



**RAMAIAH**  
Institute of Technology

# **CURRICULUM**

**for the Academic year 2020 – 2021**

## **INDUSTRIAL ENGINEERING AND MANAGEMENT**

**V & VI SEMESTER B.E**

**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 13 UG programs and 15 PG programs. All these programs are approved by AICTE. All the UG programs & 09 PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with ‘A’ grade by NAAC in 2014. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs till the year 2029. 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 to 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 & 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 Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8<sup>th</sup> for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), an initiative of Ministry of Human Resource Development (MHRD), 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. It 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, MHRD, Government of India, M S Ramaiah Institute of Technology has achieved 59<sup>th</sup> rank among 1071 top Engineering institutions of India for the year 2020 and 1<sup>st</sup> rank amongst Engineering colleges (VTU) in 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

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs):**

**PEO1:** Use the knowledge and skills of industrial engineering to model and analyze the real life problems and interpret the results.

**PEO2:** Effectively design, implement, improve and manage the integrated socio-technical systems.

**PEO3:** Build and lead cross-functional teams, upholding the professional responsibilities and ethical values.

**PEO4:** Engage in continuing education and life-long learning to be competitive and enterprising.

## **PROGRAM OUTCOMES (POs):**

**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being

Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **PROGRAM SPECIFIC OUTCOMES (PSOs):**

**PSO 1:** Develop Knowledge, Skills and abilities in the fields such as System design and development, Manufacturing and Research.

**PSO 2:** Apply the core competence in the field of industrial and systems engineering to solve real world problem and continuously improve its performance.

**PSO 3:** Exhibit innovative abilities and develop towards entrepreneurial careers with a focus on leadership and responsibility.

## Semester wise Credit Breakdown for B E Degree Curriculum

Batch 2018-22

Semester	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences(BSC)	9	8	4	4					25
Engineering Science(ESC)	11	10							21
Humanities , Social Sciences and Management (HSMS)		2			3		3		8
Professional Courses- Core (PCC)			21	21	15	11	10		78
Professional Courses - Electives (PCE)					3	3	6	3	15
Other Open Electives Courses (OEC)					3	3			6
Project Work (PROJ), Internship (IN)						4	1	17	22
<b>Total Credits</b>	<b>20</b>	<b>20</b>	<b>25</b>	<b>25</b>	<b>24</b>	<b>21</b>	<b>20</b>	<b>20</b>	<b>175</b>

**SCHEME OF TEACHING  
V SEMESTER**

Sl. No.	Subject Code	Subject	Teaching Department	Credits				Contact Hours
				L*	T*	P*	Total	
1	IM51	Applied Probability and Statistics	Industrial Engineering & Management	3	1	0	4	5
2	IM52	Operations Research	Industrial Engineering & Management	3	1	0	4	5
3	IM53	Operations Management	Industrial Engineering & Management	4	0	0	4	4
4	IM54	Intellectual Property Rights	Industrial Engineering & Management	3	0	0	3	3
Professional Elective -1 ( Any one)								
5	IME551	Computer Integrated Manufacturing and Automation	Industrial Engineering & Management	3	0	0	3	3
	IME552	Database Management Systems						
	IME553	Human Factors in Engineering						
	IME554	Maintenance and Safety Engineering						
6	IMOE01	<b>Open elective -1</b>	From other department	3	0	0	3	3
7	IML56	Mechanical Measurements and Metrology Lab	Industrial Engineering & Management	0	0	1	1	2
8	IML57	Facilities Planning and Design Lab	Industrial Engineering & Management	0	0	1	1	2
9	IML58	Applied Probability and Statistics Lab	Industrial Engineering & Management	0	0	1	1	2
Total				19	2	3	24	

\* L: Lecture

\*T:Tutorial

\*P: Practical

\*S: Self Study



## SCHEME OF TEACHING VI SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Credits				Contact Hours
				L*	T*	P*	Total	
1	IM61	Quality Assurance and Reliability	Industrial Engineering & Management	3	1	0	4	5
2	IM62	Simulation Modeling and Analysis	Industrial Engineering & Management	3	1	0	4	5
<b>Professional Elective -2 ( Any one)</b>								
3	IME631	Engineering Economy	Industrial Engineering & Management	3	0	0	3	3
	IME632	Enterprise Resource Planning						
	IME633	Lean Manufacturing						
	IME634	Industry 4.0						
<b>Professional Elective -3 ( Any one)</b>								
4	IME641	Project Management	Industrial Engineering & Management	3	0	0	3	3
	IME642	Advanced Operations Research						
	IME643	Software Engineering						
	IME644	Marketing Management						
5	IMOEO2	<b>Open elective -2</b>	From other department	3	0	0	3	3
6	IM65	Mini Project/ Professional Elective/ NPTEL Course	Industrial Engineering & Management	0	0	4	4	-
7	IML66	Operations Process Control Lab	Industrial Engineering & Management	0	0	1	1	2
8	IML67	Quality Assurance and Reliability Lab	Industrial Engineering & Management	0	0	1	1	2
9	IML68	Simulation Modeling and Analysis Lab	Industrial Engineering & Management	0	0	1	1	2
<b>Total</b>				15	2	7	24	

\* L: Lecture

\*T: Tutorial

\*P: Practical

\*S: Self Study

## V Semester

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### APPLIED PROBABILITY AND STATISTICS

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Course Code: IM51

Credit:3: 1: 0

Prerequisite: Nil

Contact Hours: 42L+ 14T

Course Coordinator(s): Dr. M. Shilpa/ Smt. Hamritha S

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#### Course Content

##### Unit I

**Introduction to statistics:** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.

##### Unit II

**Discrete Random Variables and Probability distributions:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper-Geometric distribution, Poisson distribution, Applications.

##### Unit III

**Continuous Random Variables and Probability Distributions:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Exponential Distribution, Normal distribution, Central Limit Theorem Normal approximation to Binominal and Poisson distribution  
Introduction to Weibull and Erlang probability distributions – applications (No analytical treatment)

**Joint Probability Distributions:** Introduction, simple problems

##### Unit IV

**Sampling Distributions** – Introduction, simple problems

**Statistical Intervals for single sample** – Confidence interval on mean of a Normal distribution, variance known and variance unknown.

**Testing of Hypothesis for single sample:** Introduction, Test on the mean of Normal distribution variance known, Test on the mean of normal distribution variance unknown, Tests on variance of Normal distribution, Tests on population proportion.

**Testing the Goodness of Fit** –Binomial, Poisson and Uniform distributions using Chi-Square test.

**Testing of Hypothesis for two samples** – Inference on difference in means of two Normal distributions variances known, Inference on difference in means of two Normal distributions variances unknown.

## Unit V

**Simple Linear Regression and Correlation:** Simple Linear Regression, Properties of Least Square Estimators and ANOVA to test significance of regression, confidence intervals on slope and intercept, adequacy of regression model, Coefficient of Determination ( $R^2$ ) Transformations to a straight line.

**Correlation** - types, correlation coefficient, Karl Pearson and Spearman's coefficients

**Multiple linear Regression:** Multiple linear regression model, least square estimation of parameters.

**Use of Statistical packages** – output analysis

### Text Books

1. George C Runger-Applied statistics and Probability for Engineers, John Wiley and Sons, ISBN-0-471-17027-5, 2ndEdn.
2. Richard I Levin, David S Rubin -Statistics for Management, Prentice Hall India, ISBN-81- 203-0893-X, 6thEdn.

### References

1. William W Hines, Douglas C Montgomery -Probability and Statistics in Engineering, John Wiley and Sons, 2ndEdn.
2. Douglas C. Montgomery, George C. Runger, Norma F. Hubele, "Engineering Statistics", John Wiley and Sons, 5th Edn, ISBN-13: 978-0470631478 ISBN-10: 0470631473 year: 2010
3. Schaum's Outline of Statistics, 5th Edition (Schaum's Outlines) March 14, 2014, ISBN- 13: 978-0071822527 ISBN-10:0071822526
4. Daniel, Terrell -Business Statistics for Management and Economics, Houghton Mifflin Company, ISBN-0-395-62835-0, 6thEdn.
5. Walpole & Mayer -Probability and Statistics, MacMillan Publishing Company, 1989.

### Course outcomes (COs):

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

1. Collect, organize and analyze the data in the real life situation (PO-1,2 & PSO-2)
2. Apply the correct discrete probability distribution for the given situation (PO-5 & PSO-2)
3. Identify the correct continuous probability distribution for the given situation and apply the same to determine the probability. (PO-5&PSO-2)
4. Set up, test and make decisions about hypotheses when uncertainty exists. (PO-2,5&PSO-1)
5. Identify the degree and direction of relationship among process variables and develop appropriate regression models for the same. (PO-1,5&PSO-1)

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# OPERATIONS RESEARCH

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**Course Code: IM52**

**Credit:3: 1: 0**

**Prerequisite: Nil**

**Contact Hours: 42+ 14T**

**Course coordinator(s): Dr. G.S. Prakash/A. Balakrishna**

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## Course Content

### Unit I

**Introduction:** OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features of OR models, Limitation of OR, Models of OR.

**Linear Programming: Definition,** Mathematical formulation, standard form, Solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical method. Product mix problems.

### Unit II

**Linear Programming: Simplex** method, variants of simplex algorithm – Artificial basis techniques, Duality, Solution of LPP using duality concept, Dual simplex method.

### Unit III

**Transportation Problem: Formulation** of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems.

### Unit IV

**Assignment Problem: Formulation** of the Assignment problem, unbalanced assignment problem, Typical Assignment problems, Traveling salesman problem.

**Project Management:** Network construction, determination of critical path, project duration and floats. PERT - estimation of project duration and variance.

### Unit V

**Queuing Theory: Queuing** system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model.

**Game Theory: Formulations** of games, two person zero sum game, games with and without saddle point, graphical solutions ( $2 \times n$ ,  $m \times 2$  game), and dominance property.

### Text Books

1. Taha-Operation Research an Introduction, ISBN-81-203-3043-9, 8<sup>th</sup> Edition, 2006.

2. Ravindran, Philips and Soleberg-Operations Research Principles and practice, John Wiley & Sons, ISBN-13 978-81-265-1256-0, 2nd Edition-2007.

