

RAMAIAH Institute of Technology

# CURRICULUM

## **Outcome Based Education**

Academic year 2023 – 2024

## 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 17 UG programs and 11 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A+' grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. 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 67% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.

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

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, Ramaiah Institute of Technology has achieved 78<sup>th</sup> rank among 1314 top Engineering Institutions & 23<sup>rd</sup> Rank among 105 School of Architecture in India for the year 2023.

#### 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. 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, 2015 & 2022 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 38 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

## RIT shall meet the global socio-economic needs through

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

## **QUALITY POLICY**

We at M. S. 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

## THE VISION OF THE DEPARTMENT

To produce globally competent Industrial Engineers, Researchers and Entrepreneurs capable of developing solutions to continually improve sociotechnical systems and add value to the society.

## THE 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
- 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):**

# The graduate of Industrial Engineering and Management will have the ability to

**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.

## THE PROGRAMME SPECIFIC OUTCOMES (PSOs):

## The graduates of Industrial Engineering and Management program will

**PSO1**: Develop Knowledge, Skills and abilities in the fields such as System design and development, Manufacturing and Research.

**PSO2**: Apply the core competence in the field of industrial and systems engineering to solve real world problem and continuously improve its performance.

**PSO3:** 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 2021-25

Semester Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03					22
Engineering Sciences (ESC)	11	09							20
Humanities, Social Sciences and Management (HSMC)		02	01	01	03	03			10
Ability Enhancement Course (AEC)	01	01	01	01	01		03		08
Universal Human Values (UHV)			02						02
Professional Core Courses (PCC)			11	12	11	05	04		43
Integrated Professional Core Course (IPCC)			03	03	03		04		13
Professional Elective Courses (PEC)					03	06	03		12
Institutional Open Elective Courses (IOE)						03	03		06
Internship (INT)				02		02		05	09
Mini Project / Project Work (PW)						03	03	09	15
Non Credit Mandatory Courses (NCMC)			Yes		Yes				
Total Credits	20	20	21	22	21	22	20	14	160

## SCHEME OF TEACHING V SEMESTER

						C	Total		
SI. No.	Subject Code	Subject	Teaching Department	Category	L	Т	Р	Total	contact hours /week
1	IM51	Management Information Systems & ERP	IEM	PCC	3	0	0	3	3
2	IM52	Computer Integrated Manufacturing and Automation	IEM	IPCC	2	0	1	3	4
3	IM53	Operations Management	IEM	PCC	2	1	0	3	4
4	IM54	Quality Assurance & Reliability	IEM	PCC	3	0	0	3	3
5	IME55x	Program Elective Course – 1	IEM	PEC	3	0	0	3	3
6	IML56	Facilities Planning and Design Lab	IEM	PCC	0	0	1	1	2
7	IML57	Quality Assurance and Reliability Lab	IEM	PCC	0	0	1	1	2
8	AL58	Research Methodology & Intellectual property rights	IEM	HSMC	3	0	0	3	3
9	AEC510	Ability Enhancement Course – V	Any Department	AEC	1	0	0	1	1
<b>Total</b> 17 1 3 21							26		
10	HS59	Environmental Studies *	IEM	NCMC	0	0	0	0	1

\* Environmental Studies is under the category of NCMC, 1 hour teaching per week has to be allocated in the time table.

#### **Professional Elective Course-1**

Sl. No.	Subject Code	Subject	
1	IME551	Human Factors in Engineering	
2	IME552	Database Management Systems	
3	IME553	Fluid and Thermal Systems	
4	IME554	Mechanisms and Machine Design	
ture		*T: Tutorial	*P:

