

To get exposure to Model and analyse real world decision making problems relevant to a manufacturing system through simulation using various standard software tools, optimisation techniques and multivariate analysis

Course Outcome

At the end of course, the student will be able to:

- Model and analyse real world decision making problems relevant to a manufacturing system through simulation using various standard software tools
- Generate and implement effective alternatives through the optimization techniques and multivariate analysis using the commercially available software tools in real time manufacturing scenario
- Comprehend the advancements in the fields of operations and supply chain management.

Experiments

Experiments pertaining to the applications

1. Manual simulation of a manufacturing system
2. Performance analysis of production system using simulation software ARENA/WITNESS and theoretical model
3. Performance analysis of a 4 stage serial supply chain under P-system of inventory control at all stages of the supply chain using excel spread sheet.
4. Supply chain role play game
5. Exercise on MATLAB programming to determine the inventory policy for the given problem using simulation
6. Model and optimise the given production planning problem using the optimisation software CPLEX
7. Model, analyse and infer the given management problem through regression analysis using SPSS
8. An exercise on confirmatory factor analysis using SPSS.

Internal Continuous Assessment (Maximum Marks-100)

i) Practical Records /outputs 40%

ii) Regular Class Viva-Voce 20%

iii) Final Test (Objective) 40%

07PE6114 SEMINAR I

Credits: 0-0-2 : 2 **Year : 2015**

Prerequisites : Nil

Course Objectives

To assess the debating capability of the student to present a technical topic. Also to impart training to a student to face audience and present ideas and thus creating self esteem, self confidence and courage that are essential for an engineer.

Course Outcome

At the end of course, the student will be able to:

- Present , defend and debate on a technical topic.
- confront an audience and present ideas and thus create self esteem, self confidence and courage that are essential for an engineer

Course Plan

Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. A detailed write-up on the topic of the seminar is to be prepared in the prescribed format given by the Department. The seminar shall be of 30 minutes duration and a committee with the Head of the department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Internal continuous assessment: 100 marks

Suggested evaluation procedure:-
Faculty member in charge of the seminar and another faculty member in the department nominated by the Head of the Department are the evaluators for the seminar. Distribution of marks for the seminar is as follows.

Marks for the report: 30%
Presentation: 40%
Ability to answer questions on the topic: 30%

07PE7105 REVERSE ENGINEERING

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites :Product Design and Development

Course Objectives
This paper will provide the conceptual framework and methodologies used in re-engineering. The students will understand the necessity of translating the free-form design into necessary relevant engineering design details.

Syllabus

Reverse engineering history, scope and tasks of RE, domain analysis, digitising techniques, prototyping, data reverse engineering, evaluation of RE tool, RE assembly programmes, cognitive approach, integrating RE methods

Course Outcome

At the end of course, the student will be able to:

- Understand the conceptual framework and methodologies used in re-engineering.
- Discuss the necessity of translating the free-form design into necessary relevant engineering design details.

Reference:

1. T J Biggerstaff, IEEE Corpn., "Design Recovery for Maintenance and Reuse", July 1991
2. White paper on RE, S. Rugaban, "Technical Report", Georgia Instt. of Technology, 1994
3. www.cs.usask.ca/homepages.grads/moa135/856/RE/RE.html
4. Katheryn, A. Ingle, "Reverse Engineering", McGraw-Hill, 1994
5. Aiken Peter, "Data Reverse Engineering", McGraw-Hill, 1996
6. Linda Wills, "Reverse Engineering", Kluiver Academic Publishers, 1996
7. Donald R. Honsa, ISBN 1555897, "Co-ordinate Measurement and reverse engineering", American Gear Manufacturers Association