## References

1. Hiller and Libermann-Introduction to Operation Research, Mc Graw NHill 5<sup>th</sup> Edition, -2000
2. J K Sharma -Operations Research Theory and Application, Pearson Education Pvt Ltd, 2<sup>nd</sup> Edition, ISBN-0333-92394-4-2006

## Course outcomes (COs):

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

1. Appreciate the wide applicability of operations research technology from agriculture to defense, covering almost all domains of science, arts, commerce and technology. (PO- 1&PSO-1)
2. Build the optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution using simplex method. (PO- 1,2,3 &PSO-2)
3. Obtain optimum cost /profit by the application of transportation algorithm. (PO- 1,2,3&PSO-2)
4. Develop minimum cost and maximum profit solutions to Assignment and travelling salesman problems. Optimize the project duration and cost using PERT/CPM techniques. (PO- 1,2,3&PSO-2)
5. Provide probabilistic and heuristic solutions for real life problems using the Queuing and Game theory models. (PO- 1,2,3&PSO-2)

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## OPERATIONS MANAGEMENT

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**Course Code: IM53**

**Credit:4: 0: 0**

**Prerequisite: Nil**

**Contact Hours: 56**

**Course Coordinator(s): Dr. G.S. Prakash / Dr. R. Shobha**

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### Course Content

#### Unit I

**Operations Management Concepts:** Introduction, Operations Functions in Organizations, Historical development, Framework for managing operations, The trend: Information and Non-manufacturing systems, Definition of Operations management, Factors affecting productivity, International dimensions of productivity, the environment of operations

#### Unit II

**Operations Decision Making:** Introduction, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology, Decision Tree Problems, Economic models-Break-even analysis in operations, P/V ratio.

**System Design and Capacity:** Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning, Numerical on Design Capacity, System Capacity and Capacity Planning.

#### Unit III

**Forecasting Demand:** Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Delphi technique, Time series methods, Moving Average methods, Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, and Tracking Signal.

#### Unit IV

**Aggregate Planning and Master Scheduling:** Introduction- planning and scheduling, Objectives of aggregate plan, Three Pure Strategies of Aggregate planning, aggregate planning methods, Master scheduling objectives, Master scheduling methods with numerical, Numerical on Level production and chase demand

**Material and Capacity Requirements Planning:** Overview: MRP and CRP, MRP: Underlying concepts, MRP logic, (Numerical examples on MRP calculations), Capacity management, and CRP activities.

#### Unit V

**Scheduling and Controlling Production Activities:** Introduction, PAC, Objectives and Data requirements, priority sequencing.

**Single Machine Scheduling:** Concept, measures of performance, SPT rule, Weighted

SPT rule, EDD rule.

**Flow –Shop Scheduling:** Introduction, Johnson's rule for „n“ jobs on 2 and 3 machines, CDS heuristic. **Job-Shop Scheduling:** Scheduling 2 jobs on „m“ machines.

### **Text Books**

1. Monks J.G -Operations Management, McGraw-Hill International 2<sup>nd</sup>, Editions-2004.
2. Pannerselvam. R -Production and Operations Management, PHI, 3<sup>rd</sup> edition.2012
3. Adam & Ebert -Production and Operations Management, PHI, 5<sup>th</sup> edition,1992

### **References**

1. Buffa -Modern Production/Operations Management, Wiely India Ltd. - 4<sup>th</sup> edition.2009
2. Chary S.N -Production and Operations Management, Tata-McGraw Hill. - 3<sup>rd</sup> edition 2015
3. Chase, Aquilano & Jacobs- Production and Operations Management, Tata-McGraw Hill. – 8<sup>th</sup> edition. 2014

### **Course outcomes (COs):**

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

1. Understand the historical development, frame work and functions of operations planning in organization (PO- 1,2,3&PSO-1)
2. Analyze the characteristics and methodologies for decision making & capacity planning (PO- 1,2,5&PSO-1,2)
3. Identify right methods & techniques for forecasting demands in various organizations (PO- 1,2,3,5&PSO-2)
4. Formulate strategies for solving day to day problems on planning & scheduling. (PO- 1,2,3&PSO-2,3)
5. Implement job scheduling rules for controlling production activities (PO- 1,2,3&PSO-2,3)

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## INTELLECTUAL PROPERTY RIGHTS

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**Course Code:** IM54

**Credit:3: 0: 0**

**Prerequisite:** Nil

**Contact Hours:** 42

**Course coordinator(s):** Dr.M. R. Shivakumar/Sudheer D Kulkarni

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### Course Content

#### Unit I

**Basic principles of IP laws:** Introduction, History, Concept of property, Evolution of the patent system in UK, US and India, Basis for protection, WTO, TRIPS.

**Patents:** Introduction, Origin and meaning of the term patent, Objective of a patent law, the legislative provisions regulating patents, principles underlying the patent law in India, patentable inventions.

#### Unit II

**Procedure for obtaining patent:** Submission of application, filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.

**Rights conferred on a patentee:** Patent rights, Exception and limitations, Duties of a Patentee.

#### Unit III

**Transfer of patent:** Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.

**Infringement of patents:** Construction of claims and infringement, patents held to be infringed, patents held to be not infringed, patent agents, patent drafting, database searching, case studies.

**Action for Infringement:** Where a suit is to be instituted. Who is entitled to sue, defense which may be set up by the defendant, injunction, manner assessment of damages, account of profits.

**Case Studies:** The Basamati Rice Patent Case, Hoffmann-LA Roche Ltd. vs. Cipla Ltd., AGC Flat Glass Europe SA vs Anand Mahajan, Wockhardt Ltd. vs Hetero Drugs Ltd., Stoplik Services India Pvt. Ltd. vs Panacea Biotech Ltd.

#### Unit IV

**Copyright:** Meaning and characteristics of copyright, Indian copyright law, requirement of copyright, Illustrations copyright in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.

**Author and Ownership of copyright:** Ownership of copyright, Contract of service, Contract for service, rights conferred by copyright, terms of copyright, license of copyright.



**Infringement of copyright:** Acts which constitute infringements, general principle, Acts not constituting infringements-statutory exceptions, acts which do not amount to infringement in respect of computer programmes.

**Case Studies:** Academy of General Education, Manipal v. B. Mallini Mallya, Dhodha House & Patel Field Marshal Industries v. S K Maingi & P M Diesel Ltd., Deshmukh & Co. (Publishers) Pvt. Ltd v. Avinash Vishnu Khandekar

### Unit V

**Trade Marks:** Introduction, Statutory authorities, procedure of registration of trade marks, rights conferred by registration of trade marks, licensing in trade mark, infringement of trade mark and action against infringement.

**Case Studies:** Paragon Steels (P) Ltd., v. Paragon Rubber Industries, Heinz Italia v. Dabur India Ltd, Bharati Cellular Ltd. v. Jai Distillers (P) Ltd.

**Industrial Design:** Introduction, conditions for a registrable design, procedure of registration of a design, Piracy of a registered design.

**Case Studies:** Dabur India Ltd. v. Amit Jain, Bharat Glass Tube Limited v. Gopal Glass works Ltd, A.C.Footwear Co v. Deiem (India) Pvt. Ltd.

### Text Books

1. Dr.B.L.Wadhera-Intellectual Property Law Handbook, Universal Law Publishing Co. Ltd.2002.
2. Dr. T Ramakrishna - Basic principles and acquisition of Intellectual Property Rights, CIPRA, NSLIU -2005.

### References

1. Intellectual Property Law (Bare Act with short comments) - Universal Law Publishing Co. Ltd.2007.
2. The Trademarks Act 1999 (Bare Act with short comments) - Universal Law Publishing Co. Ltd.2005.
3. The Patents Act, 1970 (Bare Act with short comments) - as amended by Patents (Amendment) Rules 2006 w.e.f. 5-5-2006. Commercial law publishers (India) Pvt.Ltd. 2006.
4. Thomas T Gordon and Arthur S Cookfair-Patent Fundamentals for Scientist and Engineers, CRC Press1995.
5. Prabuddha Ganguli-Intellectual Property Rights, TMH Publishing Co.Ltd..2001

### Course outcomes (COs):

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

1. Identify the historical development of IPR and patent, its importance in the society (PO- 6,8,10&PSO-3)

2. Understand the patent laws & regulations and procedures for obtaining patent (PO- 6,8,10&PSO-3)
3. Analyze the functioning of patent systems (PO- 6,8,10&PSO-3)
4. Analyze and apply copyright and ownership rights (PO- 6,8,10&PSO-3)
5. Design Trade mark and industrial designs (PO- 6,8,10&PSO-3)

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# COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION

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**Course Code: IME551**

**Credit:3: 0: 0**

**Prerequisite: Nil**

**Contact Hours: 42**

**Course Coordinator(s): A. Balakrishna / Dr. M. Rajesh**

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## Course Content

### Unit I

**Introduction to CIM:** The Production system, Production System Facilities, Manufacturing Support Systems, CAD / CAM defined, the product cycle and CAD / CAM. Advantages and disadvantages of CAD/CAM

**Fundamentals of CAD:** Introduction, The Design Process, The Application of Computers for Design, Creating the manufacturing Data Base. Benefits.

### Unit II

**Computer Controls in NC:** Introduction, NC Controller Technology, Computer Numerical Control, Direct Numerical Control, Combined DNC/CNC Systems, Adaptive Control Systems.

**Conventional Numerical Control:** Introduction, NC Coordinate Systems. NC Part Programming - APT Language CAPP – APT programming problems.

### Unit III

**CNC programming-** Part programming fundamentals, manual part programming methods, preparatory function, miscellaneous functions, program number, tool length compensation, coned cycles, cutter radius compensation, Simple programs.

**Computer aided process planning:** Retrieval & generative CAPP system, Benefits of CAPP

**Computer Networks in Manufacturing:** Hierarchy of computers in manufacturing, network topologies, manufacturing automation protocol.

### Unit IV

**Introduction to Automation:** Definition of automation, Automation in production systems, reasons for automating, arguments for and against automation, manual labor in production systems, basic elements of an automated system, advanced automation functions, levels of automation.