\* L: Lecture

## **SCHEME OF TEACHING**

## **VI SEMESTER**

			Teaching Department Ca				C	redit	S	Total	
SI. No.	Subject Code	Subject			Category	L	Т	Р	Total	contact hours /week	
1	AL61	Management & Entrepreneurship		IEM		HSMC	3	0	0	3	3
2	IM62	Simulation Modelling and Analysis		IEM		PCC	2	1	0	3	4
3	IME63X	Program Elective Course – 2		IEM		PEC	3	0	0	3	3
4	IME64X	Program Elective Course – 3		IEM		PEC	3	0	0	3	3
5	IML65	Simulation Modelling and Analysis Lab	ing and Analysis IEM		PCC	0	0	1	1	2	
6	IML66	Enterprise Resource Planning Lab	Resource Planning Lab IEM		PCC	0	0	1	1	2	
7	IMOE01	Institutional Open Elective – 1 (Project Management)	en Elective – 1 IEM		IOE	3	0	0	3	3	
8	IMP67	Mini Project			PW	0	0	3	3	-	
9	INT68	Innovation/Societal/Entrepreneurship based Internship	trepreneurship		INT	0	0	2	2	-	
						Total	14	1	7	22	20
Professi	ional Elective C	course- 2 & 3									
SI. NO.	Elective Code	Elective Title		SI. NO.	Ele	ective Code	Elective Title				
1	IME631	Big Data Analytics	1 IME641		Product Design and Development						
2	IME632	Lean Manufacturing	2 IME642 Innovation and Te Manageme		echnology ent						
3	IME633	Project Management	3 IME643 Advan		dvanced Operations Research						
4	IME (24	Artificial Intelligence and Machine		4	A INECAA Industrial Dalastic		hatias				

\* L: Lecture

4

IME634

**\*T:** Tutorial

Learning

\*P: Practical

Industrial Robotics

4

IME644

#### V Semester

### **MANAGEMENT INFORMATION SYSTEMS & ERP**

Subject Code: IM51	Credits: 3:0:0		
Pre requisites: Nil	Contact Hours: 42		
Course Coordinator(s): Dr. M Shilpa / Dr. Siddhartha Kar			

#### **Course Content**

#### Unit I

**Foundations of Information Systems in Business**: Information Systems in Business; Real World of Information Systems; Fundamental Roles of IS in Business; Trends in Information Systems; Role of e-Business in Business; Types of Information Systems; Managerial Challenges of Information Technology; Components of Information Systems; System Concepts: A Foundation; Components of Information Systems; Information System Resources; Information System Activities; Recognizing Information Systems.

- Pedagogy: PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc20\_mg60/ https://www.youtube.com/watch?v=BNsHs2J4QAE https://www.coursera.org/lecture/foundations-of-information-systemsfor-business/introduction-to-information-systems-for-business-y026J

#### Unit II

**E-Business Systems:** Cross-Functional Enterprise Applications; Enterprise Application Integration; Transaction Processing Systems; Enterprise Collaboration Systems; Functional Business Systems; Marketing Systems; Manufacturing Systems; Human Resource Systems; Accounting Systems; Financial Management Systems.

- Pedagogy: PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc20\_mg60/ https://slideplayer.com/slide/4910536/

https://www.youtube.com/watch?v=C6sOxEBev4A

#### Unit III

**Security and Ethical Challenges:** Security, Ethical, and Societal Challenges of IT; Ethical Responsibility of Business Professionals; Computer Crime; Privacy Issues; Current State of Cyber Law; Other Challenges; Health Issues; Societal Solutions; Security Management of Information; Technology; Tools of Security Management; Inter-Networked Security Defenses; Other Security Measures; System Controls and Audits.

- Pedagogy: PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc20\_mg60/ https://www.youtube.com/watch?v=kYWV0WQZkOI https://slideplayer.com/slide/7555129/

#### Unit IV

**ERP Implementation**: Introduction, Traditional Information Model, Evolution of ERP, 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?

- Pedagogy: PowerPoint Presentations
- Links: https://www.youtube.com/watch?v=lbdo83T1nBI&t=1366s

https://www.youtube.com/watch?v=5bLFqhLy\_Lg https://www.youtube.com/watch?v=a-KuSsx1JmE https://www.youtube.com/watch?v=CvVzst0R12A https://www.youtube.com/watch?v=NzyhYxUCjlg&list=PLSGws\_74K 01 MBJaKLVaP0iCupVawlL6i&index=60

#### Unit V

After ERP Implementation: Organizational Structure, Roles and Skills, Knowledge Management, Application Management, Ongoing Implementation Efforts, Upgrading Versus New Software.

**Operation and Maintenance of the ERP System:** Employee Relocation and Re-Training, Continuous Training, Review, Operation of The ERP System, ERP Maintenance Phase.

