RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2021 – 2022

INDUSTRIAL ENGINEERING AND MANAGEMENT

I to IV SEMESTER M. Tech

M. Tech in INDUSTRIAL ENGINEERING (MIE)

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^{+}' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), by MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 65th rank among 1143 top Engineering institutions of India for the year 2021 and is 1st amongst the Engineering colleges affiliated to VTU, Karnataka.

About the Department

The department was established in the year 1979 as Industrial & Production Engineering and renamed as Industrial Engineering & Management in the year 1992, with an intake of 60 students and M.Tech program was commenced in the year 2012. The department has been recognized as R&D center by VTU with 14 scholars pursuing their Ph.D. The department has well modernized laboratories namely Industrial & Quality Engineering lab, Computer Lab and Mechanical Measurement & Metrology lab. The department is having highly qualified, motivated and result oriented faculty members. All the faculty are involved in research and technical paper publications in reputed technical journals, conferences across the world. The department was accredited by the NBA in 2001, 2004, 2010 & reaccredited in year 2015 as per the new NBA format laid down by Washington Accord. It has consistently bagged university ranks in Bangalore University & VTU. It has set a unique record of achieving 1st rank eleven times. The department has successfully conducted around 37 faculty development programs, seminars & workshops for academicians as well as industry personnel, students and technical staff. The society of Industrial Engineering and Management, "INDEMAN SOCIETY"- a student body was established in the year 1996. The activities of this society includes: Regular Industrial visits and Guest lectures are conducted twice every semester for all students. The department also has Quality Engineering Club, Materials & Manufacturing Club and Productivity Club, the students can enroll to carryout activities based on their interest. Many funded research projects are executed which are sponsored by UGC, AICTE, DST, VTU and VGST.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at MS Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To nurture engineers, entrepreneurs who develop solutions to continually improve socio-technical systems and add value to the society

MISSION OF THE DEPARTMENT

The Industrial Engineering and Management Department shall transform the entrants of the Industrial Engineering and Management program into professionally competent engineers through innovative educational curricula, balanced research program and effective collaboration with industry and academia

M.Tech Program Educational Objectives (PEO's)

The Post Graduate of Industrial Engineering will effectively:

PEO 1: Apply the skills and competence of Industrial Engineering to interpret and solve real life problems

PEO 2: Engage, empower, build and lead the cross-functional teams to solve integrated eco-systems

PEO 3: Involve continued competitive research leading to cutting edge solutions

M.Tech Program Outcome's (PO's)

The Post Graduate of Industrial Engineering will have ability to:

PO1: Independently carry out research/investigation and development work to solve practical problems.

PO2: Write and present a substantial technical report/document.

PO3: Identify advanced engineering and IT tools to solve innovative industrial engineering challenges.

PO4: Demonstrate the importance of environmental sustenance through the application of professional ethics along with techno-social responsibilities.

PO5: Implement the principles of project management to solve societal issues.

Curriculum Course Credits Distribution

Batch 2021-2022

Semester	Humanities & Social Sciences (HSS)	Basic Sciences/ Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses- Core (Hard core, soft core, Lab) (PC-C)	Professional Courses - Electives (PC-E)	Other Electives (OE)	Project Work (PW)	Internship/ other activities (IS/ECA)	Total semester load
First		4		5	12			2	**23**
Second				9	12			2	**23**
Third				4	4		8	4	**20**
Fourth							22		**22**
Total	**0**	**4**	**0**	**18**	**28**	**0**	**30**	**8**	**88**

SCHEME OF TEACHING
I SEMESTER
M.TECH - INDUSTRIAL ENGINEERING (MIE)

Sl. No.	Subject Code	Subject	Credits			Total
			L	T	P	
1	MIE 11	Research Methodology	3	0	0	3
2	MIE 12	Advanced Mathematics	3	1	0	4
Elective – A						
3	MIE 131	Probability and Statistical Modeling	4	0	0	4
	MIE 132	Product Design and Manufacturing				
	MIE 133	Innovation and Design Thinking				
	MIE 134	Human and Organizational Factors				
Elective – B						
4	MIE 141	Advanced Production Planning and Scheduling	4	0	0	4
	MIE 142	Enterprise Resource Planning				
	MIE 143	Product cost analysis and optimization				
	MIE 144	Theory of Inventive Problem Solving				
Elective – C						
5	MIE 151	Work System Design and Ergonomics	4	0	0	4
	MIE 152	Project Management for Business, Engineering and Technology				
	MIE 153	Management Information Systems				
	MIE 154	Product Lifecycle Management				
6	MIE 16	Seminar – I	0	2	0	2
7	MIEL17	Probability and Statistical Modeling Lab	0	0	1	1
8	MIEL18	Work System Design and Ergonomics Lab	0	0	1	1
		Total				**23**

L: Lecture **T:** Tutorial **P:** Practical

SCHEME OF TEACHING
II SEMESTER
M.TECH - INDUSTRIAL ENGINEERING (MIE)

Sl. No.	Subject Code	Subject	Credits			Total
			L	T	P	
1	MIE 21	Systems Simulation and Modeling	3	1	0	4
2	MIE 22	Quality Engineering	3	0	0	3
Elective – D						
3	MIE 231	Quantitative Techniques in Decision Making	4	0	0	4
	MIE 232	Managerial Economics				
	MIE 233	Cyber Security				
	MIE 234	Python programming				
Elective – E						
4	MIE 241	Lean Manufacturing Systems	4	0	0	4
	MIE 242	Computer Aided Facilities Planning				
	MIE 243	Additive Manufacturing				
	MIE 244	Computational Methods for Queuing Networks				
Elective – F						
5	MIE 251	Management Accounting and Finance	4	0	0	4
	MIE 252	Rapid Prototyping				
	MIE 253	Software Project Management				
	MIE 254	Systems Engineering				
6	MIE 26	Seminar – II	0	2	0	2
7	MIEL 27	Quality Engineering Lab	0	0	1	1
8	MIEL 28	Systems Simulation and Modeling Lab	0	0	1	1
		Total				**23**

L: Lecture **T:** Tutorial **P:** Practical

SCHEME OF TEACHING
III SEMESTER
M.TECH - INDUSTRIAL ENGINEERING (MIE)

Sl. No.	Subject Code	Subject	Credits			Total
			L	T	P	
1	MIE 31	Evaluation of Supply Chain Management	3	1	0	4
2	MIE 32	Internship	0	0	4	4
3	MIE 33	Dissertation Preliminaries	0	0	8	8
Elective – G						
4	MIE 341	Artificial Intelligence and Expert System	4	0	0	4
	MIE 342	Experimental Design and Analysis				
	MIE 343	Block Chain Technology				
	MIE 344	Data Warehousing and Mining				
		Total				**20**

L: Lecture **T:** Tutorial **P:** Practical

SCHEME OF TEACHING
IV SEMESTER
M.TECH - INDUSTRIAL ENGINEERING (MIE)

Sl. No.	Subject Code	Subject	Credits			Total
			L	T	P	
1	MIE 41	Dissertation	0	0	22	**22**
		Total	**0**	**0**	**22**	**22**

L: Lecture **T:** Tutorial **P:** Practical

I SEMESTER

RESEARCH METHODOLOGY

Course Code: MIE 11 **Credit: 3:0:0**
Prerequisites : Nil **Contact hours: 42**
Course coordinators: Deepak Kumar

Course Content

Unit I

Research Methodology: An Introduction-Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is done, Research process, Criteria of Good Research, Problems Encountered by Researchers in India

Unit II

Defining the Research Problem: What is Research Problem, Selecting the problem, Necessity of Defining the problem, Technique involved in Defining a problem, an illustration, Conclusion.

Research Design: Meaning of Research Design, need for Research Design, features of a Good design, Importance concepts relating to Research Design, Different Research Designs, Basic principles of experimental design, Conclusion

Unit III

Sampling Design: Census and sampling survey, Implication of a sample design, steps in sampling design, Criteria of selecting a sampling procedure, Characteristics of a good sample design, Different types of sample design, How to select a Random sample, Random sample from an Infinite universe, Complex Random sampling designs, Conclusion

Methods of Data Collection: Collection of primary data, Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Different between questionnaires and schedules, some other methods of data collection, Collection of secondary data, Selection of appropriate method for data collection, Case study method

Unit IV

Survey Research an Overview: The name of surveys, Errors in survey research, Respondent Error, Administrative Error, Rule of Thumb estimates for systematic error, What can be done to reduce survey error, Classifying survey Research methods, Total quality management and satisfaction surveys, Implement total quality management

Survey Research: Basic methods of communication with respondents

Questionnaire Design: Questionnaire design: an overview of the major decisions, What should be asked?, Phrasing questions, The art of asking questions, What is the best question sequence, What is the best layout, How much pretesting and revising are necessary, Designing questionnaires for global research, Media used to communicate with respondents, Personal Interviews, Telephone Interviews, Self-administered questionnaires, Selecting the appropriate survey research design.

Unit V

Intellectual Property – IPR, Copyrights, Patents, Competing Interests, Commitments, and Values. The Researcher in Society, research ethics.

Multivariate Analysis: The nature of multivariate analysis, Classifying Multivariate techniques, Analysis of dependence, Analysis of interdependence.

Interpretation and Report Writing: Meaning of interpretation, Why interpretation, Technique of interpretation, Precaution in interpretation, Significance of report writing, Different steps in writing report, Layout of the research report, Types of reports, Oral presentation, Mechanics of writing research report, Precautions for writing research reports, Conclusion

Text Books

1. C R. Kothari, Research Methodology, New Age International Publishers, 2nd edition, 2007
2. William G Zikmund, Business Research Methods, Indian edition, south western Publishers, 8th Indian Reprint – 2009.

Reference Books

1. Panneer Selvam, Research Methodology, PHI Learning Pvt. Ltd., 2007
2. Dr. B.L.Wadhera -Intellectual Property Rights, Universal Law Publishing Co. Ltd... 2002

Course Outcomes (COs):

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

1. Understand and design appropriate methodology for research. (PO-1)
2. Evaluate between various sampling procedures and their real time applications. (PO-3)
3. Analyse and interpret data collected. (PO-2)
4. Design an optimal surrey questionnaire for specific situation. (PO-2, 4)
5. Apply multi variant analysis to real time situations. (PO-5)

ADVANCED MATHEMATICS

Course Code: MIE 12 **Credit: 3:1:0**
Prerequisites: UG Mathematics **Contact Hours: 42 +14T**
Course coordinators: Dr. Dinesh P A

Course Objectives

The student will

1. Learn the methods to solve systems of linear equations and employ the concept of Eigen values and Eigen vectors to diagonalize a matrix and to solve system of ODEs.
2. Learn the concept of Orthogonal diagonalization, Quadratic forms, the concept of basis and dimension of vector spaces and also linear transformation of vector spaces.
3. Learn the concepts of orthogonal, orthonormal vectors, projections and Least square methods.
4. Learn to solve simultaneous first order ODE, higher order ODE and PDE numerically.
5. Learn programming in MATLAB.

Syllabus

UNIT I

Linear Algebra I: Introduction to solution of system of linear equations, Gaussian elimination, Gauss-Jordan method, LU decomposition Method, Eigen values and Eigen vectors, diagonalization of a square Matrices and solution of ODE's by matrix method.

UNIT II

Linear Algebra II: Symmetric matrices, properties, Orthogonal diagonalization, Quadratic forms, Canonical form, Nature of Quadratic forms.

Vector Spaces: Vector spaces and subspaces, linear independence, basis and dimension, Coordinate vectors, Kernel and Range of linear transformation.

UNIT III

Linear Algebra III: Orthogonal sets, orthogonal projections, Gram-Schmidt process, SVD, QR factorization, least square problems, Application to linear models.

UNIT IV

Differential equations: Simultaneous first order ODE by modified Euler's method and R-K method, Higher order ODE by R-K method, Solution of one dimensional heat equation, Wave equation by Finite difference method (Explicit Scheme).

UNIT V

MATLAB: Introduction – variables, arrays, functions, Plotting – 2-D plots, 3-D plots. Script files, user defined functions, Programming – solutions for ODE and PDE.