**Transfer lines and similar automated manufacturing systems:** Fundamentals of automated production lines, applications of automated production lines, analysis of transfer lines with no internal storage, analysis of transfer lines with storage buffers.

## Unit V

**Automated Material Handling and Storage System:** Types of material handling systems, automated conveyor system, automated guided vehicle system, AS/RS and its types.

**Industrial Robotics:** Introduction to Robots, Anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications. social and economic aspects of robots.

### Text Books

1. P Mikell. Groover -Automation, Production systems, and Computer – Integrated Manufacturing, PHI 2008, 2nd edition
2. Mikell P. Groover Emory W. Zimmers-CAD / CAM Computer – Aided Design and Manufacturing, “CAD / CAM Computer – Aided Design and Manufacturing. Jr. Pearson Education inc, 2008.

### References

1. P.N. Rao -CAD/CAM Principles and Applications, TMH , New Delhi, 2<sup>nd</sup> edition 2004
2. Newman and sproull-Principles of Interactive Computer Graphics, TMH, 1995
3. Ibrahim Zeid, Management of CAD databases

### Course outcomes (COs):

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

1. Apply the knowledge acquired to work in CNC machine shop. (PO- 1,12 & PSO-1)
2. Use Numerical control system in manufacturing. (PO- 2,3 & PSO-3)
3. Build program to perform various operations on CNC machines. (PO- 2,3 & PSO-3)
4. Appreciate the application of automation in manufacturing industry. (PO- 2,3,4 & PSO-2)
5. Develop an understanding of the fundamental concepts of robotics and its functioning. (PO- 1,2,3 & PSO-1)

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## DATABASE MANAGEMENT SYSTEM

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**Course Code:** IME552

**Credit:** 3: 0: 0

**Prerequisite:** Nil

**Contact Hours:** 42

**Course Coordinator(s):** Dr. G.S. Prakash/ S. Hamritha

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### Course Content

#### Unit I

**Databases and Database users:** Introduction, characteristics of data base approach, intended uses of a DBMS, advantages and implication of database approach.

**Database Systems Concepts and Architecture:** Data models, Schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of data base management systems.

#### Unit II

**Data Modeling:** High level conceptual data models for database design. Entity types, entity sets, attributes, and keys. Relationships, relationship types, roles, and structural constraints, Weak entity types, ER diagrams.

#### Unit III

**Relational Data Model and Relational Algebra:** Brief discussion on Codd's rules, relational model concepts, constraints, and schemas. Update operation on relations, basic and additional relational algebra operations, and queries in relational algebra.

#### Unit IV

**Structured Query Language (SQL):** Data definition in SQL2, Queries in SQL: Create, Select, and Insert, Delete, Update, and Alter.

#### Unit V

**Database Design:** Design guidelines for relational schemes, functional Dependencies, normalization -1st, 2nd, 3rd, 4th, and 5th normal forms, Database design process.

**System Implementation:** System catalog for RDBMSs, transaction processing and system concepts, properties of transactions, recovery techniques, database security and authorization.

#### Text Books

1. RamezElmasri and Shamkanth B. Navathe-Fundamentals of database systems, Addison Wesley Publishing Company, 6th Edition, 2009.
2. Raghu Ramakrishnan and Johannes Gehrke-Database Management System, TATA McGraw Hill, ISBN 0-07-1231511, 3rd Edition,2002.

## References

1. Mc Lfadden, Hoffer, Prescott -Modern Data base management, Prentice Hall, 2012, 11th Edition
2. Gary W. Hansen and James V. Hanesn-Database Management and Design, PHI Pvt. Ltd 2nd Edition,1995.

## Course outcomes (COs):

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

1. Identify and define the information that is needed to design a database management system for a business information problem. .(PO- 3,5 &PSO-1,2)
2. Create conceptual and logical database designs for a business information problem.(PO- 3,5 & PSO- 1,2)
3. Build a database management system that satisfies relational theory and provides users with business queries, business forms, and business reports.(PO- 1,3,5 &PSO-1,2)
4. Build a database management system that provides structure to database system using SQL language (PO- 1,3,5 &PSO-1,2)
5. Identify the core terms, concepts, and tools of relational database management systems various security, transaction processing, recovery system. (PO- 3,5,6,8 &PSO-1,2)

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## HUMAN FACTORS IN ENGINEERING

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**Course Code:** IME553

**Credit:** 3: 0: 0

**Prerequisite:** Nil

**Contact Hours:**42

**Course Coordinator(s):** Dr. M. Rajesh /Deepak kumar

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### Course Content

#### Unit – 1

**Introduction:** Introduction to Human factors, History of Human factors, Human machine systems, Displaying information, coding of information, information processing, memory, decision making, age and information processing, mental workload. Design process involving ergonomics check.

#### Unit – II

**Visual Displays:** The process of seeing, Visual acuity types, quantitative visual displays, Dynamic quantitative displays, Qualitative visual displays, Visual performance, Maintain Security, Health and Safety, ENVIRONMENTAL CONDITIONS – Climate, Noise, Motion

#### Unit – III

**Auditory, Tactual & Olfactory Displays:** The nature and measurement of sound, the anatomy of ear, auditory displays, principles of auditory displays, Tactual display types, The Olfactory sense and displays. Latest developments in the use of olfactory displays.

#### Unit– IV

**Human activities:** Muscle physiology, Measure of physiological strain, physical work load, factors affecting, energy consumption, Strength and endurance, Biomechanics of human motion, Function of controls, factors in control design, C/R ratio, Optimum C/R ratio, Principles of hand tool and device design, Body mechanics at work

#### Unit– V

**Work space and arrangement:** Anthropometry, use of anthropometric data, work spaces, design of work surfaces, science of seating, example of individual work place, human error, accidents and warnings, Human body- structure and function, Human error and risk perception, Vertical arm reach and design application possibility, Accidents and Safety, applications of ergonomics in service sector and IT sector.

#### Text Books

1. M S Sanders and E J Mc Cormick -Human factors in Engineering & Design, McGraw Hill, 7th Edition.
2. Wickens J. Lee, YD Liu, S GordanBeckere-Introduction to Human factor in Engineering, Prentice Hall Inc, 2003.

## References

1. S Dalela and Sourabh-Work Study and Ergonomics, Standard publishers, 5<sup>th</sup> Revised & Enlarged Edition, 1999.
2. R S Bridger, introduction to ergonomics, Taylor and Francis2008

## Course outcomes (COs):

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

1. Apply the concept of ergonomics and man-machine system.(PO- 3,5 &PSO-1)
2. Demonstrates the importance of visual, auditory, tactual and olfactory displays in Human factors in engineering.(PO- 4,10 &PSO-1)
3. Understand the various display types to make the proper decision and enhance the existing technique. (PO- 5,6&PSO-2)
4. Analyze the process of metabolism, physical work load, and biomechanics of human motion. (PO- 4,9&PSO-1)
5. Create the work space, its arrangement and applications in industry. (PO- 1,7&PSO-2)



# MAINTENANCE AND SAFETY ENGINEERING

Course Code: IME554

Credit: 3: 0: 0

Prerequisite: Nil

Contact Hours: 42

Course Coordinator(s) : Dr. S. Appaiah /Deepak Kumar

## Course Content

### Unit I

**Introduction to Maintenance System:** Definition, Scope, Objectives, Importance of maintenance system, Types of maintenance system, Break down maintenance system, Preventative maintenance, Predictive maintenance, design out maintenance, corrective maintenance, Planned maintenance, total productive maintenance, Total Preventive Maintenance condition monitoring.

### Unit II

**Maintenance of Machinery:** Causes of machine failure, performance evaluation, complete overhauling of Lathes, Drilling machines, Milling machines, shapers and grinding machines. Maintenance planning and scheduling. Product safety review hazards analysis, Process safety management system, Repair order control manpower requirement, maintenance job analysis spare parts control.

### Unit III

**Economics in Maintenance:** Repair, replacement, Repair complexity, Finding out most optimal preventive maintenance frequency. Reliability of repairable and non-repairable systems, Improvement in reliability, reliability testing, reliability prediction, Alignment and testing of equipment, computer aided maintenance.

### Unit IV

**Industrial Safety:** Economic importance of accidents. Types of safety organizations, Analysis of accident Safety standards for – Mechanical equipment. Electrical equipment and systems – Chemical hazards. Material handling, exhaust systems, Plant housekeeping – building, Aisles passages, floors, tool cribs, washrooms. Safety color codes, Safety Regulations Utilization factor, drinking water, layouts, light, cleanliness.

### Unit V

**Fire Prevention & Protection:** Conditions favoring fire break down, prevention of firing methods, fire protection – classification of fires, fire extinguishing systems, fire alarms, firefighting equipment, Mock drills, and emergency response team.

**Industrial Pollution Control:** Dust control – Fiber collectors, mechanical dust collectors, wet type collectors, waste disposal. Electro static precipitators, Noise pollution Control –Noise measurement and control.

## **Text Books**

1. Staniar-Plant Engineering hand book, McGraw-Hill, 2ndEdition.
2. Morrow, Lindley. R and Higgins -Maintenance Engineering hand book, McGraw-Hill- 2001, 3rdEdition.