**Measuring the Performance and Maximizing the ERP System:** Use Metrics to Measure Success, How to Measure? Importance of Measuring Performance, Metrics, Types of Metrics, Business Performance Management, Business Analytics, Reporting, and Intelligence, Extend the Power of ERP Using Internet, Training and Learning.

- Pedagogy: PowerPoint Presentations
- Links: https://www.erpsoftwareblog.com/2021/01/tips-for-efficient-erpsystem-maintenance/ https://www.inteltech.com/how-to-measure-erp-performance/ https://www.columbusglobal.com/en-gb/blog/how-to-maximise-the-benefitsof-your-erp-system

#### **Text Books**

- 1. Management Information Systems James A. O 'Brien and George M. Marakas, Tenth Edition (2011), McGraw-Hill Irwin. ISBN: 978-0-07-337681-3
- ERP Demystified Alexis Leon, Third Edition (2014), McGraw Hill Education (India) Private Limited. ISBN: 978-93-83286-67-6

#### Reference

- Management Information Systems Kenneth Laudon & Jane Laudon (Pearson, 2017)
- 2. Management Information Systems Ken Sousa & Effy Oz (Cengage, 2014)
- 3. Integrated Business Process with ERP Systems Simha R Magal and Jeffrey Word (John Wiley & Sons, 2010)

#### Course Outcomes (COs):

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

- 1. Understand the foundation concepts of information systems in businesses. (PO-1,5,10 & PSO-1)
- 2. Apply the concepts of information systems to various business applications (PO-2,3,5 & PSO-2)
- 3. Analyze the challenges involved in the use of information technology (PO-5,6,8,9 & PSO-2)
- 4. Analyze the reasons for implementing ERP and understand its phases. (PO-5 & PSO-2)
- 5. Evaluate the performance of ERP system and maximize it. (PO- 5 & PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks					
Assessment Tool	Marks	Course outcomes addressed			
Internal test-I	30	CO1, CO2			
Internal test-II	30	CO3, CO4, CO5			
Average of the two internal tests shall be taken for 30marks.					
Other components					
Surprise Test	10	CO1, CO2, CO3, CO4			
Assignment	10	CO1, CO2, CO3, CO4, CO5			
Semester End Examination (SEE)	100	COI, CO2, CO3, CO4, CO5			

## COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION

Subject Code: IM52	Credits: 2:0:1			
Pre requisites: Nil	Contact Hours: 28+14P			
Course Coordinator(s): Dr. B S Sridhar / Dr. Siddhartha Kar				

#### **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.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=9fqygvj-O2s https://www.youtube.com/watch?v=\_OaBMsUgqgQ

#### Unit II

**Computer Controls in NC:** Introduction, NC Controller Technology, Computer Numerical Control, Direct Numerical Control.

**APT Part programming:** Introduction, NC Coordinate Systems. APT Language – APT programming problems.

- Pedagogy: Chalk board, power point presentations
- Links:https://www.youtube.com/watch?v=ImtSsDLgAaI&list=PLSGws\_74K0 1-KX9YtVZACpOoFYy60aJIC

#### Unit III

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

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=\_5r2XR1h1aQ https://www.youtube.com/watch?v=20\_K7c65Swg

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=DnjMuB0LNbQ https://www.youtube.com/watch?v=v3TmN4HhLc&list=PLwdnzlV3og oW31clPN6Dn6c8Ia-n36vXk

#### Unit V

**Industrial Robotics:** Introduction to Robots, Anatomy and related attributes, robot control systems, ends effectors, industrial robot applications.

- Pedagogy: Chalk board, power point presentations
- Links:https://www.youtube.com/watch?v=a6\_fgnuuYfE&list=PLyqSpQzTE6 M\_XM9cvjLLO\_Azt1FkgPhpH https://www.youtube.com/watch?v=DnjMuB0LNbQ

#### Lab component

Sl no	Name of the Experiment
01	NC Part programming for turning model-1
02	NC Part programming for turning model-2
03	NC Part programming for turning model-3
04	NC Part programming for milling model-1
05	NC Part programming for milling model-2
06	NC Part programming for milling model-3
07	Pick & Place components – Robotics Lab

## **Text Books**

- 1. P Mikell. Groover -Automation, Production systems, and Computer Integrated Manufacturing, PHI 2008, 2ndedition
- 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> edition2004
- 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)
- 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)