Text books:

1. David C Lay, Steven R Lay, Judi J – Linear Algebra and its applications, Pearson, 5th edition, 2014.
2. M K Jain, S R K Iyengar, R K Jain – Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 6th edition, 2012.
3. K. W. Morton, D. F. Mayers – Numerical solution of partial differential equations, 2nd edition, Cambridge University Press, 2005.
4. Rudra Pratap – Getting started with MATLAB: A Quick Introduction for Scientists and Engineers, Oxford University press, 7th edition, 2016.

Reference books:

1. Gilbert Strang –Linear Algebra and its applications, 4th edition, Cengage Learning, 2007.
2. Steven C Chapra – Applied Numerical Methods with MATLAB for Engineers and Scientists, 3rd edition, Tata Mcgraw Hill publications, 2012.
3. M K Jain, S R K Iyengar, R K Jain – Computational methods for partial differential equations, New Age International Publishers, 2nd edition, 2016.
4. Amos Gilat – MATLAB: An introduction with applications, 6th edition, WILEY Publications, 2016.

Course Outcomes (COs):

Students are expected to do the following:

1. Solve system of linear equations and simultaneous ODEs by matrix method. (PO1)
2. Diagonalize a matrix by orthogonal diagonalization and discuss the problems related to linear transformations. (PO1)

3. Find orthonormal vectors using Gram-Schmidt process and solve problems using least square concepts. (PO1)
4. Solve simultaneous first order ODE, higher order ODE and PDE. (PO1)
5. Program and simulate engineering problems using MATLAB. (PO1,PO3)

ELECTIVE- A

PROBABILITY & STATISTICAL MODELING

Course Code: MIE 131 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. M Shilpa / Hamritha S

Course Content

Unit I

Introduction: Introduction to probability theory, Conditional Probability (simple problems), Bayes Theorem (Simple Problems), Discrete & Continuous Random Variables: Binomial, Poisson, Hypergeometric, Multinomial, Uniform, Normal, Gamma (non analytical), Exponential, Chi square distributions (non analytical)

Unit II

Mathematical Expectation and Moment generating functions: Mathematical Expectation & Moment Generation of random variables: Binomial, Poisson, Uniform, Normal, And Exponential

Unit III

Markov Chains: Introduction to Stochastic Process, Discrete time Markov Chains: Introduction, Chapman Kolmogorov Equation, Transient and Steady State Analysis, Classification: Transient, Recurrent, Absorbing States, First passage times

Unit IV

Hypothesis testing: Introduction to Statistical Inference, Sampling Distribution, Point and Interval Estimation. Hypothesis Testing on Means: One Univarate and Two Univariate Populations, Non Parametric Statistics Test: Sign test, Wilcoxon signed rank test, Wilcoxon rank sum test

Unit V

Regression Analysis: Introduction, Scatter Plot, Simple Linear Regression: Least square estimators, Estimating coefficients Statistical inference on regression parameters, Coefficient of Determination and Sample Correlation Coefficient, Analysis of Residue for simple linear model, Multiple linear regression model: Estimating coefficients, properties of least squares estimators

Text books

1. Walpole, R.E., Myers, R.H., Myers, S.L., Ye, K.Y. Probability and Statistics for Engineers and Scientists, Macmillan, Pearson, 9th Edition, 2016.
2. Douglas C. Montgomery, George C. Runger: Applied Statistics & Probability, 6thEdition, Wiley, 2013
3. Sheldon M Ross: Introduction to Probability and Statistics for Engineers and Scientist, 5th Edition, Elsevier, 2014

Reference Books

1. Sheldon M Ross: Introduction to Probability models 10th Edition, Academic Press, 2009
2. Richard I. Levin, David S. Rubin, Statistics for Management, 7th Edition, 2008
3. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, 2008, Cengage Learning

Course Outcomes (COs):

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

1. To Identify, develop various types of distribution and understands its parameters develop conditional probability models (PO-1,3)
2. To Derive and Obtain the various parameters of distribution, (PO-1,3)
3. To solve real time problems using Markov chain methods (PO-1,3)
4. To conduct statistical inference on various real time problems (PO-1,3)
5. Develop Regression model for real time data (PO-1,3)

PRODUCT DESIGN AND MANUFACTURING

Course Code: MIE 132 **Credit: 4:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. G S Prakash/ Dr. M R Shivakumar

Course Content

Unit I

Introduction to Product Design: Asimow's Model: definition of Product Design, Design by Evolution, Design by Innovation, Essential Factors of Product Design, Production-Consumption Cycle, Flow and Value Addition in the Production-Consumption Cycle, The Morphology of Design (The seven phases), Primary Design Phases and flowcharting, Role of Allowance, Process Capability and Tolerance in Detailed Design and Assembly.

Characteristics of successful product development, who designs and develops products? Challenges of product development.

Unit II

Product Design Practice and Industry: Introduction, product Strategies, Time to Market, Analysis of the Product, The Three S's, standardization, Renard Series (Preferred Numbers), Simplification, The Designer and His Role, the Designer: Myth and Reality, The Industrial Design Organization, Basic Design Considerations, Problems faced by Industrial Designer, Procedure adopted by Industrial Designers, Types of Models designed by Industrial designers, What the Designer Contributes, Role of Aesthetics in Product Design, Functional Design Practice, Product development organizations.

Unit III

Industrial Design: What is industrial design? Assessing the need for industrial design, Impact of industrial design, industrial design process, Management of industrial design process.

Strength Consideration in Product Design: Principal Stress Trajectories Force – Flow Lines, Balanced Design, Criteria and Objectives of Design, Material Toughness: Resilience, Designing for Uniform Strength, Tension vis-à-vis Compression.

Design for Production – Metal Parts: Producibility Requirements in the Design of Machine Components, Forging Design, Pressed Components Design, Casting Design,

Design for Machining Ease, The Role of Process Engineer, Ease of Location and Clamping, Some Additional Aspects of Production Design, Die Casting and Special Castings, Design for Powder Metallurgical Parts, Expanded Metals and Wire Forms.

Unit IV

Optimization in Design: Introduction, Siddal's Classification of Design Approaches, Optimization by Differential Calculus, Lagrange Multipliers, Geometric Programming, Johnson's Method of Optimum Design.

Prototyping: What is prototyping? Types of prototypes, what are prototypes used for, Principles of prototyping, Prototype technologies.

Unit V

Economic Factors Influencing Design: Product Value, Design for Safety, Reliability and Environmental Considerations, Manufacturing Operations in relation to Design, Economic Analysis, Profit and Competitiveness, Breakeven Analysis, Economics of a New Product Design (Samuel Eilon Model).

Value Engineering and Product Design: Introduction, Historical Perspective, What is Value? Nature and Measurement of Value, Maximum Value, Normal Degree of Value, Importance of Value, The Value Analysis Job Plan, Creativity, creative techniques.

Modern Approaches to Product Design: Concurrent Design, Quality Function Deployment (QFD)

Text books

1. A.C. Chitale and R.C. Gupta -Product Design and Manufacturing, PHI, 4th Edition, 2008.
2. Karl T. Ulrich & Steven D., Epinger -Product Design and Development –Tata Mc Graw Hill, 3rd Edition, 2003.

References

1. Tim Jones, Butterworth Heinmann-New Product Development, Oxford, UIC1997.
2. Roland Engene Kinetovicz-New Product Development: Design & Analysis, John Wiley and Sons Inc., N.Y.1990.
3. Geofferry Boothroyod, Peter Dew Hurst and Winston Knight - Product Design for Manufacture and Assembly -3rdEdition, Taylor & Francis Group,2011.

Course outcomes (COs):

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

1. Appreciate the incremental and radical approaches to product design and the steps Involved. (PO-1,2,3)
2. Understand the organization's product strategy and designer's role. (PO- 1,2)
3. Develop an understanding of product design problems and challenges in the strength, function, manufacturability. (PO- 1,2,3)
4. Apply the optimization techniques in product design. (PO- 1,2,3)
5. Analyze the economic consideration, value engineering and modern approaches in product design. (PO- 1,2,3)

INNOVATION AND DESIGN THINKING

Course Code: MIE 133 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator(s): Deepak Kumar

Course Content

Unit I

The Entrepreneurial Economy; the Practice of Innovation; Purposeful Innovation; Seven Sources for Innovative Opportunity.

Unit II

The Unexpected; Incongruities; Process Need; Industry and market Structures; Demographics. Changes in Perception; New Knowledge; the Bright Idea; Principles of Innovation.

Unit III

The Practice of Entrepreneurship; Entrepreneurial Management; the Entrepreneurial Business; Entrepreneurship in the Service Institution; the New Venture.

Unit IV

Entrepreneurial Strategies; Market And Industry Leadership; Surprise And Least Resistance; Ecological Niches; Changing Values And Characteristics; The Entrepreneurial Society.

Unit V

Design Thinking: Process Awareness Key; Problem Statement; Discovering User Needs; Building Empathy With Users; Finding the Right Focus; Generating Ideas; Structuring and Selecting Ideas; Creating a Good Prototype; Testing Efficiently.

Text Books

Design Thinking: Process Awareness Key; Problem Statement; Discovering User Needs; Building Empathy With Users; Finding the Right Focus; Generating Ideas; Structuring and Selecting Ideas; Creating a Good Prototype; Testing Efficiently.

Reference Books

1. Essentials of Entrepreneurship and Small Business Management – Norman Scarborough & Jeffrey Cornwall (Pearson, 2016)
2. Entrepreneurship: The Art, Science, and Process for Success – Charles Bamford & Garry Bruton (McGraw-Hill, 2015)

Course Outcomes (COs):

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

1. Understand the fundamentals of entrepreneurship. (PO1)
2. Design and start a basic business plan. (PO1)
3. Manage a new small business. (PO1)
4. Manage the finances of a new small business. (PO5)
5. Understand the fundamentals of design thinking. (PO1)

HUMAN AND ORGANIZATIONAL FACTORS

Course Code: MIE 134 **Credit: 4: 0: 0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. M Shilpa / Deepak Kumar

Course Content

Unit 1

Introduction: Introduction to Human factors, History of Human factors, Human machine systems, displaying information, coding of information, information processing.

Introduction to HRM: Evolution of HRM, Objectives, Functions and Policies.

Man Power Planning: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting. Human Capital: Introduction, Economic Development, Cost of Human Capital

Unit II

Training and Development: Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods, Training as a tool for continuous growth of Individual and Organizers.

Induction & communication: Induction procedure, transfers, promotion exit interview, (Written test, Group Discussion, Interviews). Communication function, communication process, effective communication.

Unit III

Recruitment and Selection: Sources of man power, advertisement, short listing of candidates for Selection procedure – Written Test, Group Discussion, Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations.

Performance Appraisal: Components (all round performance appraisal) Methods, Advantages and limitations of different methods, Personal counseling based on Annual confidential reports, competency mapping, CSR

Unit IV

The Organization: Mechanistic and Organic structures, Minitberg's basic elements of organization, Organizational Designs and Employee behaviour, organization development – quality of work life (QWL).

The Group: Definition and classification of groups, factors affecting group formation, stages of group development, Norms, group processes, group tasks, group decision making.

Unit V

Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social Making, learning theory.

Conflict Management: Definition of conflict, functional and dysfunctional conflict, stages of conflict process.

Perception: Definition, Factors influencing perception, attribution theory, selective perception, projection.

Text Books

1. Dr. K Ashwathappa – Human Resource Management, Tata McGraw Hill, 5th Edition, 2005.
2. Hersey and Blanchard -Management of Organization's Behavior, Prentice Hall of India, 10th Edition –2012.
3. Stephen P Robbins -Organizational Behaviour, Pearson Education Publications, ISBN– 81–7808–561-5, 9thEdn. 2012.

References

1. M S Sanders and E J McCormick -Human factors in Engineering & Design, McGraw Hill, 7th Edition.
2. CB Mamoria -Management of Human Resources, Himalaya Publication House,2003.
3. Aswathappa-Organizational Behavior, Himalaya Publishers.2001.
4. Hersey and Blanchard -Management of Organization's Behavior, Prentice Hall of India, 10th Edition –2012.