## **References**

1. Frank Herbaty-Hand book of maintenance management, Crest Publishing house-2004.
2. W. Grant Larson& Eugene L.Grant-Hand book of Industrial Engg. & Management- Prentice Hall of India, 2<sup>nd</sup> edition –1988.
3. Herbert. F. Lund -Industrial Pollution Control hand book, McGraw-Hill
4. H.P. Garg -Industrial Maintenance, S. Chand publishers, 3<sup>rd</sup> edition.
5. “Chemical Process Safety, Fundamentals with Applications”, Second Edition by Daniel A. Crowl & Joseph F. Louvar Published by Prentice Hall, Inc. ISBN 0-13-018176-5

## **Course outcomes (COs):**

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

1. Understand the proper maintenance system in the organization. (PO- 3&PSO-2)
2. Analyze maintenance of machinery and other equipment (PO- 2&PSO-1)
3. Use computers in maintenance effectively for increasing the availability of machines by economics. (PO- 5&PSO-2)
4. Implement of industrial safety through a proper safety standards & reduce accidents.(PO- 3&PSO-2)
5. Apply the suitable pollution control methods in various industries. (PO- 7&PSO-2)

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## HUMAN RESOURCE MANAGEMENT (Open elective-1)

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**Course Code:** IMOE01

**Credit:** 3:0 : 0

**Prerequisite:** Nil

**Contact Hours:** 42

**Course Coordinator(s):** Dr. S. Appaiah / Dr. C.S. Chethan Kumar

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### Course Content

#### Unit –I

**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.

#### Unit –II

**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.

#### Unit –III

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

#### Unit –IV

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

#### Unit –V

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

### Text Books

1. Dr. K Ashwathappa – Human Resource Management, Tata McGraw Hill, 5<sup>th</sup> Edition, 2005.
2. Hersey and Blanchard -Management of Organization's Behavior, Prentice Hall of India, 10th Edition –2012.
3. Arun Monappa -Industrial Relations, TMH, ISBN – 0-07-451710-8,2007

## References

1. Decenzo and Robbins -Personnel / Human Resource Management, PHI, 2002.
2. CB Mamoria -Management of Human Resources, Himalaya Publication House, 2003.
3. Jain -Industrial Acts, TMH Publications, 2004.

### 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-6,9&PSO-1)
2. Analyze and select the right recruitment / rights strategy for a given organization (PO- 6,10&PSO-1)
3. Design the appropriate training and development programme to the employee after analyzing the training needs (PO- 6,10&PSO-3)
4. Evaluate the procedure for transfer, promotion, interviews types with effective communication skills( PO-6,9& PSO-3)
5. Identify the performance appraisal method depending on the type of organization.(PO- 6,10&PSO- 3)

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## MECHANICAL MEASUREMENTS AND METROLOGY LAB

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Course Code: IML56

Credit: 0: 0: 1

Prerequisite: Nil

Contact sessions: 14

Course Coordinator(s): A Balakrishna/Dr. M R Shivakumar

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### Course Content

#### List of Lab Experiments

1. Demonstration of optical flats, clinometers, load cell, stroboscope, slip gauges, sine bar.
2. Measurement of gear elements using Toolmaker's microscope.
3. Measurement of small angle using autocollimator.
4. Measurement of screw thread elements using floating carriage diameter measuring instruments.
5. Alignment tests on drilling machine.
6. Testing of gear concentricity using Parkinson gear tester.
7. Measurement of thread parameters using profile projector.
8. Calibration of dial gauge using standard LVDT.
9. Calibration of LVDT using micrometer.
10. Determination of elastic modulus using strain gauges.
11. Measurement of cutting forces using lathe tool dynamometer.
12. Determination of thermal expansion of metal specimen.
13. Calibration of CMM using standard sphere.
14. Measurement of specimen dimensions in CMM using MCS.
15. Measurement of specimen dimensions in CMM using PCS.

**Note:** At least 13 experiments have to be conducted from the above list of experiments

#### Text Books

1. Beckwith -Margangoni and Lienhard– Mechanical Measurements, Prentice Hall Publishers, 6<sup>th</sup> edition, 2006.
2. I.C. Gupta -Engineering Metrology, Dhampat Rai Publications, 7<sup>th</sup> edition, 2013.
3. R K Jain, Engineering Metrology, Khanna publications, 8th edition, 2002.

## References

1. AC – DMIS EXT Version Guide - AEH Industrial Metrology Company limited.
2. Quadra Check 200 Users Guide - Metronics, Inc., Bedford, New Hampshire, USA
3. J.F.W.Galyer and C.R. Shotbolt – “Metrology for Engineers”, 5th ed. Published by London: Cassell, 1990.

## Course outcomes (COs):

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

1. Perform measurement precisely using various measuring devices. (PO- 1, 2 & PSO-1)
2. Develop calibration methods to the various measuring devices. (PO- 1, 2, 3 & PSO-1)
3. Compare and contrast the measuring equipment required for various applications in industry. (PO-4, 5 & PSO-1, 2)
4. Interpret the measured results. (PO-4, 5 & PSO-1, 2)
5. Solve the measurement related problems encountered in industries. (PO- 4, 5 & PSO-2)

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## FACILITIES PLANNING AND DESIGN LAB

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**Course Code:** IML57

**Credit:** 0:0 : 1

**Prerequisite:** Nil

**Contact Sessions :**14

**Course Coordinator(s):** Dr. M. Rajesh / Dr. M. Shilpa

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### Course Content

#### List of Lab experiments

1. Introduction to facilities planning and design
2. Proposal of a good factor layout
3. Design of plant layout using CORELAP
4. Proposal of a facility at college
5. Layout of a showroom
6. Design of plant layout using ALDEP
7. Design of plant layout using CRAFT
8. Designing a layout using line balancing
9. Designing a material handling equipment
10. Identification of a suitable facility location
11. Single facility location model
12. Multi-facility location model
13. Designing a plant layout using Muther's SLP approach
14. Design of layout using sequence demand method
15. Demo on simple layout having stairs, workbenches, conveyors, fence, bins, etc.

**Note:** At least 13 experiments have to be conducted from the above list of experiments

#### Text Books

1. James M Apple -Plant Layout and Material handling, 2nd Edition, John Wileyand Sons.
2. Francies, R.L. and White, J.A -Facility layout and Location, Mc Graw Hill, 2<sup>nd</sup>edition.
3. Tompkins J A, White, Bozer and Tanchoco-A Facilities planning, John Wiley&Sons; 4th edition, 2010

#### References

1. Muther Richard -Practical layout, Mc GrawHill-1955.
2. SundereshHeragu-Facilities Design, PWS Publishing Company, ISBN-0-534-95183.

3. James M Moore -Plant Layout Design, Mac Millan Co.1962 LCCCN61-5204.

**Course outcomes (COs):**

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

1. Identify the optimal layout from the alternatives.(PO- 2,11 &PSO-1)
2. Compare and contrast the different types of modern material handling equipment's for their use in the industry.(PO- 3,4&PSO-2)
3. Enhance productivity of the organization by efficient usage of men, materials and equipment(PO-1,11&PSO-2)



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## APPLIED PROBABILITY AND STATISTICS LAB

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**Course Code: IML58**

**Credit: 0: 0:1**

**Prerequisite: Nil**

**Contact sessions: 14**

**Course Coordinator(s): Dr. M. Shilpa /Hamritha S**

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### Course Content

#### Part –A

**Software: MS Excel**

1. Determining the measures of central tendency and dispersion of a given process
2. Graphical/ Pictorial representation of data – Histogram, Ogive curve, Bar Chart, Column chart, Pie chart, Line chart
3. Interval estimation and hypothesis testing on single population mean
4. Interval estimation and hypothesis testing on Two population means
5. Interval estimation and hypothesis testing on single population Proportion
6. Construction of scatter plot and determination of Karl Pearson's correlation coefficient
7. Determination of Spearman's Correlation Coefficient
8. Conduction of simple linear regression analysis
9. Conduction of ANOVA to test significance of regression
10. Testing the goodness of fit using Normal distribution
11. Testing the goodness of fit using Binominal distribution
12. Testing the goodness of fit using Poisson distribution
13. Testing the goodness of fit using Uniform distribution (for experiments 11 to 14, calculations through MS Excel)

#### Part –B

**Software: SYSTAT statistical software package**

1. Determination of basic statistics and construction of histogram for a given quality Characteristic
2. Construction of Box Plot and Density Dot Graph
3. Determining the probability for discrete probability distributions –Hyper-Geometric, Binominal and Poisson distributions
4. Determining the probability for Continuous probability distributions – Normal and Exponential distributions
5. Generation of random samples for the probability distributions – Poisson, Binomial, Normal and Exponential distributions

6. Interval estimation and Hypothesis testing on single population mean.
7. Interval estimation and Hypothesis testing on two population means
8. Interval estimation and Hypothesis testing on single population Proportion.
9. Testing the goodness – of – fit using Chi- Square test for Normal Distribution
10. Construction of scatter plot and determining Karl Pearson’s correlation coefficient.
11. Conduction of simple linear regression analysis.
12. Conduction of Multiple linear regression analysis.
13. Construction of function plots for non-linear regression problems
14. Case study on engineering and management related problems.

**Suggested software packages:** MS Excel, SYSTAT / MINITAB 17 -Statistical Software Package/ R studio

**Note:** At least 13 experiments have to be conducted from the above list of experiments

### **Text Books**

1. George C Runger-Applied statistics and Probability for Engineers, John Wiley and Sons, ISBN-0-471-17027-5, 2ndEdn.2003.
2. Richard I Levin, David S Rubin -Statistics for Management, Prentice Hall India, ISBN- 81-203-0893-X, 6th Edn. 1991

### **References**

1. William W Hines, Douglas C Montgomery -Probability and Statistics in Engineering, John Wiley and Sons, 2ndEdn.
2. Daniel, Terrell -Business Statistics for Management and Economics, Houghton Mifflin Company, ISBN-0-395-62835-0, 6thEdn.
3. Walpole & Mayer -Probability and Statistics, MacMillan Publishing Company, 4<sup>th</sup> edition, 1989. ISBN: 9780024242228.
4. Douglas C. Montgomery, George C. Runger, Norma F. Hubele, “Engineering Statistics”, John Wiley and Sons, 5th Edn, ISBN-13: 978-0470631478 ISBN-10: 0470631473 year: 2010.
5. Schaum's Outline of Statistics, 5th Edition (Schaum's Outlines) March 14, 2014, ISBN- 13: 978-0071822527 ISBN-10:0071822526.

### **Course outcomes (COs):**

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

1. Collect and present the real life data numerically as well as graphically. (PO- 1,3&PSO- 1)

2. Arrive at appropriate estimates and inferences and take decisions in uncertainty (PO- 1,2&PSO-2)
3. Apply the right probability distribution for a real life problem(PO- 1,5&PSO-2)
4. Conduct correlation and regression analysis in situations involving many variables.(PO- 1,5&PSO- 1)

## VI Semester

### QUALITY ASSURANCE AND RELIABILITY

Course Code: IM61

Credit:3: 1: 0

Pre requisite : Applied Probability and Statistics

Contact Hours: 42L+14T

Course Coordinator(s): Dr. G.S. Prakash / A. Balakrishna

#### Course Content

##### Unit I

**Introduction:** Definition of Quality, Dimensions of Quality, The Juran's Spiral of quality, Quality costs – four categories of costs and hidden costs. Brief discussion on sporadic and chronic quality problems.