Continuous Internal Evaluation: 50 Marks					
Assessment Tool	Marks	Course outcomes addressed			
Internal test-I	30	CO1, CO2			
Internal test-II	30	CO3, CO4, CO5			
Average of the two internal tests shall be taken for 30marks.					
Other components					
Laboratory	10	CO2, CO3, CO5			
Laboratory	10	CO2, CO3, CO5			
Semester End Examination (SEE)	100	COI, CO2, CO3, CO4, CO5			

<b>OPERATIONS MANAGEMENT</b>					
Subject Code: IM53	Credits: 2:1:0				
Pre requisites: Nil Contact Hours: 28+14T					
Course Coordinator(s): Dr. R Shobha / Smt. Hamritha S					

#### **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

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=DEuzzLled6k https://www.youtube.com/watch?v=b0YfKoK2uF0 https://www.youtube.com/watch?v=-VJkXWmrJXI https://www.youtube.com/watch?v=a1HBvgR2pDA

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=ydvnVw80I\_8 https://www.youtube.com/watch?v=jOafCEFZ1\_8 https://www.youtube.com/watch?v=ez4yTfUQXG8 https://www.youtube.com/watch?v=jyIv9NQW2pE https://www.youtube.com/watch?v=H2O2qVI5T4c https://www.youtube.com/watch?v=3YH1cNXMdjE

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links:https://www.youtube.com/watch?v=kH6UALawYt8&list=PLLy\_2iUCG 87A-kHGx4YUY97ShTTqBfA6-&index=8 https://www.youtube.com/watch?v=Rjwknl\_LuKw&list=PLLy\_2iUCG 87A-kHGx4YUY97ShTTqBfA6-&index=9 https://www.youtube.com/watch?v=928eUjDCqJs&list=PLLy\_2iUCG8 7A-kHGx4YUY97ShTTqBfA6-&index=10

#### 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, Underlying concepts, MRP logic, (Numerical on MRP calculations)

- Pedagogy: Chalk board, power point presentations
- Links:https://www.youtube.com/watch?v=xpLnRD334Ag&list=PLLy\_2iUCG 87A-kHGx4YUY97ShTTqBfA6-&index=32

https://www.youtube.com/watch?v=vmk3yzQArpo&list=PLLy\_2iUCG 87A-kHGx4YUY97ShTTqBfA6-&index=25

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=rVGZu6AClPI https://www.youtube.com/watch?v=3xm6MrZvF5A https://www.youtube.com/watch?v=xZs7WsNPJXY https://www.youtube.com/watch?v=chGrYmBNn5Y

#### **Text Books**

- Monks J.G -Operations Management, McGraw-Hill International 2<sup>nd</sup> Editions-2020.
- 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
- Chary S.N -Production and Operations Management, Tata-McGraw Hill. 3<sup>rd</sup> edition 2015
- 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 for controlling production activities (PO- 1,2,3 & PSO-2,3)

Continuous Internal Evaluation (CIE): 50 Marks					
Assessment Tool	Marks	Course outcomes addressed			
Internal test-I	30	CO1, CO2			
Internal test-II	30	CO3, CO4, CO5			
Average of the two internal tests shall be taken for 30marks.					
Other components					
Quiz	10	CO1, CO2, CO3, CO4, CO5			
Assignment	10	CO1, CO2, CO3, CO4, CO5			
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5			

## QUALITY ASSURANCE AND RELIABILITY

Subject Code: IM54	Credits: 3:0:0			
Pre requisites: Applied Probability and Statistics	Contact Hours: 42(L)			
Course Coordinator(s): Dr. G S Prakash / Smt. Hamritha S				

#### **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, audit approach, ingredients of a quality program.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=0hzqHwu1i\_I https://www.youtube.com/watch?v=ztlbEP30s-k https://www.youtube.com/watch?v=tDrV\_070InY

#### Unit II

**Statistical Process Control:** Introduction to statistical process control. SPC tools and techniques 7QC tools, Process capability – Basic definition, standardized formula and Six sigma concept of process capability.

**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.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=a48pHKKgU0o

https://www.youtube.com/watch?v=5iQm2G8Zekk https://www.youtube.com/watch?v=D-hm5YfG0CM https://www.youtube.com/watch?v=9HRd7WSWGHY

#### Unit III

**Control Charts for Attributes:** Development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Advanced quality concepts.