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 History of Reverse Engineering – Scope and tasks of RE - Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation	**7**	**15%**
Module 2 Domain analysis- process of duplicating - Tools -for RE Functionality- dimensional- developing technical data - digitizing techniques -	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Construction of surface model - solid-part material- characteristics evaluation -software and application- prototyping - verification	**7**	**15%**
Module 4 Data reverse engineering – Three data reverse engineering strategies – Definition – organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Design experiments to evaluate a reverse engineering tool – Rule based detection for reverse engineering user interfaces – Reverse engineering of assembly programs: A model based approach and its logical basics	**7**	**20%**
Module 6 Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering –– coordinate measurement – feature capturing – surface and solid members	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7107 SUPPLY CHAIN MANAGEMENT SYSTEMS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : Operations Management

Course Objectives

In today's business scenario, fulfilment of customers' requirements is possible only through the coordination and involvement of the suppliers of the organisation. Proper design of the supply chain is of paramount importance in order to achieve this. This course provides the basic knowledge of the key issues of the supply chains, its design and operation

Syllabus

Supply chain Management, Logistics network configuration, Inventory management and risk pooling, value of information, supply chain integration, strategic alliances, coordinated product and supply chain design and decision support system for SCM.

Course Outcome

At the end of course, the student will be able to:

- Understand the importance of role of suppliers in the fulfilment of customers requirements.
- Analyse the key issues of supply chains and to design and operate supply chains.

References:

1. Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E, 'Designing and managing the supply chain – concepts, strategies and case studies', 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2004
2. Chopra, S., and Meindl, P., Supply chain Management: Strategy, Planning and Operations. Second Edition, Pearson Education (Singapore) Pte. Ltd, 2004.
3. Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E., and Ravi Shankar, Designing and Managing the supply chain, Tata McGraw Hill Education Private Limited, New Delhi, 2008
4. Shah, J., Supply chain management: Text and Cases. New Delhi: Pearson Education, 2009.
5. Tersine, R. J., Principles of Inventory and Materials Management, Fourth Edition, Prentice-Hall Inc., New Jersey, 1994.
6. Raghuram, G. and Rangaraj, N., Logistics and Supply Chain Management: Cases and Concepts, Macmillan India Limited, New Delhi, 2000.
7. Shapiro, J.F., Modelling Supply Chain, Second Edition, Cengage Learning, 2007

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Supply chain management – global optimization – managing uncertainty – key issues. Logistics network configuration - data collection – model an data validation – solution techniques – key features of a network configuration DSS.	**7**	**15%**
Module 2 Inventory management and risk pooling – single warehouse – risk pooling – centralized and decentralized systems – managing inventory in supply chains – practical issues. Value of information – bullwhip effect – effective forecasts – information for coordination systems – locating products – lead time reduction – information and supply chain trade offs.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Supply chain integration – push, pull and push-pull systems – demand driven strategies – impact of the internet on supply chain strategies – distribution strategies – centralized versus decentralized control – central versus local facilities.	**7**	**15%**
Module 4 Strategic alliances – framework for strategic alliance – third party logistics – retailer supplier partnerships – procurement and outsourcing strategies – benefits and risks – e-procurement – frameworks	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Coordinated product and supply chain design – design for logistics – supplier integration into new product development – mass customization. IT for supply chain management – goals of supply chain information technology, standardization, information technology infrastructure – supply chain management system components – integrating supply chain information technology	**7**	**20%**
Module 6 Decision support systems for SCM – challenges – structure of DSS – supply chain DSS- selecting a supply chain DSS	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7109 SIMULATION OF MANUFACTURING SYSTEMS

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites : Basics of modelling and Simulation

Course Objectives

To know about the technique of simulating actual industrial scenario

Syllabus

System Concept, System Simulation, Concepts in Discrete Event Simulation, Random Number Generation, Random Variate Generation, Input Modelling for Simulation, Verification and Validation of Simulation Models, Output Analysis for a Single Model, Metamodelling and Simulation Modelling and Analysis of Manufacturing Systems

Course Outcome

At the end of course, the student will be able to:

- Discuss the concepts of simulation and modeling and its application to manufacturing systems
- To apply the technique of simulating actual industrial scenario

References

1. Banks, J., Carson, J.S., Nelson, B.L., and Nicol, D.M., Discrete-Event System Simulation, Fifth Edition, Pearson Education, Inc., 2010.
2. Deo, N., System Simulation with Digital Computer, Prentice Hall of India, 1997.
3. Askin R.G. and Standridge, C.R., Modelling and Analysis of Manufacturing Systems, John Wiley Sons
4. Carrie, A.S., Simulation of Manufacturing Systems, John Wiley & Sons Ltd., 1988.
5. Les Oakshott, (1997), Business Modelling and Simulation, Pitman Publishing, London, 1997.
6. Robinson, S., (2004), "Simulation: The Practice of Model Development and Use", John Wiley & Sons Ltd., England, U.K.
7. Law, A.M., (2007), Simulation Modelling and Analysis, Third edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. Altiok, T., and Benjamin, M., (2011), "Simulation Modelling and Analysis with ARENA", Academic Press, Elsevier, 2011.
9. Seila, A.F., Ceric, V., and Tadikamalla, P., Applied Simulation Modelling, Cengage Learning, 2004.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module I **System Concept**: Systems and system environment, Components of a system, Discrete and continuous systems, Systems approach to problem solving, Types of system study, System analysis, system design and system postulation, System modelling, Types of models. **System Simulation:** Technique of simulation, Comparison of simulation and analytical methods, Types of system simulation, Steps in simulation study, Monte Carlo simulation. **Concepts in Discrete Event Simulation**: Event scheduling/ Time advance algorithm, Modelling world views, Simulation programming tasks, Comparison and selection of simulation languages.	**7**	**15%**
Module 2 **Random Number Generation:** Techniques for generating random numbers, Linear congruential method, Test for random numbers, Frequency tests, run tests, tests for autocorrelation, gap test, and Poker test. **Random Variate Generation:** Inverse transformation technique, Exponential, Uniform, Weibull, Triangular, Empirical-Discrete and continuous distributions. Convolution method, Acceptance-Rejection technique.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 **Input Modelling for Simulation:** Data collection, Identifying the distribution with data, Parameter estimation, Goodness of fit test, Chi square, Klomogrov and Smirnov tests, Selecting input model when data are not available.	**7**	**15%**
Module 4 **Verification and Validation of Simulation Models**: Verification of simulation models, Calibration and validation of models, Face validity, Validation of model assumption, validating input-output transformation, Input-output validation using historical input data. .	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 **Output Analysis for a Single Model:** Measures of performance and their estimation, Point estimation, Interval estimation, Output analysis for terminating simulations and Steady state simulations. **Metamodelling:** Simple linear regression, Testing for significance of regression, Multiple linear regression	**7**	**20%**
Module 6 **Simulation Modelling and Analysis of Manufacturing Systems**: Objectives, Performance measures, Issues in simulation of manufacturing systems, Simulation software for manufacturing applications, Simulation of job shop manufacturing systems, Simulation Modelling and Analysis of Single Server and Single Queue Systems, Inventory systems and PERT networks.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be a minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students' right at the beginning of the semester by the teacher.

End semester Examination: 50 marks

07PE7111 ADVANCED OPTIMIZATION TECHNIQUES

Credits: 3 -0-0 : 3 **Year : 2015**

Prerequisites: Basic Optimisation Techniques

Course Objectives

Decision making in manufacturing involves application of a variety of quantitative techniques. This course attempts to give an exposure to some of the techniques.