**Quality Assurance:** Definition and concept of quality assurance, Quality audit concept and audit approach etc., ingredients of a quality audit program.

**Statistical Process Control:** Introduction to statistical process control, SPC tools and techniques, 7QC tools, ZD program - case study, Process capability – Basic definition, standardized formula and six sigma concept of process capability, DMAIC – Problem solving using DMAIC approach.

##### Unit II

**Introduction to control charts:** Classification, chance and assignable causes of variation, Basic principles of control charts, Analysis of patterns of control charts.

**Control Charts for Variables: Controls** charts for X bar and Range, statistical basis of the charts, development and use of X bar and R charts, interpretation of charts. Control charts for X bar and standard deviation (S), development and use of X bar and S chart.

**Control Charts for Attributes: Controls chart for fraction non- conforming (defectives)** Development and operation of control chart, brief discussion on variable sample size.

**Control chart for non-conformities (defects)** – Development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts

##### Unit III

**Sampling Inspection:** Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Producer risk and Consumer risk. Determinations of AOQ, LTPD, ASN, AOQL, ATI

##### Unit IV

**Advanced quality concepts:** CUSUM chart, MSA and GRR, introduction to QMS (no analytical treatment)

**Reliability and Life Testing:** Failure models of components, definition of reliability,

MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures, in series, parallel and series-parallel device configurations, Redundancy and improvement factors evaluations.

## Unit V

**Design of experiments** – Purpose of DOE, Principles, Terminology, Methodology.

**Experimental designs:** Completely randomized design, Randomized block design, Latin square designs, simple problems ANOVA

**Full factorial design :** Experimentation as a learning process ,traditional scientific experiments, Two factor and three factor experiments, graphical display of graphical effects, replicating experiments, factor interactions( **No analytical treatment**)

### 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.4th Edision2001
4. NVR Naidu, KM Babu, and G Rajendra-Total Quality Management, NewAge International Pvt.Ltd-2006
5. D.C.Montgomery – Design and analysis of experiments, John wiley and sons , 8<sup>th</sup> edition 2012

### References

1. Dale H. Besterfield-Quality control, Prentice-Hall International; 1998.-HardCover- 2003
2. Kesavan R -Total Quality Management, IK International, New Delhi-2007
3. Robert H Lochner and Joseph E Matar – Designing for quality , an introduction Best of taguchi and western methods or statistical Experimental design- Chapman and Hall Madras -2<sup>nd</sup> edition

### Course outcomes (COs):

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

1. Appreciate the role and importance of statistical quality control in modern industry, Analyze the effects of variation on processes and utilize SPC tools for process control and improvement. (PO- 1,2,3,4 & PSO-1,2)
2. Analyze the effects of variation on processes and utilize SPC tools for process control and improvement using attribute control charts. (PO- 2,3,4,5&PSO-2)
3. Apply the concept of acceptance sampling and analyze producers and consumer risk using the OC curve. (PO- 1,2,3 &PSO-2)
4. Use reliability concepts for estimating failure rate and reliability evaluation (PO- 1,2,3,5 &PSO-3)
5. Use DOE and Six sigma concepts for quality control in real life situations (PO- 1,2,3,5 &PSO-3)

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# SIMULATION MODELING AND ANALYSIS

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**Course Code: IM62**

**Credit:3:1:0**

**Prerequisite: Applied Probability and Statistics**

**Contact Hours: 42L+14 T**

**Course Coordinator(s): Dr. M Shilpa / Dr. C. S. Chethankumar**

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## Course Content

### Unit I

**Introduction to Simulation:** Simulation, advantages, Disadvantages, System environment, components of a system, Model of a system, types of models, steps in a simulation study, Areas of application.

### Unit II

**Simulation Examples:** Simulation of Queuing systems, Simulation of Inventory System, Other examples of Simulation – Reliability models, Lead time Demand models, General Principles, Concepts in discrete - events simulation, event scheduling / Time advance algorithm.

### Unit III

**Random Numbers:** Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test, Gap test, Poker test.

### Unit IV

**Random Variate Generation:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, direct transformation for Normal and lognormal distribution. Convolution method – Erlang distribution. Acceptance and Rejection technique – Poisson and Gamma distributions.

### Unit V

**Input Modeling** - Selecting input models without data, Multivariate and time series input models – covariance and correlation, multivariate input models, and time series input models

**Verification and Validation of simulation model** – Model building, verification and validation, verification of simulation models, calibration and validation of models, Neylor and Finger’s validation process

**Output Analysis for a single model:** Types of Simulation, stochastic nature of output data, Output analysis of terminating simulation, Output analysis of steady state simulations

**Optimization via simulation:** What Optimization via simulation means? Why is optimization so difficult?

## **Text books**

1. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol -Discrete Event system Simulation, 5<sup>th</sup> Edition, Pearson Education, Asia, ISBN - 81- 7808 – 505 -4.
2. Averill M Law, W David Kelton -Simulation Modeling & Analysis, McGraw Hill International Editions – Industrial Engineering series, ISBN –0-07-100803-9.

## **Reference**

1. Narsingh Deo-Systems Simulation with Digital Computer; PHI Publication (EEE), ISBN –0-87692-028-8

## **Course Outcomes (COs):**

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

1. Apply the steps of simulation study for any real life system (PO- 2,3&PSO2)
2. Manually simulate simple queuing and inventory problems (PO- 2,3&PSO1)
3. Generate and test random numbers for simulation applications (PO- 3,4&PSO2)
4. Develop random variate generator using appropriate generation technique (PO- 2,3&PSO2)
5. Develop multivariate and time series input models and analyze the output of the simulation model (PO- 3,4&PSO2)

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## ENGINEERING ECONOMY

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**Course Code:** IME631

**Credit:**3:0 : 0

**Prerequisite:** Nil

**Contact Hours:**42

**Course Coordinator(s) :** Dr. S. Appaiah / Dr. M. Rajesh

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### Course Content

#### Unit I

**Introduction:** Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy.

**Interest and Interest Factors:** Interest rate, simple interest, Compound interest, Cash flow diagrams, Exercises and Discussion.

#### Unit II

**Present Worth Comparison:** Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives & infinite lives, Future worth comparison, Pay – back comparison, Exercises, Discussions and problems.

#### Unit III

**Equivalent Annual Worth Comparisons:** Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

**Rate of Return Calculations:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts.

#### Unit IV

**Structural Analysis of Alternatives:** Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, ranking criteria.

**Depreciation:** Causes of Depreciation, Basic methods of computing depreciation charges. Depreciation calculations as per Indian Income Tax Act.

#### Unit V

**Replacement Analysis:** Deterioration, obsolescence, inadequacy, Economic life for cycle replacements. Reasons for replacements, Individual replacements of machinery or equipment with/ without value of money, Group replacement policies.

**Break-Even Analysis:** Basic Concepts, Linear break even analysis with problems.

**Effects of Inflation:** Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions.



## **Text Books**

1. RIGGS J.L –Engineering Economy, 4th Edition, McGraw Hill, 2004.
2. PAUL DEGARMO –Engineering Economy, Macmillan Pub, Co.2001.
3. Naidu, Babu and Rajendra–Engineering Economy, New Age International Pvt. Ltd. – 2006

## **References**

1. OP Khanna –Industrial Engineering and Management, Dhanpat Rai & Sons2000
2. I M Panday–Financial Management, Vikas Publishing House2002.
3. Thuesenh.G–Engineering Economy, PHI, 2002.

## **Course outcomes (COs):**

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

1. Compare and contrast the importance of engineering and economics and different types of interest and interest factors with cash flow diagrams (PO-1&PSO-1,2)
2. Understanding the concept of present worth, future worth and its conditions. (PO- 1,5,12&PSO-1,2)
3. Analyze about equivalent annual worth concepts and its application, rate of return and its methods.(PO- 1,5,12&PSO- 1,2)
4. Identify the methodology which is used to selection of alternatives and various depreciation methods. (PO- 1,5,8,12&PSO-1,2)
5. Analyze the replacement polices and BEP analysis with leaner, non-leaner models and effect of inflation. (PO- 1,5,8,12&PSO- 1,2)

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## ENTERPRISE RESOURCE PLANNING

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**Course Code:** IME632

**Credit:**3:0 : 0

**Prerequisite:** Nil

**Contact Hours:**42

**Course Coordinator(s) :** Dr C S Chethan Kumar / P R Dheeraj

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### Course Content

#### Unit I

**Introduction to Business Processes:** The Functional Organizational Structure, Business Processes.

**Introduction to Enterprise Systems:** Enterprise Systems, Data in an Enterprise System, Reporting.

#### Unit II

**Introduction to Accounting:** Organizational Data, Master Data, Key Concepts, Processes, Reporting.

**Procurement Process:** Organizational Data, Master Data, Key Concepts, Process, Reporting.

#### Unit III

**Fulfillment Process:** Organizational Data, Master Data, Process, Credit Management Process, Reporting.

**Production Process:** Master Data, Process, Reporting.

#### Unit IV

**Inventory and Warehouse Management Processes:** Inventory Management, Organizational Data in Warehouse Management, Master Data in Warehouse Management, Processes in Warehouse Management, Reporting.

**Material Planning Process:** Master Data, Process, Reporting.

#### Unit V

**Implementation Basics:** Introduction, Why ERP, Technological Operational and Business Reasons for Implementing ERP, Implementation Challenges.

**Implementation Life Cycle:** Introduction, Objectives of ERP Implementation, Different Phases of ERP Implementation, Why Do Many ERP Implementations Fail.