**Design of experiments** – Quality Loss function, Step function, Quadratic loss function, Types of loss functions, problems.

Pedagogy: Chalk board, power point presentations
Links: https://www.youtube.com/watch?v=AatGnlsOdAY
https://www.youtube.com/watch?v=7PCFyERnp7I

#### Unit IV

**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

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=IWkiBm0DKtY https://www.youtube.com/watch?v=4H5wdZ3qHZU

#### Unit V

**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, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=\_c-iZ2BAXPw

#### **Text Books**

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

 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)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Surprise Test	10	CO1, CO2, CO3, CO4	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	COI, CO2, CO3, CO4, CO5	

#### **HUMAN FACTORS IN ENGINEERING**

Subject Code: IME551

Credits: 3:0:0

Pre requisites: Nil

**Contact Hours: 42** 

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

#### **Course Content**

#### Unit I

**Introduction:** What is ergonomics/human factors? The purpose of production ergonomics, Historical development of ergonomics and human factors, how are ergonomics and human factors connected to engineering?

**Human Engineering Basics:** Basic Anatomy and Physiology, Musculo-skeletal disorders, How big is the problem? The musculo-skeletal system, the muscles, the skeletal system, Joints, Injuries and healing, Movements, Musculo-skeletal complexes, the back, the neck, the shoulders, the hands.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=G5PxuOEUWA8&list=PLFkR6k-V2SSr J7OSXn kyp6WSnyh9JP2

#### Unit II

**Physical Loading:** The components of physical loading, Posture, Force, Time, Interaction of posture, forces and time, other factors influencing physical loading, Biomechanics, Applying mechanics to the human body.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=lpIBwp7txhY

#### Unit III

Anthropometry: Designing for the human, Terminology, Static (structural) measurements, Dynamic (functional) measurements, Normal distribution and percentiles, Correlations, Multivariate design, Variation, Methods for measuring body dimensions, Anthropometric datasets, Design principles, Designing for the extremes, Designing for adjustability, Designing work heights.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=MeDjaJTdX20 https://www.youtube.com/watch?v=mtar06a3Dh8

#### Unit IV

**Cognitive Ergonomics:** What cognitive limitations exist in the workplace? Human capabilities and limitations, The senses, Human cognitive processes, The role of expertise: The SRK model and types of mistakes, Mental workload, Designing to support human mental capabilities, Cognitive ergonomics supports used in industrial production, Design For Assembly, The use of fixtures, Kitting, Standardized work, Work instructions, Poka yoke.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=k\_NyvdOOsNw

#### Unit V

**Ergonomics Evaluation Methods:** Heuristic evaluation (HE), Methods for evaluating physical loading, Posture-based analysis, Biomechanics-based analysis, Multi-aspect methods, Standards, legal provisions and guidelines, Example: Swedish AFS provisions.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=k NyvdOOsNw

#### **Text Books**

- 1. Cecilia Berlin, & Caroline Adams, Production Ergonomics Designing Work Systems to Support Optimal Human Performance, Ubiquity Press Ltd., Windmill Street, London, 2017.
- Wickens, C.D., Lee, J.D., Liu, Y., Gordon Becker, S.E. (2004). An Introduction to Human Factors in Engineering (2nd Ed.). Upper Saddle River, New Jersey: Pearson Prentice-Hall.

#### References

- 1. Industrial Design for Engineers Mayall W.H. London Hiffee books Ltd. 1988.
- 2. Applied Ergonomics Hand Book Brain Shakel (Edited) Butterworth scientific London -1988.
- 3. Introduction to Ergonomics R. C. Bridger McGraw Hill Publications 1995.
- Human Factor Engineering Sanders & McCormick McGraw Hill Publications – 6<sup>th</sup> edition, 2002

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

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

1. Gain a comprehensive understanding of ergonomics, assess and design of ergonomic solutions in various contexts. (PO- 1,2,3,4,5,6 & PSO-1,2)