Course outcomes (COs):

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

1. Plan and organize for the manpower in the given type of organization. (PO-1)
2. Design the appropriate training and development programme to the employee after analyzing the training needs. (PO- 3)
3. Analyze and select the right recruitment / rights strategy for a given organization. (PO-1)
4. Identify the different groups and their values and different conflict process in an organization. (PO-1)
5. Manage the art of getting work in the corporate organization and learning with different platform or areas with different views. (PO- 3)

ELECTIVE-B

ADVANCED PRODUCTION PLANNING AND SCHEDULING

Course Code: MIE 141 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinators: Dr. G S Prakash / Dr. R Shobha

Course Content

Unit I

Introduction: Introduction to operations and production Planning & Control, Historical evolution, Latest Trends in Decision Making in business, Operations Management, Competitiveness, strategy and Productivity, Case study/exercise problems

Unit II

Forecasting: Introduction, Features common to all forecasts, Elements of forecast, Steps in forecasting process, Approaches to forecasting, Forecast based on judgment and opinion, forecasts based ion time-series data, Associative forecasting technique, Accuracy & control of forecast, Choosing of right forecasting technique, exercise problems

Unit III

System Design: Product redesign, Global product design concepts, Phases in product design and development, Designing for Manufacture, Quality Function Deployment, The Kano Model, Service Design for operations strategies, Defining and Measuring capacity, Determinants of Effective Capacity, Forecasting Capacity requirements, Challenges of Planning service capacity, Developing Capacity alternatives and evaluating the alternatives, Case study/Exercise problems

Unit IV

Aggregate Planning: Nature and importance of Inventories in Industry, Requirement for Effective inventory management, Quantity models, Techniques for Aggregate Planning, Use of strategies for meeting uneven demand, Master Scheduling Process, overview of Material Resource Planning (MRP), MRP inputs, processing and outputs, MRP-II, Capacity Requirement planning (CRP), Enterprise resource Planning (ERP), Distribution Requirement Planning. Production Activity Control (PAC), Exercise problems

Unit V

Just in Time (JIT) & Scheduling: Introduction, The Toyota Approach, Supporting goals and building blocks, JIT in services, JIT-II, Scheduling operations, Scheduling in Low-Volume systems, Scheduling services, Operations strategy used in scheduling, case study/exercise problems.

Text books

1. Operations Management, William J Stevenson, Tata McGraw Hill, 9th Edition, 2009**.**

Reference books

1. Operations Management for competitive advantage, Richard B Chase/F Robert Jacobs/ Nicholas J Aquilano, McGraw-Hill International edition, Eleventh edition, 2006.

Course Outcome (COs):

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

1. Appreciate the role of PPC in enabling the enterprise to respond to the dynamic business environment. (PO-1, 3)
2. Acquire sufficient theoretical knowledge and analytical skills to forecast demand for production / service operations. (PO-3)
3. Asses and formulate decision making strategies to address operating issues, capacity requirements and developing capacity alternatives. (PO-2, 3)
4. Develop analytical skills in the area of sales and operating planning, ERP, MRP, CRP and PAC. (PO-3)
5. Implementing JIT concepts to minimize the inventory and to produce with minimum time and cost using scheduling techniques. (PO-4, 5)

ENTERPRISE RESOURCE PLANNING

Course Code: MIE 142 **Credit: 4:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Deepak Kumar / Hamritha S

Course Content

Unit I

Introduction: Enterprise – overview, business processes, basic ERP concepts, justifying ERP investment, Risks and benefits, related technologies

Unit II

ERP marketplace and functional modules: ERP marketplace and related dynamics, business modules of ERP packages, criteria for selection of ERP packages

Unit III

ERP implementation: Implementation basics and life cycle, transition strategies, deployment models, implementation process, project teams, success and failure factors of ERP implementation, ERP operation and maintenance, maximizing ERP system.

Unit IV

ERP – Present and Future: ERP and E-business, ERP internet and WWW, ERP II, future directions and trends in ERP

Unit V

ERP Security: Types of ERP security issues, System access security, data security and technology, migration of data

Textbooks

1. Enterprise Resource Planning – Alexis Leon (Tata McGraw Hill,2008)
2. Rajesh Ray, Enterprise Resource Planning – Text and Cases, Tata McGraw Hill, New Delhi, 2011,

References

1. "Integrated Business Process with ERP Systems" – Simha R Magal and JeffreyWord (John Wiley & Sons,2010)

Course outcomes (COs):

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

1. Justify investment in ERP by analyzing its risks and benefits (PO- 3)
2. Select the necessary business module of ERP software package depending on the requirement (PO- 3)
3. Implement ERP in organizations and analyze the success and failure factors (PO- 4)
4. Review the future requirements of ERP in an organization (PO- 3)
5. Analyze the security issues associated with ERP and take necessary measures (PO- 5)

PRODUCT COST ANALYSIS AND OPTIMIZATION

Course Code: MIE 143 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. M Rajesh/ Sudheer D Kulkarni

Course Content

Unit I

Introduction: New products, New product strategy, Sequential Decision Process, Market definition and entry strategy, Idea generation, introduction to the design process, forecasting sales potential

Unit II

Consumer Measurement process, Research Methods, Sampling, Attitude Scaling, Perceptual Mapping: Perceptual Positioning, Perceptual Maps and Analytical methods to Perceptual Maps Product Positioning: Preference in Product Positioning, Proactive Product Positioning, Benefit Segmentation, Managerial use of Preference Models

Unit III

Manufacturing Planning: Selection of optimum process, standardization. Break even analysis application and area of use -problems -multi - product analysis and Process planning. Value Analysis: Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost - problems.

Unit IV

Cost Accounting Cost estimation -difference -types -steps involved in cost estimation. Types of Cost: Cost Centers, Direct –indirect, material cost -direct indirect material cost Overhead cost Elements in overheads: Preparation of cost sheet, machine hour rate, apportioning methods Variance Analysis – Labour variance, Material variance and Overhead variance, Activity based costing - Introduction to target costing

Unit V

Cost Calculation Cost calculation for machined components, welding, casting, Sheet Metal and forged components illustrations - calculation of sales cost. Launching the product: Launch Planning, Track Launching, Durable and Industrial Products.

Text books

1. Glen L Urban, John R Hauser, “Design and Marketing of New Products”, Prentice Hall. New Jersey, ISBN: 40:0257-02-0001
2. T.R.Ranga and S C Sharma, “Mechanical Estimating and Costing”,- Khanna Publishers2015. ISBN: 40:0257-02-0001

Reference books

1. Yasuhiro Monden Cost management in the New Manufacturing Age -, Productivity Press-1992, ISBN: 90:0777-02-0001
2. Miles Lewrence, “Technique for Value Analysis and Engineering”, McGraw Hill, New york-1972, ISBN: 65:0257-22-0004

Course Outcomes (COs):

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

1. Thoroughly understand the new product development process (PO-3).
2. Describe the Value Analysis and new product strategy (PO-3).
3. Apply suitable manufacturing process based on material and product (PO-4).
4. Analyzing the Cost Accounting machined components for a given material (PO-5).
5. Evaluate the parameters for design considerations based on process (PO-5).

THEORY OF INVENTIVE PROBLEM SOLVING

Course Code: MIE 144 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. R Shobha

Course Content

Unit I

Introduction to Design: Fundamentals of Engineering systems, Functional interrelationship, Physical interrelationship, Systematic Design approach, problem solving as information conversion, Algorithmic design procedure

Unit II

Design Process: Steps of Conceptual Design, Establishing function structures, Methods with intuitive Bias, Method 635, Delphi, Theory of Inventive Problem Solving (TRIZ), Application of TRIZ through Case studies of various mechanical system design, Estimating Technical Feasibility, Concept Selection Process, Pugh Concept Selection Charts, Measurement Theory, Numerical Concept Scoring, A Critique of Design Evaluation Scheme

Unit III

Axiomatic Design: Entropy and it's relation to Design, Axiomatic Design, One-FR Design, Multi-FR Design, Design of Systems, Product Design, Axiomatic Quality of a Design

Embodiment Design:Steps of Embodiment Design, Principles of Force Transmission, Principles of the Division of Tasks, Principles of Stability and Planned Instability, Designing to allow for expansion, creep and relaxation, Design for Ease of Assembly

Unit IV

Physical Prototyping and Robust Design: Prototyping Essentials, Types of Prototypes, Uses of Prototypes, Rapid Prototyping Techniques, Scale, Dimensions Analysis, and Similitude Basics Method: Physical Prototyping Design and Planning, Quality Design Theory, Taguchi's Methods, Probabilistic Design

Unit V

Advances in Engineering Design: Sustainable Design, Why DFE? Environmental Objectives, Basic DFE Methods: Design Guideline, Life cycle Assessment, Techniques to Reduce Environment Impact, Intelligent System Design

Text books

1. PRODUCT DESIGN- techniques in reverse enginerring and new product development, Otto and Wood, Pearson Education 2001

Reference books

1. AXIOMATIC DESIGN: Advances and Applications, Nam P Suh, MIT-Pappalardo Series in Mechanical Engineering
2. ENGINEERING DESIGN, G. Pahl and W. Beitz, The Design Council, London

Course Outcomes (COs):

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

1. Understand the complexities in engineering system approach in problem solving (PO-3)
2. Apply various tools and techniques to obtain comprehensive solution in engineering design concept. (PO-3)
3. Develop models to obtain engineering solution for the conceptual design developed (PO-4)
4. Create prototype modelling and evaluate the performance and feasibility of the design prototype (PO-3)
5. Analyze the advances in engineering design to take up more complex issues with respect to engineering design. (PO-4)

ELECTIVE-C

WORK SYSTEM DESIGN AND ERGONOMICS

Course Code: MIE 151 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator(s): Deepak Kumar

Course Content

Unit I

Introduction: Nature of work (Pyramidal Structure of work, Importance of time), **Work System**: Physical work system, Professional Practice, Types of Occupation, Productivity: Labor, Multifactor, Productive work Content,

Manual work and Worker Machine Systems: Types of Manual work, Cycle time analysis of manual work, Worker-Machine Systems: Types of worker-machine systems, Cycle time worker machine systems, Automated Systems, determination of worker and machine requirements (Set up not included and included), Machine cluster

Unit II

Method & Motion Study: Outline Process Chart, Flow Process Chart, Two Handed Process Chart, Multiple Activity Chart, String Diagram, Travel Chart, Principles of Motion Economy, Motion Study: Therblig, Simo chart

Unit III

Work Measurement : Types, Average worker and standard performance, allowances, Accuracy, precision and speed ratio, Direct Time study : Procedure, Determination of standard time, Determination of work cycles, Performance rating, Time study equipment, Predetermined motion time systems : procedure, Methods time measurement : MTM1, MTM2, MTM3, MOST, Work sampling : confidence interval in work sampling, Number of Observation, Determining Average task and standard times, Application of work sampling

Unit IV

Ergonomics: Introduction, Man Machine system, Physical ergonomics: Human Physiology, Muscular effort and work Physiology, Anthropometry: variables, Principles and Application. Cognitive Ergonomics: Human Sensory System, Perception, Attention resources, Memory

Unit V

Cognitive Ergonomics contd.: Response Selection and execution, Common cognitive tasks, Design Guidelines for cognitive work

Physical Work Environment: Visual Environment and Lighting, Auditory Environment and Noise, Climate Control in work Environment

Text books

1. M.P. Groover-Work Systems: The Methods, Measurement & Management of Work, ISBN: 978-93-325-8124-1, Pearson, 1st Edition, 2013.
2. Geroge Kanawaty - ILO -Introduction to work study, ISBN 13:9788120406025 Publisher: India Book House Pvt. Ltd, 4th Revised Edition, 2008.

References

1. Ralph M Barnes -Motion and Time study, ISBN:13:978981426182 Publisher: John Wiley, 7th edition 2009.
2. Andris Freivalds and Benjamin Niebel - Niebel's Methods, Standards, & Work Design, ISBN-13: 978-0073376318, Mc Graw Hill, 13th Edition, 2014
3. M S Sanders and E J McCormic - Human Factors in Engineering Design, ISBN: 13:9780070549012, Mc Graw Hill, 7th Edition.