Syllabus

Nonlinear Optimization, Interpolation methods, Unconstrained Nonlinear Optimization, Constrained Nonlinear Optimization , Dynamic Programming and non traditional Optimisation and Genetic algorithms

Course Outcome

At the end of course, the student will be able to:

- Distinguish the various quantitative techniques used in optimization of manufacturing systems.
- Apply the quantitative techniques in manufacturing and to take decisions

References:

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice", Wiley-Interscience, 3rd Edition, 1996.
2. Kalyanmoy Deb, " Optimization for engineering design", Printice-Hall India (Pvt) Ltd., New Delhi, 2000.
3. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison-Wesley Co., 1989
4. Dimitri P. Bertsekas, "Dynamic Programming: Deterministic and Stochastic Models ", Prentice Hall, 1987.
5. Harvey M.Salkin, "Integer Programing", Addison-Wesley Pub. Co., 1975,
6. Stephen C. Nash and Ariela Sofer, "Linear and Nonlinear Programming", McGraw Hill College Div., 1995.
7. Fred Glover, Manuel Laguna, and Fred Laguna, "Tabu Search", Kluwer Academic Publishers, 1997.
8. Cihan H.Dagli, "Artificial Neural Networks for Intelligent Manufacturing", Chapman & Hall, London 1994.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 Nonlinear Optimization Introduction - one-dimensional optimization – Elimination methods - unrestricted search, exhaustive scare Fibonacci and Golden section methods	**7**	**15%**
Module 2 Interpolation Methods Interpolation methods: quadratic and cubic interpolations, direct root methods.	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Unconstrained Nonlinear Optimization Direct search methods – Random search methods - Pattern search methods - Method of rotating coordinates - Descent methods - steepest descent, conjugate gradient, Quasi-Newton, and variable metric methods.	**7**	**15%**
Module 4 Constrained Nonlinear Optimization Direct methods - the complex method, cutting plane method, methods of feasible directions - Indirect methods – transformation techniques, interior and exterior penalty function methods.	**7**	**15%**
SECOND INTERNAL TEST		
Module 5 Dynamic Programming Bellman's principle of optimality, examples on the application on routing problem, inventory problem, simplex problem, marketing problem.	**7**	**20%**
Module 6 Non-Traditional Optimisation Techniques Introduction to Genetic Algorithms, Simulated Annealing, Tabu Search, and Neural Networks.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7113 INDUSTRIAL ENERGY MANAGEMENT

Credits: 3-0-0 : 3 **Year 2015**

Prerequisites :Nil

Course Objectives

To understand the concept of energy engineering, electrical system optimization, energy conservation, energy economics and environmental aspects of energy utilization.

Syllabus

Energy engineering, solar energy, wind energy, energy from biomass, electrical system optimisation, energy conservation, energy economics, efficiency and audits, energy management and energy and environment.

Course Outcome

At the end of course, the student will be able to:

- Understand the concept of energy engineering, electrical system optimization and energy conservation.
- Discuss energy economics and environmental aspects of energy utilization.

References:

1. A.P.E.Thumann, Fundamentals of Energy, Engineering, Prentice Hall,1984.
2. A.P.E.Thumann, Plant Engineers and Managers Guide to Energy Conservation, 7e,UNR,1977.
3. W.F.Kenney, Energy Conservation in the Process Industries, Academic press,1984
4. M.H.Chiyogioji, Industrial Energy Conservation, Marcel Dekker,1979
5. C.B. Smith, Energy Management Principles, Pergamon Press, New York, 1981.
6. Amit Tyagi, Handbook on Energy Audit and Management, TERI, New Delhi, 2000
7. Environmental Considerations in Energy Development, Asian Development Bank (ADB) publication,Manila, 1991