- 2. Understand and analyze the components of physical loading and apply mechanics to the human body. (PO-2,3,5 & PSO-1,3)
- 3. Apply anthropometric principles to design and develop solutions for ergonomic challenges in various contexts. (PO- 1,2,3,5,7 & PSO-2,3)
- 4. Understand human cognitive processes and have practical knowledge of designing for assembly of products. (PO- 3,4,5,6 & PSO-1,3)
- 5. Proficiently apply heuristic evaluation and be aware of legal provisions and guidelines of ergonomics. (PO-2,6,8 & PSO- 2,3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30marks.		
Other components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATABASE MANAGEMENT SYSTEMS		
Subject Code: IME552	Credits: 3:0:0	
Pre requisites: Nil Contact Hours: 42 (L)		
Course Coordinator(s): Dr. G S Prakash / Smt. Hamritha S		

#### **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.

- Pedagogy: Chalk board, power point presentations
- Links: https://nptel.ac.in/courses/106106220

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links: https://nptel.ac.in/courses/106106220

#### 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.

- Pedagogy: Chalk board, power point presentations
- Links: https://nptel.ac.in/courses/106106220

## Unit IV

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

- Pedagogy: Chalk board, power point presentations
- Links: https://nptel.ac.in/courses/106106220

#### Unit V

**Database Design:** Design guidelines for relational schemes, functional Dependencies, normalization -1st, 2nd, 3rd Database design process.

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

- Pedagogy: Chalk board, power point presentations
- Links: https://nptel.ac.in/courses/106106220

#### **Text Books**

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

#### References

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

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30marks.		
Other components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

FLUID AND THERMAL SYSTEMS		
Subject Code: IME553	Credits: 3:0:0	
Pre requisites: Nil Contact Hours: 42		
Course Coordinator(s): Dr. M R Shivakumar / Dr. Sridhar B S		

#### **Course Content**

#### Unit I

**Properties of fluids**: Introduction to fluid mechanics and its applications, properties of fluids, viscosity, thermodynamics properties, surface tension, capillarity, vapor pressure and cavitation.

Fluid pressure: Fluid pressure at a point, pascal's law, pressure variation in a static fluid, absolute, gauge, atmosphere and vacuum pressure. Manometers, simple and differential manometers

- Pedagogy: Chalk board, power point presentations
- Links: https://testbook.com/learn/fluid-properties/ https://www.toppr.com/guides/physics/force-and-pressure/fluid-pressure/

#### Unit II

**Fluid Dynamics:** Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, limitation of Bernoulli's equation, fluid flow measurements, veturi – meter.

**Flow through pipes**: Frictional loss in pipe flow, Darcy's – equation (No derivation) and Chezy's equation for loss of head due to friction in pipes (No derivations), hydraulic gradient line and total energy line.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=3ME-s1z1uk8 https://www.youtube.com/watch?v=S-oHA7sDyJU

#### Unit III

**Fundamental Concepts & Definitions:** Thermodynamics-definition and applications. Microscopic and macroscopic view point. System-types of systems, boundary, Thermodynamic properties- intensive and extensive properties, Thermodynamic state, path, process, cyclic and non-cyclic processes, quasi-static process, point and path functions. Thermodynamic equilibrium, Temperature-zeroth law of thermodynamics, concepts, temperature measurement scales.

**Work & Heat:** Definition of displacement work and its limitations, similarities and dissimilarities of heat and work. Expressions for displacement work in various processes through P-V diagrams.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=6QXtnmB1vqk https://www.youtube.com/watch?v=vlzYLk5ll14

#### Unit IV

**First Law of Thermodynamics:** First law for a closed system undergoing a cycle, First law for a closed system undergoing a change of state, Energy-energy as a property, different forms of stored energy, specific heat ay constant volume, enthalpy, specific heat at constant pressure, Energy of an isolated system. Limitation of the first law, First law applied to the flow process-control volume, steady flow process, mass balance and energy balance in a steady state-steady flow process, important applications-Nozzle, diffusor, throttling device, turbine and compressor, heat exchanger.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=NyOYW07-L5g https://www.youtube.com/watch?v=10FlW80XN64

#### Unit V

**Second Law of Thermodynamics:** Thermal reservoirs, Devices- heat engine, heat pump and refrigerator -schematic representation and efficiency. Kelvin-Planck statement and Clausius'statement of Second law of thermodynamics; PMM1 and PMM2, Carnot cycle, Thermodynamic temperature scale.