Course Outcomes (COs):

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

1. Identify various types of work and provide various measures of analyzing work (PO-1,3)
2. Identify and Develop various method study techniques for solving real time problems (PO-1,3,4)
3. Develop work measurement techniques for solving real time problems (PO-1,3,4)
4. Develop, Design Analyze Man machine system using principles of anthropometry (PO-1,3,4)
5. Develop, Design various Man Machine system based on consideration of cognitive, lighting and noise aspects (PO-1,3,4)

PROJECT MANAGEMENT FOR BUSINESS, ENGINEERING AND TECHNOLOGY

Course Code: MIE 152 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinators: M R Shivakumar / Sudheer D Kulkarni

Course Content

Unit I

Philosophy and concepts: Functions and views of management, Project view Point and traditional management, Evaluation of project management, Where is project management appropriate, Management by project: A common approach, different forms of project management, Project environments, Project management by industrial settings, Project management in the industrial setting, Project management in the service sector, Project and program management in government and the public sector.
Systems thinking, definition of system, systems concepts and principles, Human organizations, Systems approach, Systems engineering, Relevancy of the systems approach to project management.

Unit II

Systems development cycle: Systems life cycle, System development cycle, Phase A: Conception, Project feasibility, project charter, the project proposal, project contracting. Phase B: Definition.
Systems and Procedures for planning and control: Planning steps, the project master plan, Scope and statement of work, work definition, Project organization and responsibilities, Scheduling, Planning and scheduling charts, Line of balance, procurement management.

Unit III

Project time planning and Networks: Network diagrams, the critical path, Gantt and calendar schedules, Management schedule reserve, precedence diagramming method, Scheduling with resource constraints, Criticism of network methods.
Advanced project network analyses and Scheduling: CPM and time –cost tradeoff, variability of activity duration, PERT, Theory of constraints and critical chain method, Allocating resources and multiple project scheduling, Theory of constraints methods for allocating resources to multiple projects.

Unit IV

Cost estimation and Budgeting: Cost estimating, Cost escalating, Cost estimating and the systems development cycle, Life cycle costs, Cost estimating process, Elements of budgets and estimates, Project cost accounting systems, Budgeting using control (cost) accounts, Cost summaries, Cost schedules and forecasts.

Project quality management: The concepts of quality, the processes of project quality management, Techniques for quality assurance during system development, Processes and techniques for quality control.

Managing risks in projects: Risk concepts, Risk identification, Risk assessment, risk response planning, risk tracking and response, Project management is risk management.

Unit V

Project Execution and Control: Phase C: Execution, Design stage, Production and /Build stage, The control process, Project monitoring, Internal and external project control, Traditional cost control, Cost- accounting systems for project control, Work package and control accounts, Project control emphasis, Performance analysis, Forecasting "To complete" and "At completion", Monitoring performance indexes and variances, Controlling changes, Contract administration, Control problems.

Project evaluation, Communication, implementation and closeout: project evaluation, Communication plan, Project review meetings, Reporting, Project management information systems, Web-enabled project management, PMIS in the project life cycle, Informal communication, Implementation stage, project terminating and closeout, Closing contract, Project summary evaluation, After project-Phase-D: operation.

Text books

1. John M Nicholas and Herman Steyn- Project management for Business, Engineering and Technology, Elsevier India Private Ltd. -2011.
2. James P Lewis – Project planning scheduling and control, Tata McGraw Hill-2001.

References

1. Harold Kerzner -Project management - A Systems approach to planning, scheduling and controlling, CBS Publishers and distributors, 2004.
2. David I Clelnad -Project Management –Strategic design and Implementation, McGraw Hill, 1999.

Course Outcomes (COs):

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

1. Understand the philosophy and concepts of systems engineering. (PO-1, 5)
2. Analyze the system development and procedure for planning and control. (PO-:2, 5)
3. Estimate project time planning. (PO-3, 5)
4. Develop estimate and budgeting, controlling quality and managing risks of a project. (PO-3, 5)
5. Apply technique for execution, control, evaluation, communication, implementation of a project. (PO-3, 5)

MANAGEMENT INFORMATION SYSTEMS

Course Code: MIE 153 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinators: Dr. M Shilpa / Deepak Kumar

Course Content

Unit I

Introduction to Information Systems in Business: Why study Information Systems? Why Businesses Need Information Technology.

Fundamentals of Information Systems: Fundamentals of Information Systems concepts, Overview of Information systems.

Unit II

Solving Business Problems with Information Systems: A Systems Approach to Problem Solving, Developing Information System Solutions.

The Internet and Electronic Commerce: The Internet Business, Fundamentals of Electronic Commerce.

Unit III

Internets, Extranets and Enterprise Collaboration: Internets Extranets in Business, Enterprise Collaboration Systems.

Information Systems for business Operations: Business Information Systems, Transaction Processing Systems.

Unit IV

Information Systems for Managerial Decision Support: Management Information and Decision Support Systems, Artificial Intelligence Technology in Business.

Information Systems for Strategic Advantage: Fundaments of Strategic Advantage, Strategic Application and Issues in Information Technology.

Unit V

Managing IT: Planning and Implementing Change: Planning for Business Change with IT, Implementing Business Change with IT

Managing IT: Security and Ethical Challenges: Security and Control Issues in Information Systems, Ethical and Societal Challenges of Information Technology.

Text Book:

1. James A O'Brien, G.M. Marakas and Ramesh Behl. Management Information Systems, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 10th edition, 2010, ISBN: 0073376817
2. S. Sadagopan, Management Information Systems, PHI, second edition, 2014

Reference:

1. Laudon and Laudon, Essentials of Management Information Systems, Prentice Hall, 2009.

Course Outcomes (COs):

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

1. Identify the role of Information Systems (IS) applications in business. (PO: 1,2)
2. Analyze business problems and solve them using IS (PO: 1,2)
3. Analyze the opportunities for collaboration using internet (PO: 1,3)
4. Analyze the strategic advantage of IS (PO: 1,3)
5. Manage the security and ethical challenges of IS (PO: 3,5)

PRODUCT LIFE-CYCLE MANAGEMENT

Course Code: MIE 154 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinators: Dr. R Shobha / Dr. M. R. Shivakumar

Course Content

Unit I

Introduction: Product; Product Life-cyle Management; Background; Corporate Challenges. Product Data; Product Information; PLM; PLM Concepts; Items; PLM Systems; System Architecture; Information Models; Product Structures.

PLM Systems: Functionality of the Systems; Use of PLM Systems in Different Organisation Verticals; Product Development and Engineering; Production; After-Sales; Sales and Marketing; Sub-Contracting; Sourcing and Procurement.

Unit II

Product Structures: Examples of Product Structures.

Integration of PLM System: Different Ways to Integrate PLM Systems; Transfer File; Database Integration; System Roles; Enterprise Resource Planning; Computer Aided Design; Configurators; Enterprise Application Integration

Unit III

Deployment of PLM System: Different Stages of Deployment; Present Processes; Objective Processes; Choosing a System; Realisation Stage of the Project; Accomplishing Change in the Organisation.

Business Benefits of PLM: Factors Leading to PLM; Benefits of PLM; Measuring Business Benefits in Daily Operations; Material Costs; Improving the Productivity of Labour; Costs of Quality; PLM and Data-Warehousing; Analysing the Cost of Acquisition; PLM Software Licences; Database Licences; Hardware Acquisitions; Maintenance of Equipment.

Unit IV

PLM in Manufacturing: Challenges of PLM in Engineering and Manufacturing Industry; Special Challenges of PLM in High-Tech Industry; Frame of Reference for PLM; Developing PLM in Project Workshop; Advantages and Development Potential of PLM; Breakthroughs on Sub-Projects; Controlled Entry of Documentation; Business Processes; Guidelines for the Future

Unit V

PLM in Services: Introduction; Service; PLM in Service Business.

Product Information Management: Computer Integrated Manufacturing; Concurrent Engineering; PLM as Enabler of Cooperation; Contents of Collaboration; Successful Cooperation; Tools of Collaboration; Collaborative Product Commerce; Collaborative Product Definition Management.

Text books

1. Product Lifecycle Management – Antti Saaksvuori & Anselmi Immonen (Springer, 2005)

References

1. Product Lifecycle Management – Michael Grieves (McGraw-Hill, 2005)
2. Product Lifecycle Management – John Stark (Springer, 2011)

Course Outcomes (COs):

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

1. Understand the fundamentals of PLM. (PO-1)
2. Integrate a PLM system in an industry. (PO-1)
3. Deploy a PLM system in an industry. (PO-1)
4. Carry out PLM in a manufacturing industry. (PO-5)
5. Carry out PLM in a services industry. (PO-5)

SEMINAR - I

Course Code: MIE16 **Credit: 0:2:0**
Prerequisites: Nil
Course Coordinator: Deepak Kumar

Course Content

Seminar will be evaluated based on:

- Literature Review of best practices in chosen area
- At least one case study review that demonstrates student ability to related theory to application
- Project/ Paper Write-up
- Presentation

Course Outcomes (COs):

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

1. Identify emerging technological areas/tools in engineering. (PO-3)
2. Collect data from reputed peer revived international journals and interpret them. (PO-4)
3. Prepare an effective Power Point presentation. (PO-1, 2)
4. Construct a feasible technical report and document (PO-2)

PROBABILITY AND STATISTICS MODELING LAB

Course Code: MIEL 17 **Credit: 0:0:1**
Prerequisites: Nil **Contact Hours: 14P**
Course Co ordinator's: Dr. M Shilpa / Hamritha S

Laboratory exercises

List of experiments

1. Determination of Basic Statistics
2. Graphical Interpretation of Data Using Histogram
3. Scatter Plot and Correlation Analysis
4. Hypothesis Testing of Single Sample with Known variance
5. Hypothesis Testing of Single Sample with unknown variance
6. Hypothesis Testing of Two Samples with Known variance
7. Hypothesis Testing of Two Sample with unknown variance
8. Testing the goodness of fit for Poisson Distribution
9. Testing the goodness of fit for Normal Distribution
10. Development of Markov Chain and analyzing Markova chain for a gambler ruin problem
11. Conduction of Simple Linear Regression Analysis
12. Conduction of Multiple Linear Regression Analysis
13. Determination of Principal components, Factor analysis: Case Study
14. Conducting Discriminate analysis: Case Study

Suggested Software Packages: SYSTAT Version 11/12, MS Excel, Statistical, Minitab

Text Books

1. Sheldon M Ross: Introduction to Probability and Statistics for Engineers and Scientist, 5th Edition, Elsevier, 2014
2. Walpole-le, R.E., Myers, R.H., Myers, S.L., Ye, K.Y. Probability and Statistics for Engineers and Scientists, Macmillan, Pearson, 9th Edition, 2016.
3. Douglas C. Montgomery, George C. Runger: Applied Statistics & Probability, 6th Edition, Wiley, 2013

Reference Books

1. Sheldon M Ross: Introduction to Probability models 10th Edition, Academic Press, 2009
2. Richard I. Levin, David S. Rubin, Statistics for Management, 7th Edition, 2008
3. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, 2008, Cengage Learning

Course Outcomes (COs):

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

1. Develop Various Probability Models from real time data. (PO-1, 3)
2. Analyze various real time problems through probability & statistical techniques (PO-1, 3)
3. Develop and Evaluate Various Univariate and Multivariate Models for various real life scenarios. (PO-1, 3)

WORK SYSTEM DESIGN AND ERGONOMICS LAB

Course Code: MIEL18 **Credit: 0:0:1**
Prerequisites: Nil **Contact Hours:14P**
Course Coordinator (s): Deepak Kumar

List of Experiments

1. Application of various Recording techniques.
2. Determination of standard time for various operations.
3. Productivity improvement techniques.
4. Rating practices.
5. Measurement of body parameters (heart beat rate, calorie consumption) using walking simulator.
6. Measurement of body parameters (heart beat rate, calorie consumption, revolutions per minute) using Ergometer.
7. Conduction of work sampling in office environment to determine office utilization.
8. Effect of noise, light and heat of human efficiency in work environment.
9. Measurement of body parameters using DASH BOARD-4000.