Course Plan

Modules	**Contact hours**	**Sem. Exam Marks %**
Module 1 Energy Engineering- World energy outlook. Application of Non Conventional and Renewable Energy Systems - Use of Energy Efficient Technologies.	**7**	**15%**
Module 2 Solar energy –solar energy collectors and energy storage-applications of solar energy. Wind energy-basic components of a wind energy conversion system-performance of wind machines-applications of wind energy. Energy from biomass – biomass conversion technologies-types of biogas plants-Energy conservation schemes-case studies	**7**	**15%**
FIRST INTERNAL TEST		
Module 3 Electrical system optimization-Importance of power factor-Power factor correction-Energy efficient motors –lighting basics-energy efficient light sources-domestic, commercial or industrial lighting. Energy conservation in lighting schemes-case studies.	**7**	**15%**
Module 4 Energy conservation in HVAC system, energy conservation by cogeneration scheme-boiler efficiency improvement-waste heat recovery – case studies	**7**	**15%**
SECOND INTERNAL TEST		

Module 5 Energy economics-payback analysis-energy auditing and accounting-types-energy use profiles-the energy survey-Sankey diagram for energy audit-Energy Audit Instruments- Thermal Energy Efficiency & Audits - Electrical Energy Efficiency - Audits -case studies Energy management- Maintenance management-Preventive maintenance schedule-Energy management organization.	**7**	**20%**
Module 6 Energy and Environment. Environmental aspects of energy utilization-public health issues related to environmental pollution. Methods to measure pollution in industries-air pollution & water pollution. Compliance with standards-International Environmental Policy. Energy recovery by solid waste management. Environmental auditing-case studies	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7115 SOFT COMPUTING TECHNIQUES

Credits: 3-0-0 : 3 **Year 2015**

Prerequisites: Basic computing techniques

Course Objectives

To acquaint the students with soft computing methodologies such as neural networks, fuzzy logic, genetic algorithms and hybrid algorithms and enable the students to implement real time intelligent and adaptive systems.

Syllabus

Introduction to Fuzzy logic, membership functions, Artificial Neural Networks, Fundamentals of genetic algorithms, Hybrid systems and Genetic algorithm based back propogation network

Course Outcome

At the end of course, the student will be able to:

- Explain soft computing methodologies such as neural networks, fuzzy logic, genetic algorithms and hybrid algorithms.
- Implement real time intelligent and adaptive systems.

REFERENCES

1. S.Rajasekharan, G.A.Vijayalakshmi Pai, Neural Network, Fuzzy Logic and Genetic Algorithms Synthesis and Applications, Prentice Hall India.
2. S.N.Sivanandam, S.N.Deepa, Principles of Soft Computing, Wiley India.
3. Timothy J Ross, Fuzzy logic with Engineering Applications, Mc Graw Hill ,New York.
4. S.Haykins, Neural Networks a Comprehensive foundation, Pearson Education.
5. D.E.Goldberg, Genetic Algorithms in Search Optimisation and Machine Learning, Pearson Education.
6. Recent literature

Course Plan

Modules	Contact hours	Sem. Exam Marks %
MODULE 1 **Introduction to Fuzzy logic**: Fuzzy sets- Fuzzy set operations- Fuzzy relations-Cardinality of Fuzzy relations-Operations on Fuzzy relations-Properties of Fuzzy relations	**7**	**15%**
MODULE 2 **Membership Functions**-Features of Membership functions- Fuzzification-Methods of Membership value Assignments- Fuzzy Rule Base-Defuzzification-Deffuzzification methods- Fuzzy logic controller(Block Diagram)	**7**	**15%**
FIRST INTERNAL TEST		
MODULE 3 **Artificial Neural Networks**: Basic concepts-Neural network Architectures-Single layer feed forward network-Multilayer feed forward network-Recurrent Networks-Characteristics of Neural Networks-Learning methods. Perceptron networks-Back Propagation networks-Radial base function network-Hopfield network- Kohonen Self organizing maps-ART	**7**	**15%**
MODULE 4 **Fundamentals of genetic algorithms:** Basic concepts- working principle – encoding – different methods – fitness function – reproduction-different methods. Genetic modelling-inheritance- Crossover mutation-convergence of genetic algorithm.	**7**	**15%**
SECOND INTERNAL TEST		
MODULE 5 **Hybrid systems:** Neural network, fuzzy logic and genetic algorithm hybrids – Neuro fuzzy hybrids- neuro genetic hybrids-Fuzzy genetic hybrids	**7**	**20%**
MODULE 6 **Genetic algorithm based back propogation network-** Fuzzy back propagation networks -fuzzy logic controlled genetic algorithms.	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7117 ADVANCED MAINTENANCE MANAGEMENT