#### Text Books

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

## **References**

1. Enterprise Systems for Management – Luvai Motiwalla & Jeffrey Thompson (Pearson, 2000)
2. Enterprise Systems Integration – Judith M. Myerson (Auerbach Publications, 2001)

## **Course outcomes (COs):**

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

1. Identify the fundamental features of ERP. (PO-1&PSO1)
2. Design basic accounting and procurement systems in ERP. (PO-3& PSO2)
3. Design basic fulfillment and production systems in ERP. (PO-3& PSO2)
4. Design basic inventory and materials systems in ERP. (PO-3& PSO2)
5. Implement a basic ERP system in an industry. (PO-5& PSO2)

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## LEAN MANUFACTURING

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**Course Code: IME633**

**Credit:3:0 : 0:0**

**Prerequisite: Nil**

**Contact Hours:42**

**Course Coordinator(s): Dr. C.S. Chethan Kumar / Deepak kumar**

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### Course Content

#### Unit I

**Race without a Finish Line:** Competitive Advantage, Just-in-Time and Total Quality Management, Evolution of Manufacturing, the Quality Movement, the Imperative.

**Value – Added and Waste Elimination:** Value – added focus, sources of waste, JIT Principles, The meaning of JIT. 5S housekeeping Concepts, 5S auditing, Kaizen activities, Kaizen workshop, Benefits of kaizen. Case studies.

#### Unit II

**Elements of Lean Production:** Small-Lot Production, Lot-Size Basics, Lot Sizing, Lot- Size Reduction, Facilitating small Lot Sizes. Case studies.

**Setup-Time Reduction:** Improve Setups? Why Bother? Setup-Reduction Methodology, Techniques for Setup Reduction, setup-Reduction Projects. Case studies.

#### Unit III

**Maintaining and Improving Equipment:** Equipment Maintenance, Equipment Effectiveness, Preventive Maintenance Program, Total Productive Maintenance, Implementing TPM.

**Pull Production Systems:** Production Control Systems, Process Improvement, How to Achieve Pull Production, Other Mechanisms for Signal and Control, To Pull or Not to Pull.

#### Unit IV

**Focused Factories and Group Technology:** Ways of Doing Work, Facilities Layout, Group Technology, Focused Factory, Establishing Product, Chapter Supplement.

**Work cells and Cellular Manufacturing:** Work cell Concepts, Work cell Applications, Work Design, and Workers in Cells, Equipment Issues, Implementing, and Getting Started. Case studies.

#### Unit V

**Lean Systems: Introduction** to value stream mapping, VSM Principles, VSM TOOLS, and Current Value stream mapping, Future State Mapping. Case studies.

#### Text Books

1. John M Nicholas -Competitive Manufacturing Management, TMH, Edition-2001.

2. Ronald G Askin and Jeffrey B Goldberg, Design and Analysis of Lean, John Wiley – 2001.

## **References**

1. Pascal Dennis -Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System, Second Edition, ISBN
2. John Miltenburg-Manufacturing Strategy, ISBN, Second Edition.
3. Don Tapping, Tom Luyster and Tom Shuker-Value Stream Management, Productivity Press.

## **Course outcomes (COs):**

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

1. Appreciate Value added activities and eliminate non value added processes to improve organizational efficiency (PO- 4&PSO-1)
2. Identify and evaluate various processes through lean tools. (PO- 5,2,3&PSO-1,2)
3. Apply and evaluate pull production system. (PO- 2&PSO-1,2)
4. Design workcells and calculate OEE. (PO- 1,2&PSO-2)
5. Design and implement value stream mapping. (PO- 3&PSO- 2,3)

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## INDUSTRY 4.0

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**Course Code: IME634**

**Credit:3: 0: 0**

**Prerequisite: Nil**

**Contact Hours: 42**

**Course Coordinator(s): Dr. M. Shilpa/ Dr. R. Shobha**

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### Course Content

#### Unit I

**Fourth Industrial Revolution** – Introduction, Current Practices, Challenges and Opportunities, Qualifications and skills for Industry 4.0

#### Unit II

**Enabling Technologies** - Management of new technologies, functional aspects, drivers of industry 4.0, main idea of industry 4.0, end-to-end digital transformations, and introduction to block chain technology

#### Unit III

**Cyber-physical Systems** - Introduction, Internet of Things and Services, Intelligent Objects vs. Intelligent Systems

#### Unit IV

**Technological requirements** - hardware based technologies, Software based technologies, Artificial Intelligence, autonomy of action, advanced data analytics

#### Unit V

**Human Capital in Industry 4.0** – Future competencies for Industry 4.0, Education in smart manufacturing, National knowledge management, Rewarding human capital.

#### **Text Books:**

1. Christoph Jan Bartodziej, The Concept Industry 4.0 - An Empirical Analysis of Technologies and Applications, Springer Gabler, 2017
2. Antronella Petrillo, Raffaele Cioffi, Fabio De Felice, Digital Transformation in Smart Manufacturing, In Tech, Croatia, 2018, ISBN: 978-953-51-3841-9

#### **References:**

1. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, Handbook of Industry 4.0 and Smart Systems, CRC Press, Taylor and Francis Group, 2019
2. Narendra Jadhav, New Age Technology and Industrial Revolution 4.0, Konark Publishers Pvt. Ltd., 2019

**Course outcomes (COs):**

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

1. Analyze the challenges and opportunities of Industry 4.0 (PO-1,3 &PSO-1)
2. Identify the right enabling technologies to transform into Industry 4.0 (PO-5 &PSO-2)
3. Analyze the interface between humans and computers in industries and services. (PO-1,3&PSO-2)
4. Identify and suggest the technological requirements for Industry 4.0. (PO-1,3&PSO-1)
5. Analyze the role of human capital for future competencies of Industry 4.0 (PO-8&PSO-1)

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# PROJECT MANAGEMENT

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**Course Code: IME641**

**Credit:3:0:0**

**Prerequisite: Nil**

**Contact Hours: 42**

**Course Coordinator(s): Dr. M R Shivakumar /Sudheer D Kulkarni**

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## Course Content

### Unit I

**Concepts of Project Management:** Concepts of projects, characteristics of project, Phases of project life cycle, Tools and techniques for project management, Computer based project management.

**Project planning and estimating:** Feasibility report, Preparation of cost estimation, Evaluation of the project profitability.

### Unit II

**Organizing Human Resources and Contracting:** Delegation, Skills / abilities required for project manager, Authorities and responsibilities of project manager, Project organization, Contracts, Tendering and Selection of contractors.

### Unit III

**Tools and techniques of project management** Bar (GANTT) chart, Crashing of projects, Resource allocation.

### Unit IV

**Performance measures in Project Management:** Performance indicators, Performance Improvement, Project management and environment.

**Risk Analysis:** Sources, measures and perspectives on risk, sensitivity analysis, scenario analysis, breakeven analysis, Hiller model, simulation analysis, decision tree analysis, managing risk, project selection under risk.

### Unit V

**Financing of Projects:** Capital structure, menu of financing, equity capital, internal accruals, term loans, debentures, working capital advance, miscellaneous sources, raising of venture capital, raising capital in international markets

### Text books

1. Project Management: Choudhry S., Tata McGraw-Hill,2010
2. Projects: Planning, Analysis, Financing, Implementation, and Review-Prasanna Chandra, 5<sup>th</sup> edition, Tata McGraw-Hill publishing company limited,2005
3. Operations Research and Engineering Management, S. D. Sharma, Kedar Nath Ram Nath & Co., 2010



## References

1. A Guide to the Project Management Body of knowledge PMBOK Guide 6<sup>th</sup> Edition, Project Management Institute 2017.
2. Project management - a system approach to planning scheduling and controlling- Harold Kerzner, CBS Publisher and distributors,2002.
3. A management guide to PERT and CPM- WEIST and LEVY Eastern Economy of PH 2002.
4. T R Banga, N K Agarwal and S C Sharma -Industrial engineering and Management Sciences, -Khanna Publishers

## Course outcomes (COs):

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

1. Prepare project plan by applying the concepts of project management (PO- 6,7,10,11&PSO 2,3)
2. Organize and manage the resources of projects (PO- 6,9,11&PSO 3)
3. Apply tools and techniques used in project management (PO- 1,2,3,11 &PSO 1,2)
4. Identify, analyze, quantify and mitigate risks (PO- 11 &PSO 3)
5. Evaluate the sources of finance (PO- 11 &PSO 3)

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## ADVANCED OPERATIONS RESEARCH

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**Course Code: IME642**

**Credit:3:0:0**

**Prerequisite: Operation Research**

**Contact Hours: 42**

**Course Coordinator(s): V. Vivekanand / Dr. G.S.Prakash/ P.R.Dheeraj**

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### Course Content

#### Unit I

**Linear Programming:** Two phase simplex technique, revised simplex techniques, Sensitivity analysis: Algebraic method

#### Unit II

**Integer Programming-** Gomory's technique, **Non-Linear Programming: Kuhn – Tucker** conditions

#### Unit III

**Queuing Theory:** Queuing system and their characteristics, The M/M/1 Queuing system, Steady state performance analyzing of M/M/1 queuing model, M/M/K/ Model, M/Ek/1, M/D/1, M/M/C and M/G/1 models.

#### Unit IV

**Discrete Markov Chains:** Discrete Stochastic Process, Markovian process, Stationary Markov chains, Markov diagrams, Ergodic and Absorbing Markov chains, Steady State probabilities, stochastic matrix, transition m, matrix and their applications.

#### Unit V

**Project Management Using Network Analysis:** Network construction, determination of critical path and duration, floats. PERT- Estimation of project duration, variance Crashing, Resource Leveling

**NOTE:** Numerical problems to be set starting from optimal tables for the topics – sensitivity analysis and integer programming

#### Textbooks

1. Taha.H.A-Introduction to OperationResearch, Prentice Hall of India-10<sup>th</sup> edition, 2016.
2. Wayne L. Wintson - Operations Research : Application and Algorithms, Cengage Learning; 4<sup>th</sup> edition , 2003
3. A management guide to PERT and CPM- WEIST and Levy Eastern Economy of PH 2002.