Text books

1. M.P. Groover-Work Systems : The Methods, Measurement & Management of Work, ISBN : 978-93-325-8124-1, Pearson, 1st Edition, 2013.
2. Geroge Kanawaty - ILO -Introduction to work study, ISBN 13:9788120406025 Publisher: India Book House Pvt. Ltd, 4th Revised Edition, 2008.

References

1. Ralph M Barnes -Motion and Time study, ISBN:13:978981426182 Publisher: John Wiley, 7th edition 2009.
2. Andris Freivalds and Benjamin Niebel - Niebel's Methods, Standards, & Work Design, ISBN-13: 978-0073376318, Mc Graw Hill, 13th Edition, 2014
3. M S Sanders and E J McCormic - Human Factors in Engineering Design, ISBN: 13:9780070549012, Mc Graw Hill, 7th Edition.

Course Outcomes (COs):

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

1. Identify areas where work study tools and techniques can be applied. (PO-3)
2. Apply the tools and techniques to various simulated scenarios and real life problems in industry and society. (PO-1,3)
3. Create novel designs of work place and other areas where improvement can be applied with perspective of various constraints faced in real life situation at society and industry level. (PO-1,3)

II SEMESTER

SYSTEMS SIMULATION AND MODELING

Course Code: MIE 21 **Credit: 3:1:0**
Prerequisites: Nil **Contact Hours: 42L+14T**
Course Coordinator: Dr. G S Prakash / Dr. M Shilpa

Course Content

Unit I

Introduction - Simulation components, State of a system, Simulation procedure
Simulation Examples - Simulation of queuing models, inventory models, Reliability models and lead time demand models.

Unit II

Random numbers – Generation and tests for random numbers
Generating Random variates - Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, direct transformation for Normal and lognormal distribution.

Unit III

Input Modeling – Multivariate and Time-series input models
Output Analysis for a Single System - Terminating system – confidence interval estimation for fixed number of replications, specified precision and quantiles. Non-terminating system – initialization bias, replication method

Unit IV

Comparing Two System Configurations - Independent sampling with equal and unequal variances, correlated sampling or common random numbers, confidence intervals with specified precision
Comparison of several system Designs- Bonferroni Approach to multiple Comparisons, Bonferroni Approach to selecting the best

Unit V

Simulation of Manufacturing Systems, material handling systems – models of manufacturing systems, models of material handling, goals and performance measures, issues in simulation of manufacturing and material handling systems

Text books

1. Banks, J., J. S. Carson, and B. L. Nelson. 2005. Discrete event system simulation. 4th edition. Pearson Education India.

Reference Books

1. Averill M. Law, Michael G. McComas, SIMULATION OF MANUFACTURING SYSTEMS, Proceedings of the 1997 Winter Simulation Conference ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson, 1997
2. Law, A. M. 1997. How to select simulation software. Tucson, Arizona: Averill M. Law & Associates.
3. Sheldon Ross, Simulation, 5th Edition, ISBN: 9780124158252, 2012, Academic Press

Course Outcomes (COs):

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

1. Apply the concepts of simulation modelling to real life situations and generate & test the random numbers required for simulation. (PO-3)
2. Apply simulation to solve simple real life problems. (PO-1, 3)
3. Generate random variates required for simulation
4. Conduct output analysis for termination and steady state simulations and evaluate two system designs. (PO-2, 5)
5. Reduce the variation in simulation data and apply simulation for manufacturing and material handling systems (PO-3,5)

QUALITY ENGINEERING

Course Code: MIE 22 **Credit: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Dr. G S Prakash / Dr. M. Rajesh

Course Content

Unit I

Introduction and Process Control For Variables: Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart

Process Capability – process capability studies. Six sigma concepts.
Control chart for variables – X chart and R chart.

Unit II

Process Control for Attributes: Control chart for attributes –control chart for non-conforming– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

Unit III

Acceptance Sampling: Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

Unit IV

System Reliability: Definition, Series, parallel and mixed configuration, Block diagram concept, r-out-of-n structure solving problems using mathematical models. Numerical problems

FMEA: Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, numerical problems, Introduction to Failure Mode and Effect Analysis.

Unit V

Quality in Health Care: Reasons for the Rising Health Care Cost, Steps for improving quality in healthcare, Quality Tools for Use in Health Care. Software Quality: Software Quality Factors and their sub factors, Software Quality Cost.

Quality Control in the **Textile Industry:** Textile Quality Control Department Functions, Quality Control in Finishing and in the Clothing Industry. Quality Control in the Food Industry: Factors Affecting Food Quality, HACCP Concept, Fruits and Vegetables Quality.

Text books

1. Douglas.C. Montgomery, " Introduction to Statistical quality control", 4th edition, John Wiley 2001.
2. Dhillon, B.S, Applied Reliability and Quality- Fundamentals, Methods and Procedures Series: Springer Series in Reliability Engineering, 2007
3. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 1991.

Reference Books

1. Hoang Pham, Recent Advances In Reliability And Quality In Design, Springer Series In Reliability Engineering, 2008
2. John.S. Oakland. "Statistical process control", 5th edition, Elsevier, 2005
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
5. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

Course Outcomes (COs):

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

1. Appreciate the role and importance of statistical quality control and reliability in modern industry. (PO:1)
2. Analyze the effects of variation on processes and utilize SPC tools for process control and improvement. (PO:3)
3. Bridge the quality and managerial functions in reference to Quality and Reliability Engineering. (PO:1)
4. Understand the concept of reliability analysis methods and quality analysis methods. (PO:4)
5. Understand the application of Quality Engineering in various streams. (PO:5)

ELECTIVE – D

QUANTITATIVE TECHNIQUES IN DECISION MAKING

Course Code: MIE 231 **Credit: 4:0:0**
Prerequisites: None **Contact hours: 56**
Course coordinators: Dr. G S Prakash / Dr. M Shilpa

Course Content

Unit I

Introduction to Decision Making and Quantitative Techniques: Complexity of Real-life problems, Models, Types of models for decision support, Model building process, Solution procedures, Advantages and limitations, Role of Human Judgment to make decisions.

Linear Programming: Introduction, Formulation and Graphical Solution, Simplex Method, Big-M method

Unit II

Sensitivity Analysis – Algebraic method in Linear Programs

Specially structured linear program: Transportation problems and assignment problems

Unit III

Integer programming – Introduction, Cutting plane method (Gomory cut)

Goal programming: Introduction, Formulation of goal programming problems

Unit IV

Network models: PERT and CPM, crashing (Simple Problems), Maximum Flow Problems, Shortest Route Problems, Minimal spanning tree algorithm

Waiting Line models: Introduction, general characteristics, Kendall-Lee notation, performance measures, Single-server model, multiple server model – M/M/K: ∞/FCFS

Unit V

Optimization Heuristics: (No analytical treatment)

Genetic Algorithm – Introduction, characteristics, mapping GA to natural evolution, methodology, advantages, applications

Particle Swarm Optimization – Introduction, mapping to social behavior of some of the animals, methodology

Simulated Annealing – Introduction, mapping to physical annealing process, methodology
Ant Colony Optimization – Introduction, mapping to ant's foraging behavior, methodology
Analytical Hierarchical Processing – Introduction to multi-criteria decision making, methodology

Text Book

1. Taha, Hamdy A. Introduction to Operations Research, PHI Pvt Ltd., New Delhi 2003.
2. Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga, Meta-heuristic and Evolutionary Algorithms for Engineering Optimization, John Wiley and Sons, 2017

Reference books

1. M P Gupta and R B Khanna, Quantitative Techniques for Decision Making, PHI, 2011.
2. Anderson, Sweeney and Williams, quantitative Methods for business, Lengage Learning, 2006.
3. Ravindran, Philips and Solberg, Operations research Principles and Practice, John Wiley and Sons, 1987.
4. Kaushik Kumar, Divya Zindani, J. Paulo Davim Meta Heuristic - Optimizing Engineering Problems through Heuristic Techniques, CRC Press, 2019

Course Outcomes (COs):

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

1. Use human judgment to make informed decisions and formulate and solve linear programming problems in real life situations (PO-3)
2. Arrive at optimum solutions for transportation problems and conduct sensitivity analysis to aid in decision making (PO-3)
3. Obtain solutions to integer programming problems and formulate the multi objective problems as goal programming problems. (PO-3)
4. Arrive at optimum solutions for network problems and analyze queuing systems. (PO-5)
5. Identify and apply the right heuristic for solving optimization problems (PO-3,5)

MANAGERIAL ECONOMICS

Course Code: MIE 232 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator: Dr. R Shobha

Course Content

Unit I

Introduction: Nature, Scope and Methods, The theory of the firms, Markets. Demand Analysis: Demand theory, Individual demand, Market demand, Demand and Income, Business demand, Elasticity, Elasticity of demand, Own-price Elasticity, Estimating Elasticities, Supply, Elasticity of supply.

Unit II

Demand Estimation: Methods, Model specification, Data collection, Simple regression, Goodness of fit, Power regression, Forecasting, Multiple regression, Implications of empirical studies, Problems.

Unit III

Production Theory: Introduction, Basic terms and definitions, Factors of production- The short run and the long run, Problems.

Unit IV

Cost Theory: Introduction, Short run cost behavior, Long run cost behaviour, the learning curve, Cost-volume-profit analysis, Cost estimation- Short run and long run cost estimation.

Unit V

Market Structure and Pricing: Introduction, Perfect competition, Monopoly, Monopolistic competition, Investment analysis, Cash flow analysis, Risk analysis, Cost of capital, Evaluation criteria, Problems.

Text books

1. A Problem solving approach- Nick Wilkinson -Managerial Economics, Cambridge University Press, 2015.
2. Ivan Png -Managerial Economics, Blackwell Publishing, Second Edition,2010.

Reference Books

1. Samuel Paul and G.S.Gupta -Managerial Economics.
2. Theory and Practice by Thomas and J. Webster -Managerial Economics,2003.
3. Michel R Bye -Managerial Economics and Business Strategy, McGraw Hill International, 6th Ed.

Course Outcomes (COs):

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

1. Understand the roles of managers and the nature of internal and external decisions to be made by managers. (PO-1,2)
2. Analyze the demand and supply conditions and assess the position of a company.(PO-1,4,5)
3. Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets. (PO-1,4)
4. Analyze real-world business problems with a systematic cost estimation. (PO-1,3)
5. Make optimal business decisions by integrating the concepts of economics, mathematics and statistics and assess market risks. (PO-1,3)

CYBER SECURITY

Course Code: MIE 233 **Credit: 4:0:0**
Prerequisites: Nil **Course Hours: 56**
Course coordinator: Dr. M Rajesh / Hamritha S

Course Content

Unit I

Security Concepts and Mechanisms -Networking Concepts Overview -Information Security Concepts -Security Threats and vulnerabilities.

Unit II

Cryptography -Security Management -Security Management Practices

Unit III

Network Security -Access Control and Intrusion Detection -Server Management and Firewalls - Security for VPN and Next Generation Networks

Unit IV

System and Application Security - Security Architectures and Models - System Security - OS Security

Unit V

Security Laws and Standards - Cyber Laws

Text books

1. Cyber Security Essentials – James Graham (Editor), Ryan Olson (Editor), Rick Howard (Editor)Auerbach Publications; 1 edition, 2010

Reference Books

1. Cyber Security And Global Information Assurance: Threat Analysis And Response Solutions (Hardcover) by Kenneth J. Knapp (Editor) Publisher: Information Science Publishing, 2010
2. Cyber Laws, Shikha Singh, Global India Publications Pvt Ltd., 2011

Course Outcomes (COs):

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

1. Apply to knowledge of basic security and networking concepts to real time problems (PO-1,3)
2. Apply knowledge of Security Management principles to Real Life Problems (PO-1,3)
3. Develop Network Security Systems and Future Systems for various Problems (PO-1,3)
4. Create Security System Architecture and Models (PO-1,3)
5. Apply Knowledge of Security Laws for Various Real time problems (PO-1,3)

PYTHON PROGRAMMING

Course Code: MIE 234 **Credit: 4:0:0**
Prerequisites: Computer Concepts and C Programming **Contact Hours: 56**
Course Coordinator: Dr. R Shobha

Course Content

Unit I

Introduction to Python, use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, Illustrative Programs, Exercises

Unit II

Define and use functions and modules, working with recursion, Basic skills for working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries, Illustrative programs, Exercises.