Credits: 3 -0-0 : 3 **Year : 2015**

Prerequisites: Basic Maintenance Management

Course Objectives

To build-up effective technical competencies in maintenance management in engineering organisations. To expose the students to scientific and proactive approaches in maintenance

Syllabus

Maintenance Concepts, Failure Data Analysis, System reliability and availability , Maintenance Logistics, Staffing and maintenance planning and Total Productive Maintenance

Course Outcome

At the end of course, the student will be able to:

- Develop effective technical competencies in maintenance management in engineering organisations.
- Discuss the scientific and proactive approaches in maintenance

References

1. Lindley R.Higgins & R.Keith Mobley, "Maintenance Engineering Handbook", McGraw Hill, 2002.
2. Charles E.Ebeling, "An introduction to Reliability and Maintainability engineering", Tata McGraw Hill, 2000.
3. K Venkataraman, Maintenance Engineering and Management, Prentice Hall of India, 2007.

Course Plan

Modules	Contact hours	Sem. Exam Marks %
Module 1 - Maintenance Concepts Maintenance objectives – Maintenance functions – Maintenance costs – Five zero concept – Maintenance Models - Maintenance policies – Imperfect maintenance – Choice between PM and breakdown maintenance – Optimal PM schedule and product characteristics – Inspection decisions – Condition monitoring – Replacement models - Tero technology.	7	15%
Module 2 - Failure Data Analysis Mortality curve – useful life – Evaluating data for failure rate estimation – Analysis using probability plotting: Exponential Weibull – Design life –	7	15%
FIRST INTERNAL TEST		
Module 3 – System reliability and availability System Reliability: Decomposition method – Cut and tie sets – FTA – Standby system – Maintainability prediction – MTTR – System availability	7	15%
Module 4 - Maintenance Logistics Maintenance planning and scheduling – Spare parts management – Classification – Breakdown, Capital, Insurance and rotable spares -	7	15%
SECOND INTERNAL TEST		

Module 5 Staffing and maintenance planning Maintenance staffing – Use of learning curves and simulation – Human factors in maintenance – Maintenance manuals – Queuing theory applications – Shutdown planning – Computer Applications in maintenance management.	**7**	**20%**
Module 6 Total Productive Maintenance Overall Equipment Effectiveness – Chronic and sporadic losses – Autonomous maintenance – Maintenance prevention – Reliability cantered maintenance (RCM).	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7119 CLOUD MANUFACTURING

Credits: 3-0-0 : 3 **Year : 2015**

Prerequisites: Basic concepts of Product design and integrated product development

Course Objectives

This course will provide an insight into the application of cloud computing in manufacturing enabling high level integration of product development phases. It gives an idea about different tools and methodologies used for cloud based product management .

Syllabus

Cloud based manufacturing systems k, Distributed service, product data management, PLM systems, Integration of PLM with other applications, deployment of PLM systems, business benefits to PLM, PLM softerae, Challenges of product management in manufacturing and Product management strategy

Course Outcome

At the end of course, the student will be able to:

- Understand the concept of cloud based distributed environment for collaborative manufacturing.
- to apply the cloud concepts in a sustainable and global product development

References :

1. Weidong Li , Jorn Mehnen, ‘Cloud Manufacturing Distributed computing technologies for global and sustainable manufacturing , Springer New York
2. Stark, J., Product Lifecycle Management - 21st Century Paradigm for Product Realization, Springer-Verlag, London, 2005