## References

1. Hiller and Libermann -Introduction to Operation Research, McGraw Hill - 9<sup>th</sup> edition, 2009.
2. S.D. Sharma -Operations Research, Kedarnath, Ramnath & Co -1996
3. Philips, Ravindran and Soleberg– Theory and Practice -Principles of Operations Research theory and Practice, Wiley India Pvt Ltd. 4<sup>th</sup> edition,2001

## Course outcomes (COs):

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

1. Apply and Analyze LP Techniques and Conduct Sensitivity analysis for real life problems.(PO-1,2,5&PSO : 1,2)
2. Apply and Solve Integer and Non Linear Programming Techniques for various real life problems.(PO-1,2,5&PSO : 1,2)
3. Analyze complex problems by using queuing theory. (PO-1,2,5) (PSO : 1)
4. Formulate and Analyze various complex problems by using Markov chain approaches(PO-1,2,5&PSO : 1,2)
5. Implement and Analyze the concepts of Project Management through network techniques(PO-1,2,5,11&PSO : 1,2)

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## SOFTWARE ENGINEERING

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**Course Code: IME643**

**Credit: 3:0:0**

**Prerequisite: Nil**

**Contact Hours: 42**

**Course Coordinator(s): Dr. C S Chethan Kumar / Dr. M Rajesh**

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### Course Content

#### Unit I

**The Product and the Process:** The product - Evolving role of Software, Characteristics, Components, and Applications. The Process - Software process, Models - Linear, sequential, Prototype, RAD, Process Technology, Software Development Life cycle.

**Software Project Management Concepts:** The Management Specification, People, Problem, Process.

#### Unit II

**Software Project Planning: Objectives,** Scope, Resources, Project estimation, Decomposition Techniques, Empirical Estimation Models, Make-buy decision, automated estimation tools.

**Risk Management: Reactive v/s Proactive Risk Strategies,** Software Risks, Risk identification, Risk projection, Monitoring.

#### Unit III

**Software Project Scheduling and Tracking:** Basic concepts, defining a task set selection, Defining Scheduling, Project Plan.

**Software Quality Assurance/Quality Control:** Quality assurance concept, Cost impact of software defects, Technical review, statistical Quality assurance, software reliability, ISO 9000 Quality standards.

#### Unit IV

**System Analysis Concept and Principles:** Requirement analysis, Principles, software prototyping, specifications, Data Modeling, Functional Modeling and Information Flow, Structured Analysis, Data Dictionary.

**System Design Concepts and Principles:** Design Process Concept, Modular design, Documentation Design Methods, Data Design, Interface Design, Procedural Design, Design for Real Time Systems, Considerations in Real Time systems, Analysis and Simulation of Real Time Systems.

#### Unit V

**Dependability and security specification:** safety specification, reliability specification, formal specification.

**Security Engineering:** Security management, Design for Security, System survivability,

**Dependability and security assurance:** static analysis, reliability testing, security testing, process assurance, safety and dependable cases.

### **Text Book**

1. Roger S. Pressman -Software Engineering: A Practitioner's Approach, Software Engg. Series, McGraw-Hill International Editions, 4<sup>th</sup> Ed.

### **Reference**

1. Somerville -Software Engineering, Adison Wesley publications, 9<sup>th</sup> edition, 2012, ISBN 978-81-317-6216-5

### **Course outcomes (COs):**

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

1. Appreciate Software concepts and understand the significance of software development life cycle. (PO- 1,2 &PSO1)
2. Identify and classify key project planning steps. (PO- 2 &PSO 2 )
3. Track and evaluate software quality control process. (PO-5 &PSO 2 )
4. Demonstrate data modeling and functional modeling. (PO-4 &PSO 1)
5. Design security specification and handle security engineering. (PO-3 &PSO3 )

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# MARKETING MANAGEMENT

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**Course Code: IME644**

**Credit:3:0:0**

**Prerequisite: Nil**

**Contact Hours: 42**

**Course Coordinator(s): V. Vivekanand / P R Dheeraj**

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## Course Content

### Unit I

**Define Marketing for the 21<sup>st</sup> Century:** The importance of marketing, the scope of marketing, what is marketed? Who markets? How business and marketing are changing, Company orientations toward the marketplace.

The production concept, The product concept, The selling concept, The marketing concept, The holistic marketing concept, Fundamental marketing concepts, trends, and tasks, Core concepts, Shifts in marketing management, Marketing management tasks,

**Developing marketing strategies and plans:** Marketing and customer value, the value delivery process, The value chain, Core competencies, A holistic marketing orientation and customer value, The central role of strategic planning, Corporate and division strategic planning, Defining the corporate mission, Defining the business, Assessing growth opportunities, Organization and organizational culture, Business unit strategic planning, The business mission, SWOT analysis, Goal formulation, Strategy formulation, Program formulation and implementation.

### Unit II

**Gathering information and scanning the environment:** Components of a modern marketing information system, Internal records and marketing intelligence, The order to payment cycle, Sales information systems, Databases, data warehousing and data mining, The marketing intelligence system, Analyzing the macro environment, Needs and trends, Identifying the major forces, the demographic environment, Worldwide population growth, population age mix, Economic environment, Social-cultural environment, Natural environment.

**Conducting marketing research and forecasting demand:** The marketing research process- Step1: Define the problem and the research objectives, Step2: Develop the research plan, Step3: Collect the information, Step4: Analyze the information, Step 5: Present the findings, Step 6: Make the decision, Measuring marketing productivity, Measuring marketing plan performance, Profitability analysis, Marketing-mix modeling, Forecasting and demand measurement, The measures of market demand, A vocabulary for demand measurement, Estimating current demand.

### Unit III

**Creating customer value, Satisfaction, and loyalty:** Building customer value, satisfaction, and loyalty, Customer perceived value, Total customer satisfaction,

Measuring satisfaction, Product and service quality, Total quality management, Maximizing customer lifetime value, customer profitability, measuring customer lifetime value, customer equity, Cultivating customer relationships, Customer relationship management (CRM), Customer database and database marketing, customer databases, Data warehouses and data mining, The downside of database marketing and CRM.

**Analyzing consumer markets:** What influences consumer behavior?, Cultural factors, Social factors, Personal factors, Key psychological processes, Motivation: Freud, maslow, herzberg, Perception, Learning, Memory, The buying decision process: the five-stage model, Problem recognition, Information search, Evaluation of alternatives, purchase decisions, Other theories of consumer decision making, level of consumer involvement, Decision heuristics and biases, Mental accounting, Profiling the customer buying decision process.

#### Unit IV

**Analyzing Business Markets:** What is organizational buying?, The business market versus the consumer market, buying situations, Systems buying and selling, Participants in the business buying process, The buying center, Buying center influences, buying center targeting, The purchasing/procurement process, Purchasing orientations, Types of purchasing processes, Purchasing organization and administration, Stages in the buying process, Problem recognition, General need description and product specification, Supplier search, E-procurement, Managing business-to-business customer relationships, The benefits of vertical coordination.

**Identifying market segments and targets:** Levels of market segmentation, segment marketing, niche marketing, local marketing, customization, segmenting consumer markets, geographic segmentation, Demographic segmentation, psychographic segmentation, behavioral segmentation, Bases for segmenting business markets, sequential segmentation, market targeting, effective segmentation criteria, Evaluative and selecting the market segments, Additional considerations.

#### Unit V

**Dealing with competition:** Competitive forces, Identifying competitors, Industry concept of competition, Market concept of competition, Analyzing competitors, Strategies, Objectives, Strengths and weaknesses, Selecting competitors, Competitive strategies for market leaders, Expanding the total market, Defending the market share, Expanding market share, Other competitive strategies, Market challenger strategies, market-Follower strategies, Market-Nicher strategies, Balancing customer and competitor orientations, Competitor-centered companies, Customer-centered companies.

**Creating brand equity:** What is brand equity?, The role of brands, The scope of branding, Defining brand equity, Brand equity as a bridge, Brand equity models, Building brand equity, Choosing brand elements, Designing holistic marketing activities, Measuring brand equity, Brand audits, Brand tracking, Brand valuation, managing brand equity, Brand reinforcement, Brand revitalization, Brand crisis,

Devising a branding strategy, Branding decision: to brand or not to brand?, Brand Extensions, Brand portfolios, Product life-cycle marketing strategies, product life cycles, Style, fashion and fad lifecycles.

**Marketing strategies:** introduction stage and the pioneer advantage, Growth stage, Maturity stage, decline stage, The product life-cycle concept: critique. Marketing channels and value networks, the importance of channels, Channel development, Value networks, the role of marketing channels, Channel functions and flows, Channel levels. Green marketing- Case studies, Digital marketing -Case studies, Global aspects of markets- Case studies and societal marketing - Case studies.

### **Text books**

1. Philip Kotler, Kevin Lane Keller Abraham Koshy and MithileshwarJha - Marketing Management: A South Asian Perspective, Pearson Education, 13th Edition, ISBN 978- 0-13-607941-5
2. Michael R Czinkota, 2<sup>nd</sup> Edition, 2010 - Marketing Management, Vikas Publishing House, ISBN9780324022032

### **References**

1. Philip Kotler- Principles of Marketing, 3<sup>rd</sup> Edition, 2009, Prentice –Hall.
2. William J Stanton - Fundamentals of Marketing, 9<sup>th</sup> Edition, 2010, McGraw-Hill.
3. Rajagopal - Marketing Management Text & Cases, Vikas Publishing House, ISBN 81- 259-0773-4,2010

### **Course outcomes (COs):**

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

1. Design and develop of marketing solutions for current retail environments by employing appropriate marketing strategies. (PO-2&PSO1)
2. Apply knowledge of basic management skills to maximize employee productivity. (PO-3 &PSO1,2,3)
3. Evaluate and apply marketing practices to create measurable results to meet marketing objectives. (PO-6 &PSO1,2)
4. Analyze the competitors, Their Strategies, their Objectives, Strengths and weaknesses. (PO-4&PSO1,2,3)
5. Devising a branding strategy for Value networks. (PO-4,9&PSO3)



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## PROJECT MANAGEMENT (Open elective-2)

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Course Code: IMOEO2

Credit: 3:0:0

Prerequisite: Nil

Contact Hours: 42

Course Coordinator(s): Dr. M R Shivakumar/Sudheer D Kulkarni

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### Course Content

#### Unit I

**Concepts of Project Management:** Concepts of projects, characteristics of project, Phases of project life cycle, Tools and techniques for project management, Computer based project management.