Unit III

An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises Exits

Unit IV

Object Oriented Programming, An introduction to classes and objects, define a class, work with object composition, work with encapsulation, and work with inheritance, override object methods, Illustrative programs, Exercises

Unit V

An introduction to relational databases, SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components, Illustrative programs, Exercises

Text books

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Mark Lutz ,"Learning Python", O Reily, 4th Edition, 2009, ISBN: 978-0-596-15806-4

3. Tim Hall and J-P Stacey ,"Python 3 for Absolute Beginners" , 2009, SBN:9781430216322

Reference Books

1. Mark Lutz ,Programming Python, O Reily, 4th Edition, 2010, ISBN 9780596158118
2. Magnus Lie Hetland , "Beginning Python: From Novice to Professional", 2nd Edition, 2009, ISBN:9781590599822

Course Outcomes (COs):

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

1. Acquire programming skills in core Python. (PO-3)
2. Implement Object Oriented Skills in Python. (PO-1,3)
3. Develop the skill of designing Graphical user Interfaces in Python. (PO-1)
4. Write database applications in Python. (PO-1,3)
5. Independently create GUI based applications. (PO-3)

ELECTIVE – E

LEAN MANUFACTURING SYSTEMS

Course Code: MIE 241 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hour: 56**
Course Coordinator: Deepak Kumar

Course Content

Unit I

Introduction to lean manufacturing systems and cell design, Steps to lean production

Unit II

Manufacturing system design, Axiomatic design principles, manned interim manufacturing and assembly cells

Unit III

Setup reduction, integrated quality control, integrated reliability

Unit IV

Refining lean production, Production and inventory control, making the vendors lean

Unit V

Ergonomics in cell design, Automation and auto nomation, Simulation, The Toyota production system today

Text Book

1. Ronald G. Askin, Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, Wiley, 2007

Reference Book

1. JT Black, Steve L. Hunter, Steve L. Hunter, Lean Manufacturing Systems and Cell Design, Society of Manufacturing Engineers, 2003

Course Outcomes (COs):

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

1. Understand the fundamentals of lean manufacturing. (PO-1, 3)
2. Design a basic lean manufacturing system. (PO-1, 2)
3. Integrate a lean system into an industry. (PO-3, 4)
4. Refine a lean manufacturing system. (PO-2, 3)
5. Design a basic automation system. (PO-3, 4)

COMPUTER-AIDED FACILITIES PLANNING

Course Code: MIE 242 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator: Dr. M Rajesh

Course Content

Unit I

Defining Requirements – Facilities planning defined, significance, objectives, planning process. Flow, Space and Activity relationships, flow patterns, flow planning, measuring flow, space requirements.

Unit II

Definition of material handling, material handling principles, design material handling systems, unit load design, material handling equipment, estimation material handing cost, safety considerations. AGVS, types of AGVS, Guidance methods, routing, traffic management, load transfer, application.

Unit III

Layout Planning Models and Design Algorithms-Introduction, basic layout types, layout procedure, algorithmic approaches.

Unit IV

Facility Design for Various Functions - Warehouse Operations, Mission of warehouse, functions, receiving and shipping operation, dock locations, order picking.

Unit V

Facility location models, preparing the facilities plan, presenting the facilities plan, implementing the facilities plan, maintaining the facilities plan.

Text books

1. Tompkins, James A; White John A; et al; Facilities Planning, Wiley, 2008

Reference Books

1. Andrew A. Signore, Terry Jacobs, Good Design Practices For Gmp Pharmaceutical Facilities, Taylor & Francis Group, 2005
2. Orin Flanigan, Underground Gas Storage Facilities: Design and Implementation, Gulf Professional Publishing, 1995

Course Outcomes (COs):

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

1. Understand the importance of facilities planning and activity relationships in an industry (PO-1, 5)
2. Aware of the different types of modern material handling equipment for their use in the industry. (PO-1, 3)
3. Use computer algorithms to design plant layouts. (PO-1, 3)
4. Independently design the facility for various functions. (PO-3, 5)
5. Evaluate and present the facilities plan of an industry. (PO-2, 5)

ADDITIVE MANUFACTURING

Course Code: MIE 243 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator: Dr. R Shobha / Dr. M R Shivakumar

Course Content

Unit I

Introduction, the Basic Principles, Additive Manufacturing Processes, Personal Printer Revolution, AM Process Work flow A Closer Look at Rep-Rap Machines Preparing Files for 3D Printing Choosing the Right Materials

Unit II

Extrusion Systems Extrusion Systems Sheet Lamination Jetting Direct-Write Bio printing Sintering Overview Powder Bed Fusion Directed Energy Deposition Photo Polymerization

Unit III

Software & Methods, Designing for Additive Manufacturing (DFAM), Software Tools vs. Requirements Pre- & PO-st-processing 3D Scanning & the Scanning Process Sculpting & Repairing Data AM File Formats STEP File Format More Detail on NURBS Model Validation Working with DICOM Files for 3D Printing Medical Imagery

Unit IV

Materials Choosing, Materials for Manufacturing, Multiple Materials, Metal AM Processes & Materials Composite Materials Biomaterials, Hierarchical Materials & Bio-ceramics Shape-Memory Materials, 4D Printing & Bio-active materials Advanced AM Materials

Unit V

Key Related Processes, Choosing the Right Manufacturing Process, Applications of AM Direct Digital Manufacturing, Distributed Manufacturing, Mass Customization, Biomedical Applications, Aerospace & Automotive Applications and Architectural Engineering. Intellectual Property, Commercialization, Trends, Business Opportunities & Future Directions

Text books

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
2. Chua C. K., Leong K. F., and Lim C. S., "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific Publishers (2003)
3. Patri K. Venuvinod, Weiyin Ma "Rapid Prototyping: Laser-Based and Other Technologies" Springer, 2004

Reference Books

1. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", CRC Press, 2000.
2. Burns. M, "Automated fabrication", Prentice-Hall, 1993.

Course Outcomes (COs):

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

1. Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies. (PO-1,3)
2. Demonstrate comprehensive knowledge of the broad range of AM processes, devices, capabilities and materials that are available. (PO-1,5)
3. Describe different RP techniques and fundamentals of Reverse Engineering. (PO-1,4)
4. Understand the various software tools, processes and techniques that enable advanced/additive manufacturing and personal fabrication (PO-1,3)
5. Understand the latest trends and business opportunities in AM, distributed manufacturing and mass customization. (PO-1,3,5)

COMPUTATIONAL METHODS FOR QUEUING NETWORKS

Course Code: MIE 244 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator's: Dr. G S Prakash / Dr. M.Shilpa

Course Content

Unit I

Introduction -Modelling Automated Manufacturing Systems - Performance Modeling Tools. Markov Chain Models - Memoryless Random Variables - Stochastic Processes in Manufacturing - Discrete Time Markov Chain Models - Continuous Time Markov Chain Models - - Absorbing States and Modeling of Deadlocks - Semi-Markov Processes in Manufacturing

Unit II

Queuing Models - Queues: Notation and Examples - The M/M/1 Queue - The M/M/m Queue - Batch Arrival Queuing Systems - Queues with General Distributions - Queues with Breakdowns

Unit III

Queuing Networks - Open Queuing Networks - Closed Queuing Networks - Product Form Queuing Networks - Queuing Networks with Blocking. Analysis of Queues - Approximate Analysis of Queuing Systems - Analysis of a Flexible Machine Centre - Per formability Analysis

Unit IV

Petri Net Models - Classical Petri Nets - Stochastic Petri Nets - Generalized Stochastic Petri Nets - Deadlock Analysis using Petri Nets - Extended Classes of Petri Nets - Integrated Petri Net - Queuing Network Models

Unit V

Applications - Automated Manufacturing Systems - Performance Measures - Computer Controlled Machines - Material handling Systems - Plant Layout- Flexible Manufacturing Systems - Computer Control Systems - Modeling of Kanban Systems

Text books

1. Viswanadham N, Narahari Y, Performance Modeling of Automated Manufacturing Systems, Prentice Hall of India Pvt Ltd, 2005

Reference Books

1. Computer systems performance evaluation and prediction, Paul J Fortier, 2006

Course Outcomes (COs):

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

1. Analyze discrete time and continuous time marker chain models in manufacturing. (PO-3)
2. Analyze different types of queues along with their breakdowns. (PO-3)
3. Conduct perform ability analysis for different types of queue networks. (PO-3)
4. Identify the type of Petri Net models and analyze the same. (PO-3)
5. Analyze the queues in manufacturing, material handling systems. (PO-3, 4)

ELECTIVE – F

MANAGEMENT ACCOUNTING AND FINANCE

Course Code: MIE 251 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator: Dr. NVR Naidu/ Dr. Shobha R

Course Content

Unit I

Basic records, Preparing financial statements Financial Accounting Conventions, trading account, profit and Loss account and Balance sheet concepts.

Unit II

Balance sheet concepts with Adjustment entries, Inventory valuation financial ratios, Sources of funds, Cash Flow statements

Unit III

Cost accounting, Cost classification, Allocation and absorption of cost, relevant costs, Allocation joint costs. Design of historical and standard costing systems, Overhead cost control Managerial Economics concept, process costing.

Unit IV

Working capital management New Trends in Managerial Accounting.

Unit V

Budgeting and Budgeting Control: Sales budget, production budget, raw materials purchasing budget, selling and administrative expense budget, cash budget, Flexible Budget, Master budget

Text Books

1. Guruprasad Murthy, Financial Accounting, Himalaya, 2009
2. Anthony A. Atkinson, Robert S. Kaplan, S. Mark Young, Ella Mae Matsumura, Management Accounting, Prentice Hall, 2007.

Reference Books

1. Hansen Don R, Mowen M Maryanne, Management Accounting, Cengage Learning, 7th Edition, 200742.

Course Outcomes (COs):

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

1. Demonstrate the concept of accounting principles for obtaining comprehensive Solutions in accounting. (PO-1, 5)
2. Apply the accounting ratios knowledge to solve industrial problems. (PO-1, 5)
3. Exhibit knowledge about the cost of product, process and their controlling factors to solve industrial problems. (PO-1, 5)
4. Apply the knowledge of working capital requirement and its management in industry (PO-1, 5)
5. Demonstrate the importance of budgeting and its methods to control finance in industry. (PO-1,5)

RAPID PROTOTYPING

Course Code: MIE252 **Credit: 4:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Sudheer D. Kulkarni

Course Content

Unit I

Introduction: Definition of Prototype, Types of prototype, Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo lithography Systems: Principle, Process parameter, process details, Data preparation, data files and machine details, Application.

Unit II

Selective Laser Sintering: Type preparation for SLS, Applications, Path generation, Applications. Principle of operation, process parameters, Data Fusion Deposition Modeling**:** Principle, Process parameter.

Unit III

Solid Ground Curing: Principle of operation, Machine details, Applications, Laminated Object Manufacturing: Principle, of operation, LOM materials, process details, application.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genisys Xs printer HP system 5, object Quadra systems, Laser Engineering Net Shaping.

Unit IV

Rapid Tooling: Indirect Rapid tooling -Silicon rubber tooling —Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3D keltool, Direct Rapid Tooling — Direct, AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, ProMetal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

Unit V

Software for RP: Stl. files, Overview of Solid view, Magics, Mimics, magic communicator, etc. Internet based software, Collaboration tools

Application of Rapid Prototyping and Technology:- Functional models, pattern for investment and Vacuum casting, medical models, Art models, Engineering analysis models.

Text Books:

1. Paul F. Jacobs: "Stereo 1ithography and other RP & M Technologies"-SME NY, 1996.
2. Flham D.T & Dinjoy S.S "Rapid Manufacturing"- Verlog London 2001.