Web reference
www. searchsoa.techtarget.com
www.cimdata.com
www.aberdeen.com

Course Plan

Modules	Contact hours	Sem. Exam Marks %
MODULE 1 cloud based manufacturing systems- Introduction to cloud computing – definition- architecture of cloud manufacturing-resouce requirements – service oriented manufacturing environment – IaaS, SaaS, PaaS, interoperability of systems, cloud based systems and interoperability – virtual service layer	**7**	**15%**
MODULE 2 Distributed service – definition – application of manufacturing ,assembly processes and management of products for recycling of e-waste – customizable decision making model. Development of cloud community for small and medium industries	**7**	**15%**
FIRST INTERNAL TEST		
MODULE 3 integrating OEMs and suppliers, out sourcing machining process – Cloud based manufacturing of parts, Vendor selection and supply chain management in cloud environment	**7**	**15%**
MODULE 4 Factors affecting cloud technology adoption and implementation – Benefits of cloud, Barriors and approaches of cloud adoption, various perspectives of users, developers and market teams, Data as a service, Buisness process as a service.	**7**	**15%**
SECOND INTERNAL TEST		
MODULE 5 Sustainable manufacturing system, product design, manufacturing – Needs of sustainability - adaption of sustainability factors in product development- manufacturing requirement, strategy, domain for production paradigm, Re use, Recycle, Remanufacture for sustainability- Lifecycle sustainable information management-	**7**	**20%**
MODULE 6 Cloud based integrated systems for design and manufacturing – collaborative cloud based systems - visualization information sharing – Designing by service for collaborative product development – Real time work in progress management- modeling for operational information exchange network	**7**	**20%**

Internal continuous assessment: 40 marks

Internal continuous assessment is in the form of periodical tests, assignments, seminars or a combination of all whichever suits best. There will be minimum of two tests per subject (2 x 15 marks) and assignments (10 marks). The assessment details are to be announced to students at the beginning of the semester by the teacher.

Semester end examination: 60 marks

07PE7101 SEMINAR II

Credits: 0-0-2 : 2 **Year : 2015**

Prerequisites : Nil

Course Objectives

To assess the debating capability of the student to present a technical topic. Also to impart training to a student to face audience and present ideas and thus creating self esteem, self confidence and courage that are essential for an engineer.

Course Outcome

At the end of course, the student will be able to:

- Present , defend and debate on a technical topic.
- confront an audience and present ideas and thus create self esteem, self confidence and courage that are essential for an engineer

Course Plan

Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. A detailed write-up on the topic of the seminar is to be prepared in the prescribed format given by the Department. The seminar shall be of 30 minutes duration and a committee with the Head of the department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Internal continuous assessment: 100 marks

Suggested evaluation procedure:-
Faculty member in charge of the seminar and another faculty member in the department nominated by the Head of the Department are the evaluators for the seminar. Distribution of marks for the seminar is as follows.

Marks for the report: 30%
Presentation: 40%
Ability to answer questions on the topic: 30%

07PE7103 MASTERS RESEARCH PROJECT (PHASE – I)

Credits: 0-0-14 : 6 **Year : 2015**

Prerequisites : All courses of first and second semesters

Course Objective

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Course Outcome

At the end of course, the student will be able to: :

- To identify manufacturing process or operations management issues in manufacturing organisations, formulate, analyze and develop solution to them
- Planning for construction, design, generation or production solutions for manufacturing organisations.
- Do research in area of manufacturing systems management and come out with practical, creative, innovative solutions for manufacturing organisations.
- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
- Apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.
- To create a theses out of the research carried out in manufacturing organisations and by applying selected methodologies and tools learnt though the course
- To produce a research paper out of the research carried out and to add to the body of knowledge.