**Project planning and estimating:** Feasibility report, Preparation of cost estimation, Evaluation of the project profitability.

#### Unit II

**Organizing Human Resources and Contracting:** Delegation, Skills / abilities required for project manager, Authorities and responsibilities of project manager, Project organization, Contracts, Tendering and Selection of contractors.

#### Unit III

**Tools and techniques of project management:** Bar (GANTT) chart, Networks – PERT and CPM, Applications, Basic steps in PERT/CPM, Rules for drawing network diagram, Labelling, Time estimates, Critical Path Method, Project Evaluation and Review Technique (PERT).

#### Unit IV

**Performance measures in Project Management:** Performance indicators, Performance Improvement, Project management and environment.

**Risk Analysis:** Sources, measures and perspectives on risk, sensitivity analysis, scenario analysis, breakeven analysis, Hiller model, simulation analysis, decision tree analysis, managing risk, project selection under risk.

#### Unit V

**Financing of Projects:** Capital structure, menu of financing, equity capital, internal accruals, term loans, debentures, working capital advance, miscellaneous sources, raising of venture capital, raising capital in international markets.

#### Text books

1. Project Management: Choudhry S., Tata McGraw-Hill,2010

2. Projects: Planning, Analysis, Financing, Implementation, and Review- Prasanna Chandra, 5<sup>th</sup> edition, Tata McGraw-Hill publishing company limited,2005
3. Operations Research and Engineering Management, S. D. Sharma, Kedar Nath Ram Nath & Co., 2010

## References

1. A Guide to the Project Management Body of knowledge PMBOK Guide 6<sup>th</sup> Edition, Project Management Institute 2017.
2. Project management a system approach to planning scheduling and controlling- Harold Kerzner, CBS Publisher and distributors, 2002.
3. A management guide to PERT and CPM- WEIST and LEVY Eastern Economy of PH 2002.
4. T R Banga, N K Agarwal and S C Sharma -Industrial engineering and Management Sciences, -Khanna Publishers

## Course outcomes (COs):

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

1. Prepare project plan by applying the concepts of project management (PO- 6,7,10,11&PSO 2,3)
2. Organize and manage the resources of projects (PO- 6,9,11&PSO 3)
3. Apply tools and techniques used in project management (PO- 1,2,3,11 &PSO 1,2)
4. Identify, analyze, quantify and mitigate risks (PO- 11 &PSO 3)
5. Evaluate the sources of finance (PO- 11 &PSO 3)

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## MINI PROJECT

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**Course Code: IM65**

**Credit:0:0 :4**

**Course Coordinator(s): Dr M. Shilpa / Dr. R Shobha**

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### Note:

- A team of four members has to be formed.
- Identify the company in which project work will be carried out.
- The project can also be carried out in-house.
- Identify the problem area in order to carry out the project work.
- Expected outcomes should be clearly stated.
- Applying any one of the engineering tools and techniques to solve the problem.
- Extensive literature review can be carried out in emerging areas, identification of gaps and providing suitable suggestions to bridge the gap.
- The project report should well organized; points should be logically ordered with sharp sense of beginning and end
- Book and conference references along with reference to journal papers should be provided
- Scope for future work must be indicated
- The report should be well formatted and documented with adequate table and figure titles etc.
- Project work evaluation will be progressively carried in three stages and finally at the end of the semester through external examination.
- Project review committee comprises of internal project guide and two faculty members.

### Course outcomes (COs):

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

1. Identify the cross functional interdependencies in a project. (PO- 9,10&PSO-1,2)
2. Suggest / Implement the concepts of Project, financial, technology and industrial management to solve productivity and competitive issues. (PO- 3,11&PSO-2)
3. Participate in cross - functional teams. (PO- 9,10&PSO- 2,3)
4. Provide suggestions to develop new systems or subsystems to solve the identified problem (PO- 3,4&PSO-2)
5. Demonstrate the ability and skill to solve industrial problems within a specific time frame. (PO- 1,2,3&PSO-2,3)

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## OPERATIONS PROCESS CONTROL LAB

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**Course Code:** IML66

**Credit:** 0:0 : 1

**Prerequisite:** Nil

**Contact Sessions :**14

**Course Coordinator(s):** Deepak Kumar / Sudheer D Kulkarni

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### Course Content

#### Laboratory Exercises

1. Supplier / Customer information and order entry for the components of a given product.
2. Confirming supplier / customer information and order details for the components of a given product.
3. Approval of supplier / customer information and order details for the components of a given product.
4. Generating Bill of Material (BOM): entry and item master for the components of a given product.
5. Generating Bill of Material (BOM) report for the components of a given product.
6. Vendor management by rating the vendors against the chosen parameters.
7. Approval of vendors according to the relevant parameters.
8. Generating stock status for the given inventory model.
9. Inventory issue details for the given model.
10. Preparing the inventory received details and generating the GRN.
11. Material Requirement Planning (MRP) entry, run & generation of results.
12. Supply chain: invoice, report and sales.
13. Optimization problems using OR package.
14. Creating quotation process for MRP items with usual terms for a customer.
15. Generate purchase order for MRP items with usual terms for a vendor.

**Note:** At least 13 experiments have to be conducted from the above list of experiments

#### Suggested Software Packages

1. ERP Packages : OPTIMIIZER 10.6
2. Preactor – Scheduling Software OR Packages : Lindo /Lingo

#### Text Books

1. Monks J.G -Operations Management, McGraw-Hill International, Editions - 1987.
2. Pannerselvam. R -Production and Operations Management, PHI, 2<sup>nd</sup> edition.
3. Adam & Ebert -Production and Operation Management, PHI, 5<sup>th</sup> edition

## References

1. Buffa-Modern Production / Operations Management, Wiley India Ltd.-4<sup>th</sup> edition.
2. Chary S.N-Production and Operations Management, Tata-McGrawHill.- 3<sup>rd</sup> edition
3. Chase, Aquilano & Jacobs- Production and Operations Management, Tata-McGraw Hill. – 8<sup>th</sup> edition

## Course outcomes (COs):

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

1. Select the appropriate ERP software based on different criteria like customer order processing, Purchase order, Inventory transactions. (PO- 3,5 & PSO-1,2)
2. Develop bill of materials for engineering design, dispatch slip and payment reconciliation. (PO- 3, 5&PSO- 1, 2)
3. Analyze and interpret the results of optimizations problems. (PO- 3,5&PSO-1,2)

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## QUALITY ASSURANCE AND RELIABILITY LAB

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**Course Code:** IML67

**Credit:**0:0 :1

**Prerequisite:** Nil

**Contact Sessions :**14

**Course co-ordinator(s):** A. Balakrishna/ Dr. M. Shilpa

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### 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. Construction of Xbar- S chart using MS Excel
6. Construction of Xbar – S chart using SYSTAT software
7. Construction of CUSUM chart using SYSTAT software
8. Process capability analysis using Normal Probability Paper method
9. Process capability analysis using Multifunctional Vernier height gauge
10. Process capability analysis using SPC software
11. Process capability analysis using SYSTAT software
12. Process capability analysis using SQC display unit
13. 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
14. Conduction of full factorial experiment – 2 factors and 2 levels
15. Conduction of full factorial experiment – 2 factors and 3 levels
16. Conduction of GRR study
17. Conduction of single sampling plan experiment
18. Conduction of Deming’s funnel experiment
19. Experimentation on DMAIC approach of Six Sigma

**Note:** Any 13 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.4<sup>th</sup> Edition-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-3,4&PSO-1,2)
2. Conduct experiments using principles of design of experiments and analyze the results (PO- 3,4&PSO-1,2)
3. Design the sampling plan and determine producer's and consumer's risks (PO-3,4&PSO-1,2)
4. Conduct experiments on GRR, Six Sigma and variability studies and analyze the results (PO- 3, 4, 5&PSO-1,2)

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## SIMULATION MODELING AND ANALYSIS LAB

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**Course Code: IML68**

**Credit:0:0:1**

**Prerequisite: Nil**

**Contact Sessions: 14**

**Course Coordinator(s): Dr. M Shilpa**

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### Course Content

#### Laboratory Exercises

1. Introduction to Simulation Packages and selection.
2. Simulation of inventory model using MS Excel
3. Building simulation Models for Banking service ( Bank teller problem – with common templates)
4. Building simulation Models for Banking service ( Bank teller problem – with basic templates)
5. Building simulation Models for Mortgage application problem (with common templates)
6. Building simulation Models for Mortgage application problem (with basic templates)
7. Building simulation Models for Post office animation (with common templates)
8. Building simulation Models for Post office animation (with basic templates)
9. Building simulation models for manufacturing operations (Electronic assembly – With Basic templates)
10. Building simulation models for manufacturing operations (Electronic assembly – With Common templates)
11. Building simulation Models for food processing problem (with basic templates)
12. Simulation of garment stitching industry (with basic templates)
13. Simulation of a supermarket (with basic templates)
14. Simulation of a health care system (with basic templates)
15. Simulation of axle manufacturing process (with basic templates)
16. Simulation of vehicle traffic system (with basic templates)

**Note:** At least 13 experiments have to be conducted from the above list of experiments

**Software Packages:** MS Excel, ARENA simulation software package

#### Text books

1. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol -Discrete Event system Simulation, 5<sup>th</sup>Edition, Pearson Education, Asia, ISBN - 81- 7808 – 505 -4.



2. Narsingh Deo -Systems Simulation with Digital Computer; PHI Publication (EEE), ISBN– 0-87692-028-8

### **Reference**

1. Averill M Law, W David Kelton -Simulation Modeling & Analysis, McGraw Hill International Editions – Industrial Engineering series, ISBN –0-07-100803-9.
2. W. David Kelton, RandallSadowski, Nancy Swets, Simulation with Arena, edition 6,Mc Graw Hill,2014

### **Course outcomes (COs):**

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

1. Select the appropriate simulation software based on different criteria like model building features, graphic user interface etc. (PO- 2,3&PSO 2)
2. Build simulation model for simple manufacturing and service operations (PO- 3,4&PSO1,2)
3. Analyze and interpret the results and suggest suitable alternatives for decision making. (PO- 2,3&PSO2)