Reference Books:

1. Terry Wohler's " Wohler's Report 2000 "- Wohler's Association 2000
2. Peter D Hilton, Paul F Jacobs, "Rapid Tooling Technologies and Industrial Applications", Marcel Dekker, 2000.

Course outcomes (COs):

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

1. Understand the basic concepts and principle of RP process. (PO-1)
2. Select and analyze the process parameters related to various machines. (PO-1)
3. Comprehend the working of various machines used in RP process. (PO-1)
4. Select the right tool for the given operation. (PO-3)
5. Apply RP software technology for manufacturing various products. (PO-3)

SOFTWARE PROJECT MANAGEMENT

Course Code: MIE 253 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinator: Dr. M Rajesh/ Dr. M R Shivakumar

Course Content

Unit I

Project evaluation and project planning: importance of software project management – activities methodologies – categorization of software projects – setting objectives – management principles – management control – project portfolio management – cost-benefit evaluation technology – risk evaluation – strategic program management – stepwise project planning.

Unit II

Project life cycle and effort estimation: software process and process models – choice of process models - mental delivery – rapid application development – agile methods – extreme programming – scrum – managing interactive processes – basics of software estimation – effort and cost estimation techniques – cosmic full function points - cocomo ii a parametric productivity model - staffing pattern.

Unit III

Activity planning and risk management: objectives of activity planning – project schedules – activities – sequencing and scheduling – network planning models – forward pass & backward pass techniques – critical path (crm) method – risk identification – assessment – monitoring – pert technique – monte carlo simulation – resource allocation – creation of critical patterns – cost schedules.

Unit IV

Project management and control: framework for management and control – collection of data project termination – visualizing progress – cost monitoring – earned value analysis- project tracking – change control- software configuration management – managing contracts – contract management.

Unit V

Staffing in software projects: managing people – organizational behavior – best methods of staff selection – motivation – the oldham-hackman job characteristic model – ethical and programmed concerns – working in teams – decision making – team structures – virtual teams – communications genres – communication plans.

Text Books

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

Reference Books

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.

Course Outcomes (COs):

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

1. Understand Project Management principles while developing software. (PO-3)
2. Obtain adequate knowledge about software process models and software effort estimation techniques. (PO-3)
3. Estimate the risks involved in various project activities. (PO-1,5)
4. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles. (PO-5)
5. Learn staff selection process and the issues related to people management (PO-4)

SYSTEMS ENGINEERING

Course Code: MIE 254 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinator: Dr. M Shilpa

Course Content

Unit I

Overview of the systems engineering domain; definitions key to systems engineering; the system life cycle, and the product development life cycle. Phase gate approach to product development enabled by application of systems engineering principles. Concept Exploration and the four types of systems requirements that must be extracted from the customer's statement of want and needs. Dual nature of validation, and its differences from verification.

Unit II

Requirement analysis, requirements development, and how these relate to planning for systems integration, verification and validation. Functional analysis, interface analysis, requirement allocation, traceability, and use of commercial tools to enable effective application of SE principles in an integrated team environment.
Development of a master compliance matrix, a test and evaluation master plan, and use of technical performance measures in defining system performance.

Unit III

Use of trade study methods for system definition. Applying these methods in concept exploration and system definition. Modeling, simulation and systems analysis enable analysis of alternatives in concept exploration.
Applying specialty-engineering disciplines by the system engineer throughout the product development life cycle, and the system life cycle. Gaining practical experience in the use of reliability, system safety and human factors engineering.

Unit IV

Engineering Design: preliminary design, detailed design, integration and test, system validation, full rate production. Explore the ideas behind concurrent engineering, design for six sigma and total quality development as they apply to the systems engineering roles, responsibilities, and the development of high quality products in any market, industry or sector. Explore the fundamentals of how an integrated product and process development system can enhance the application of systems engineering

principles and what an engineer should look for in a company's "people, methods, tools/processes, and environment (PMTE)".

Unit-V

Design and Specification Design:- usability, survival, damage tolerance, safety, reconfigure ability, stealth, self-defence, self-healing, replacement, test, production, integration, installation, preplanned improvement. Development Interface control, adjusting design for integration, configuration management, compatibility management

Textbook:

1. Benjamin S. Blanchard and Wolter J. Fabrycky, Systems Engineering and Analysis, 5th ed., Prentice Hall International Series in Industrial and Systems Engineering, (Upper Saddle River, NJ), 2006. ISBN-13: 978-0-13-221735-4

Reference Books

1. Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer Systems Engineering Principles and Practice, wiley series 2nd edition-2011
2. Dahai Liu, Systems Engineering: Design Principles and Models CRC Press-2016
3. Derek K. Hitchins, Systems Engineering: A 21st Century Systems Methodology John Wiley & son's - 2008

Course Outcomes (COs):

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

1. Define systems engineering, the system life cycle phases, and the product development life cycle phases.(PO-1,3)
2. Write 'good' requirements and explain the characteristics of: a 'good' requirement, a suitable requirement management process, and enabling tools. (PO-3)
3. Describe and apply a general methodology for trade study and analysis of alternatives. (PO-3)
4. Describe how integrated product teams and specialty engineering are used to achieve effective product development. (PO-4,5)
5. Analyze Specification Design for technical project management and systems engineering principles(PO-3,5)

SEMINAR - II

Course Code: MIE 26 **Credit: 0:2:0**
Prerequisites: Nil
Course coordinator: Deepak Kumar

Course Content

Seminar will be evaluated based on:

- Literature Review of emerging work in chosen area. Emphasis will be on modeling and other Industrial Engineering tools and techniques
- At least one case study review that demonstrates student ability to related theory to application
- Project/ Paper Write-up
- Presentation

Course Outcomes (COs):

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

1. Identify emerging technological areas/tools in engineering. (PO-3)
2. Collect data from reputed peer revived international journals and interpret them. (PO-4)
3. Prepare an effective Power Point presentation case study discussion. (PO-1, 2)
4. Construct a feasible technical report / project document. (PO-2)

QUALITY ENGINEERING LAB

Course Code: MIEL 27 **Credit: 0:0 :1**
Prerequisite: Nil **Contact Sessions :14**
Course co-ordinator(s): Dr. M. Shilpa / Dr. M. Rajesh

Course Content

Lab experiments

1. Construction of Xbar- R chart using SPC software
2. Construction of Xbar- R chart using SYSTAT software
3. Construction of Xbar- R chart using Multifunctional Vernier height gauge
4. Construction of Xbar- R chart using SQC display unit
5. Process capability analysis using Normal Probability Paper method
6. Process capability analysis using Multifunctional Vernier height gauge
7. Process capability analysis using SPC software
8. Process capability analysis using SYSTAT software
9. Process capability analysis using SQC display unit
10. Construction of attribute control chart using SYSTAT software (P- chart , nP-chart, c-chart, u-chart) at least 2 attribute control charts to be constructed
11. Conduction of single sampling plan experiment

Note: Any 10 experiments from the above list of experiments to be conducted in a semester and the same should be indicated in the lesson plan.

Text Books

1. Montgomery -Introduction to Statistical Quality Control, John Wiley and Sons -2007.
2. Grant and Leavenworth -Statistical Quality Control, McGraw-Hill. -2008
3. Juran and Gryna-Quality Planning and Analysis, 3rd edition, TMH.4thEdision-2001
4. NVR Naidu, KM Babu, and G Rajendra-Total Quality Management, New Age International Pvt.Ltd-2006

References

1. Dale H. Besterfield-Quality control, Prentice-Hall International; 1998.-HardCover- 2003
2. Kesavan R -Total Quality Management, IK International, NewDelhi-2007

Course outcomes (COs):

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

1. Construct quality control charts and assess the capability of the process. (PO-1,3,4)
2. Conduct experiments using principles of design of experiments and analyze the results (PO- 1,3,4)
3. Design the sampling plan and determine producer's and consumer's risks (PO- 3,4)
4. Conduct experiments on Six Sigma and variability studies and analyze the results (PO- 3, 4, 5)

SYSTEMS SIMULATION MODELING LAB

Course Code: MIEL 28 **Credit: 0:0:1**
Prerequisites: Nil **Course Hours: 14P**
Course coordinators: Dr. G S Prakash / Dr. M Shilpa

Laboratory Exercises

List of experiments

1. Introduction to and Understanding the Simulation Packages
2. Building simulation Models for Banking service (With Basic templates)
3. Building simulation Models for Banking service (With Common templates)
4. Building simulation Model for Mortgage application problem (With Basic templates)
5. Building simulation Model for Mortgage application problem (With Common templates)
6. Building simulation Model for food processing problem
7. Building simulation Model for post office animation
8. Building simulation models for manufacturing operations (Electronic assembly – With Basic templates)
9. Building simulation models for manufacturing operations (Electronic assembly – With Common templates)
10. Building simulation models for manufacturing operations with transport System
11. Building simulation models for manufacturing operations with layout
12. Simulation of hospital emergency room (Basic Templates)
13. Evaluation of two alternative designs of retail outlet stores (Basic Templates)
14. Identifying probability distributions for given data
15. Statistical Analysis of Simulation models (input analysis)
16. Statistical Analysis of Simulation models (output analysis)

Note: At least 13 experiments from the above list have to be conducted during the semester

Textbooks

1. Law, A. M., and W. D. Kelton, Simulation Modeling and Analysis. Tata McGraw Hill, 2007

Reference books

1. Averill M. Law, Michael G. McComas, SIMULATION OF MANUFACTURING SYSTEMS, Proceedings of the 1997 Winter Simulation Conference ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson, 1997
2. Banks, J., J. S. Carson, and B. L. Nelson. 1996. Discrete event system simulation. 2nd edition,. Upper Saddle River, New Jersey: Prentice-Hall.
3. Law, A. M. 1997. How to select simulation software. Tucson, Arizona: Averill M. Law & Associates.

Course Outcomes (COs):

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

1. Create Simulation Model for various real time scenarios (Manufacturing, Servicing Industry, Health Care, Retail Sectors) using Arena. (PO-3)
2. Analyze the simulation output and suggest improvement (PO- 3,5)
3. Evaluate alternative system designs using Arena Software (PO-3)

III SEMESTER

EVALUATION OF SUPPLY CHAIN MANAGEMENT

Course Code: MIE 31 **Credit: 3:1:0**
Prerequisites: Nil **Contact Hours: 42+14T**
Course coordinators: Deepak Kumar

Course Content

Unit I

Conceptualization of Supply Chain Competitiveness: Evolution of the Concept of Competitiveness, Definitions of Competitiveness, Competitiveness from an International Approach, Competitiveness from a National Approach, Competitiveness from an Industrial Approach, Competitiveness from a Regional Approach, Competitive Advantage, Comparative Advantage, Competitiveness and Supply Chain, Definition of Supply chain.

The Importance of Supply Chains in Global Competitiveness: Global Production, The Supply Chain and Its Relationship with Global Production, Successful Companies with an Excellent Supply Chain Management, Why Do Companies Want to Improve Their Supply Chains?

Unit II

Conceptualization and Environment of Competitiveness in the Manufacturing Industry: The Manufacturing Industry in Mexico and Its Transformation , Overview, Trade Opening, Importance of Manufacturing Industry and Numbers, Mexican Manufacturing Industry: Peculiarities, Industrial Upgrading in Mexico: An Overview, Main Export-Oriented Manufacturing Industries, The Manufacturing Industry in Ciudad Juárez and Its Evolution, The Manufacturing Industry in Ciudad Juárez: Important Data, Competitiveness in the Manufacturing Industry.

Supply Chain Evaluation in the Manufacturing Industry: The Supply Chain, Overview, Modern Supply Chains, Supply Chain in the Export-Oriented Manufacturing Industry, Supply Chain Evaluation Trends, Supply Chain Evaluation in the Export-Oriented Manufacturing Industry

Unit III

Conceptualization of Supply Chain Performance: Supply Chain Performance Definition of Performance, Goal of Performance Measurement, Performance Indicators, Performance Improvement Goals in the Supply Chain, Evolution of Supply

Chain Performance, Supply Chain Performance Attributes (Metrics), Performance and Measurement Categories, Supply Chain Performance Measurement Models, Performance Benefits.