Course Plan

The objective of this course is ,to improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Normally students are expected to do the project within the college. However they are permitted to do the project in an industry or in a government research institute under a qualified supervisor from that organization. Progress of the project work is to be evaluated at the end of the third semester. For this a committee headed by the head of the department with two other faculty members in the area of the project and the project supervisor/s. If the project is done outside the college, the external supervisor associated with the student shall also be a member of the committee. Final evaluation of the project will be taken up only if the student has earned all course credits listed in the first three semesters. Project evaluation shall be done by the same committee mentioned above with an external expert, either from an academic/R&D organization or from Industry, as an additional member. Final project grading shall take into account the progress evaluation done in the third semester and the project evaluation in the fourth semester. If the quantum of work done by the candidate is found to be

unsatisfactory, the committee may extend the duration of the project up to one more semester, giving reasons for this in writing to the student. Normally further extension will not be granted and there shall be no provision to register again for the project.

While students are expected to do their projects in their colleges, provision is available for them to do it outside the college either in an industry or in an institute of repute. This is only possible in the fourth semester and the topic of investigation should be in line with the project part planned in the 3rd semester. Student should apply for this through the project supervisor indicating the reason for this well in advance, preferably at the beginning of the 3rd semester. The application for this shall include the following:-

Topic of the Project:
Project work plan in the 3rd Semester:
Reason for doing the project outside:
Institution/Organization where the project is to be done:
External Supervisor – Name:
Designation:
Qualifications:
Experience:

Letter of consent of the External Supervisor as well as from the organization is to be obtained. This application is to be vetted by the head of the department and based on the decision taken the student is permitted to do the project outside the college.

The project work can be a design project, experimental project, computer simulation project or an empirical study involving data collection and analysis from manufacturing organisations. The topic should be on Manufacturing Systems Management or any of the topics related with manufacturing stream. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute. If found essential they may be permitted to continue their project outside the parent institute subject to the conditions of M.Tech regulations. Department will constitute an Evaluation Committee to review the project work.

The student is required to undertake the masters research project phase-I during the third semester and the same is continued in the 4th semester (Phase-II). Phase-I consists of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester.

Project Evaluation

Project evaluation weights shall be as follows:-

Total marks for the Project: 150 (third and fourth semester combined)

In the 3rd Semester:- Marks:50

Project Progress evaluation:

Progress evaluation by the Project Supervisor : 20 Marks

Presentation and evaluation by the committee : 30 Marks

07PE7102 : MASTERS RESEARCH PROJECT (PHASE-II)

Credits: 0-0-22 : 12 **Year : 2015**

Prerequisites : All courses of first and second semesters

Course Objective

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

Course Outcome

At the end of course, the student will be able to: :

- To identify manufacturing process or operations management issues in manufacturing organisations, formulate, analyze and develop solution to them
- Planning for construction, design, generation or production solutions for manufacturing organisations.
- Do research in area of manufacturing systems management and come out with practical, creative, innovative solutions for manufacturing organisations.
- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
- Apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.
- To create a theses out of the research carried out in manufacturing organisations and by applying selected methodologies and tools learnt though the course
- To produce a research paper out of the research carried out and to add to the body of knowledge.

Masters Research project phase-II is a continuation of project phase-I started in the third semester. Before the end of the fourth semester, there will be two reviews, one at middle of the fourth semester and other towards the end. In the first review, progress of the project work done is to be assessed. In the second review, the complete assessment (quality, quantum and authenticity) of the thesis is to be evaluated. Both the reviews should be conducted by guide and Evaluation committee. This would be a pre qualifying exercise for the students for getting approval for the submission of the thesis. At least one technical paper is to be prepared for possible publication in journal or conferences. The technical paper is to be submitted along with the thesis. The final evaluation of the project will be external evaluation.

Project Evaluation

Project evaluation weights shall be as follows:-

Total marks for the Project: 150 (third and fourth semester combined)

In the 4th Semester:- Marks:100

Project evaluation by the supervisor/s	: 30 Marks
Presentation & evaluation by the Committee	: 40 Marks
Evaluation by the External expert (from outside cluster)	: 30 Marks

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