Supply Chain Performance Factors in the Manufacturing Industry: Overview, Factors Associated with Performance in the Manufacturing Industry, Supply Chain Risk, Definition of Risk and Risk Management, Risk Assessment Methodologies, Types of Supply Chain Risk, Manufacturing Practices, Toyota Production System and Competitiveness Enterprises, Regional Aspects of the Supply Chain: Overview.

Unit IV

Supply Chain Performance Attributes and Benefits in the Manufacturing Industry: Overview of Supply Chain Performance (SCP), Concept of Supply Chain Performance, Attributes for Supply Chain Performance Measurement, Agility, Flexibility, Customer Service, Delivery Times, Quality, Inventory, Transportation, Financial Performance, Firm Performance: Overview, Financial Performance Benefits, Firms Benefits Associated to Non-financial Performance, Conclusions

Supply Chain Evaluation and Methodologies: Analysis of Performance Factors, Multivariate Analysis Methods, Introduction, Multiple Linear Regression, Path Analysis, Factor Analysis, Structural Equations (SE), Structural Equation Modeling (SEM), Partial Least Squares (PLS), Characteristics of PLS Path Modeling, Observed Variables and Latent Variables, Sample Size in PLS Path Modeling, Specifications of PLS Path Modeling, Basic Terminology, Evaluation Criteria for the Measurement Model

Unit V

Impact of Competitiveness on the Supply Chain Performance: Methodology,

Exploratory Analysis of the Data: Introduction and Generalities, Sample Description, Descriptive Analysis of Risk Factors, Descriptive Analysis of Regional Factors, Descriptive Analysis of Manufacturing Practices, Descriptive Analysis of Supply Chain Performance, Exploratory Factor Analysis Risks Factors, Regional Factors, Manufacturing Practices Supply Chain Performance, Conclusions.

Text book:

1. Evaluation of Supply Chain Performance- Avelar-Sosa, Liliana, Garcia Alcaraz, Jorge Luis, Maldonado-Macías, Aide Aracely
2. Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies – David Simchi-Levi (McGraw Hill, 2008)

References

1. Supply Chain Management: Strategy, Planning, and Operation – Sunil Chopra (Pearson, 2015)
2. Operations and Supply Chain Management - Robert Jacobs (McGraw Hill, 2013)

Course Outcomes (COs):

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

1. Understand the fundamentals of supply chain management and inventory management. (PO-1)
2. Execute Supply Chain Evaluation in the Export-Oriented Manufacturing Industry. (PO-3)
3. Understand the Conceptualization of Supply Chain Performance. (PO-3)
4. Examining Supply Chain Methodologies. (PO-3)
5. Analyzing Impact of Competitiveness on the Supply Chain Performance. (PO-3)

INTERNSHIP

Course Code: MIE 32 **Credit: 0:4:0**
Pre requisite: Nil **Course duration: 1 Month**
Course Coordinator(s): Hamritha S

Course Content

Students are Subjected to undergo industrial training in the form of Internship for one month in reputed industries.

Course objectives

- To provide opportunities for students to apply their knowledge in industrial environment
- To expose students to industrial working environment.

Assessment and Evaluation vis-à-vis Course Outcomes

Note: Students have to undergo one month internship in an industry. The student has to compulsorily submit a report and the evaluation will be done by a committee constituted by the HOD. Each student must give a presentation for about 30 minutes, comprising of:

- Company Profile
- Recording of information/observations
- Short comings noticed during the internship
- Application of industrial engineering techniques
- Conclusions

Course outcomes (COs):

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

1. Identify the products of the company and its customers and draw the appropriate plant layout of the industry (PO-1)
2. Construct the process map for some of the important products of the industry (PO-1,2)
3. Identify some of the problems present in the industry and apply industrial engineering techniques to provide suitable suggestions to overcome them (PO-2,3)

DISSERTATION PRELIMINARIES

Course Code: MIE 33 **Credit: 0:0:8**
Prerequisites: Nil
Course Coordinator(s): Dr. R Shobha / Dr.G S Prakash

Course Content

The Project preparatory work will be evaluated based on:

- Company Information
- Appreciating the different aspects of the business
- Narrowing down to the specific problem
- Its importance and relevance / significance
- Project problem definition
- Scope – In Scope, Out of Scope
- Assumptions
- Project Plan

Course Outcomes (COs):

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

1. Identify engineering problems area. (PO-1,2)
2. Define project methodology/approach. (PO-2,3)
3. Evaluate various engineering tools / techniques. (PO-4, 5)

ELECTIVE – G

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Course Code: MIE 341 **Credit: 4:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course coordinators: Dr. R.Shobha

Course Content

Unit I

Introduction to Artificial Intelligence: Historical Backdrop, What is intelligence? Turing Test, Intelligent Decisions, Intelligent agent and model of world, symbolic reasoning in AI, model of cognitive agent

Unit II

Communication and Integration: Multiple agents, interacting agents, models of other agents, modal logic of knowledge

Unit III

State Space Search: Introduction, Generate and Test, Simple search 1, Depth First Search, Breadth first search, Comparison of DFS and BFS

Unit IV

Heuristic Search: Heuristic functions, Best First Search, Hill Climbing, Local Maxima, Solution Space search, variable neighborhood descent, Beam search, peak to peak method

Unit V

Expert Systems: Introduction, representing and using domain knowledge, Expert system shells, Explanation, Knowledge acquisition

Textbooks

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education Pvt. Ltd., 2013
2. Elaine Rich, Kevin Knight, Shivashankar B Nair, “Artificial Intelligence” 3rd edition, Tata McGraw Hill Publication, New Delhi.

Reference books

1. Nils J. Nilsson, Nils Johan Nilsson, Artificial Intelligence: A New Synthesis, MK Publishers, California, 2000
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial intelligence, Prentice Hall, 2003

Course Outcomes (COs):

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

1. Identify intelligent decisions taken up by AI and understand symbolic reasoning in AI (PO-2)
2. Establish communication and integration models among the AI agents (PO-1)
3. Conduct different searches under State Space Search (PO-1)
4. Analyze different searches under heuristic functions (PO-2)
5. Identify how expert systems work and how they acquire knowledge. (PO-3)

Experimental Design & Analysis

Course Code: MIE 342 **Credit: 4:0:0**
Prerequisites: Nil **Course Hours: 56**
Course coordinator: Dr. M Shilpa

Course Content

Unit I

Experiments with a Single Factor: The Analysis of Variance, Randomized Blocks, Latin Squares, and Related Designs.

Unit II

Introduction to Factorial Designs, the 2^k Factorial Design.

Unit III

Blocking and Confounding in the 2^k Factorial, Two-Level Fractional Factorial Designs.

Unit IV

Fitting Regression Models, Response Surface Methods: Method of Steepest Ascent, Analysis of Second Order response Surface, Characterizing Response Surface.

Unit V

Random Effects Model: Single Random factor, Nested Design: Two Stage Nested Design, M Stage Nested Design (3 stages). Split Plot Design with Two Factors.

Text books

1. Douglas C. Montgomery, Design And Analysis Of Experiments, 8th Edition, 2012, Wiley

Reference books

1. Angela Dean, Daniel Voss, Design And Analysis Of Experiments, Springer, 2006
2. Douglas C. Montgomery, George C. Runger : Applied Probability & Statistics, 5th Edition, Wiley, 2010

Course Outcomes (COs):

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

1. Develop and Analyze Single Factor Model, Latin Square Designs. (PO-3)
2. Develop and Analyze Two Level Design and Apply to real time Scenarios (PO-3)
3. Develop and Design fractional factorial models and conduct analysis (PO-3)
4. Develop Reponses surface models (PO-3)
5. Analyze complex designs such as Random factors, Nested and Split Designs (PO-3)

BLOCKCHAIN TECHNOLOGY

Course Code: MIE 343 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator(s): Dr. M. Shilpa

Course Content

Unit I

Introduction: Concept of blockchain, Nodes, cryptocurrency, token, distribution, modern encryption, blocks to hashes, Ledgers, public witness

Blockchain Principles and Qualities: Blockchain qualities, basic principles, three main types of blockchains, popular platforms

Unit II

Blockchain Networks: History of blockchain networks, top challenges, deeper dive into Bitcoin, major Bitcoin contributors, hyperledger, Ripple, Waves Platform – a Russian blockchain

Unit III

Blockchain for Data Management: Big Data, cloud computing technology, cloud-based blockchain, monetizing big data, challenges for blockchain in data analytics, blockchain and Ricardian contracts

Unit IV

Implementing Blockchain: Identifying opportunities and threats, determining use cases and impact on processes, people and partners, conceptual model for implementation, transformation success

Unit V

New Business Applications: Decentralized sharing economy, neighborhood micro-grids, data-sharing marketplace, machine to machine transactions, smart cities, digital medicine, value based healthcare, energy sector, payroll service

Blockchain Security issues: Rise of cyber security threats, blockchain risks, cyber security risks, blockchain risk management

Textbooks

1. Tiana Laurence, Introduction to Blockchain Technology, Van Haren Publishing, 1st edition, 2019.
2. Mohsen Attaran, Angappa Gunasekaran, Applications of Blockchain Technology in Business: Challenges and Opportunities, Springer, 2019

References

1. Alan T. Norman, Blockchain Technology Explained, CreateSpace Independent Publishing Platform, 2017
2. Ahmed Banafa, Blockchain Technology and Applications River Publishers, 2020, ISBN: 8770221065, 9788770221061
3. Peter Lipovyanov, Blockchain for Business 2019: A user-friendly introduction to blockchain, Packt Publishing, 2019

Course outcomes (COs):

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

1. Identify the type of blockchain required for the business (PO- 4)
2. Analyze and select a blockchain network (PO- 3,4)
3. Understand the significance of blockchain for data management. (PO- 4)
4. Analyze the challenges in implementing blockchain for a business (PO- 3)
5. Identify new business applications of blockchain and address the related security issues (PO- 5)

DATA WAREHOUSING AND DATA MINING

Subject Code: MIE 344 **Credits: 4:0:0**
Prerequisites: Nil **Course Hours: 56**
Course Coordiantor: Hamritha S

Course Content

Unit I

DW methodology - DW architectures - The DW development processes: Logical and physical DW

Unit II

DW data modeling - ETL, Data access, Data quality - DM - Query tools

Unit III

State-of-the-art in DM tools and technologies

Unit IV

DM and Business intelligence – From findings to application

Unit V

From research to a mature technology – technological artifact - DW, DM and beyond.

Text books

1. Berry, M.J.A. and Linoff G.S. (2004). Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management (paperback), 2nd Edition. ISBN: 0-471-47064-3, Wiley

Reference Books

1. Sperley, Eric. (1999) the Enterprise Data Warehouse: The Planning, Building & Implementation Volume I: 1st Edition. ISBN 0139058451, Prentice Hall.

Course outcomes (COs):

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

1. Identify the data ware housing and methodologies and architecture .(PO-3)
2. Understand data modelling and data mining quarry tools (PO-3)
3. Application of state of the arts in mining tools and technologies. (PO-3)
4. Aware of business intelligence from findings to applications. (PO-4)
5. Apply various data modelling techniques to any given business process. (PO-4)

IV SEMESTER

DISSERTATION

Subject Code: MIE 41 **Credits: 0:0:22:0**
Prerequisites: MIE 11
Course Coordinator(s): Dr. R Shobha / Dr.G S Prakash

Course Content

Final Project work will be evaluated based on

- Project problem definition
- Scope – In Scope, Out of Scope
- Assumptions
- Literature Survey
- Project Plan
- Project Preparatory Work and
- Data Gathering
- Inferences
- IE Concepts and Methodology used
- Implementation Methodology
- Analysis and Interpretation
- Recommendations
- Results
- Original Contribution of the project
- Project Report Depth and Quality
- Project Presentation

Course Outcomes (COs):

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

1. Collect and Interpret engineering data. (PO-1)
2. Implement engineering tools / techniques. (PO-2)
3. Validate the results obtained. (PO-3, 4)
4. Develop a technical report. (PO-2)