Air Standard Cycle: Assumptions, Efficiencies of Otto cycle, Diesel cycle, Dual cycle. (no nemericals)

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=WTtxlaeC9PY https://www.youtube.com/watch?v=DWiCaDPM7Hk

#### **Text Books**

- 1. Fluid Mechanics by Dr. Bansal. RK Lakshmi publications, 4th edition 2011
- 2. Fluid Mechanics by Streeter, 1<sup>st</sup> edition 2005
- Fluid Mechanics and hydraulics, by Jagadish Lal, Metropolitan book co-Ltd 4<sup>th</sup> edition 2004
- 4. P.K. Nag –Basic and Applied Thermodynamics, Tata McGraw Hill, 3<sup>rd</sup> Edition. 2003
- 5. Yunus A. Cenegal and Michael A. Boles –Thermodynamics an engineering approach, Tata McGraw hill Pub. 2006
- Rajput –Engineering Thermodynamics, Laxmi Publication pvt ltd., 3<sup>rd</sup> Edition. 2007.

#### **Reference books**

- 1. Fluid Mechanics by Modi and Seth, 5th edition 2004
- Engineering Fluid Mechanics by Dr. K.L.Kumar, revised edition 2009.S Chand & Co
- 3. Fluid Mechanics and fluid power Engineering by Kumar .D.S, Kataria & Sons, 2<sup>nd</sup> edition 2004.
- 4. J.B.Jones and G.A.Hawkin –Engineering Thermodynamics, John Wiley and Sons.
- 5. S.C.Gupta Thermodynamics, Person Edu. Pvt. Ltd., 1st Edition, 2005.

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

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

- 1. Understand the basic principles and applications of properties of fluid and fluid statics. (PO-1,2,3 & PSO1)
- 2. Apply basic concepts of fluid dynamics, friction in pipe flows, fluid flow measurements (PO:1,2,3,4 & PSO1)
- 3. Apply the concepts of heat and work in thermodynamics devices. (PO:1, 2 & PSO1, 2)
- 4. Apply the first laws to the thermodynamic system. (PO-1, 2, 3 & PSO1, 2)
- Solve engineering problems by utilizing laws of thermodynamics. (PO-1, 2, 3 & PSO1, 2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

MECHANISMS AND MACHINE DESIGN		
Subject Code: IME554	Credits: 3:0:0	
Pre requisites: Nil Contact Hours: 42		
Course Coordinator(s): Dr. Sridhar B S / Smt. Hamritha S		

#### **Course Content**

#### Unit I

**Introduction, Kinematic chain and Inversions:** Definitions, Link or element, kinematic chain, mechanisms, inversion, machine, grubler's criterion mobility of mechanisms, four bar chain, single slider crank chain & double slider crank chain & their inversions.

**Kinematic mechanisms:** Quick return motion mechanism –Whitworth mechanism intermittent motion mechanism – Geneva mechanism, Pantograph, Ackerman's steering gear mechanism, condition for correct steering.

- Pedagogy: Chalk board, power point presentations
- Links: https://archive.nptel.ac.in/courses/112/106/112106270/ http://vlabs.iitkgp.ernet.in/mechanisms/mechanism\_videos/mechvid2.htm

#### Unit II

**Balancing of Machinery: Balancing of rotating masses:** Balancing of several masses in the same plane, balancing of masses rotating at different planes –Tabular Column method only.

**Cams:** Types of cams, followers. Displacement, velocity and acceleration time curves for cam profiles, follower motions including SHM, Uniform velocity, uniform acceleration & retardation.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=HKVvJWArgg8 https://www.youtube.com/watch?v=55tKVBVQDUY

#### Unit III

**Design for Static Strength:** Static strength; Static loads and factor of safety; Theories of failure -Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory; Stress concentration, Determination of Stress concentration factor.

**Variable Stresses in machine parts:** Fatigue strength, S -N diagram, cyclic loading, High cycle fatigue, Endurance limit, effect of loading on endurance limit. Modifying factors -size effect, surface effect, Stress concentration effects; fatigue stress concentration factors, Soderberg's relationship.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=v02OXAFKFyU https://www.youtube.com/watch?v=3vXNsNemMz4 https://www.youtube.com/watch?v=\_zYm5VmGMRo https://archive.nptel.ac.in/courses/112/105/112105124/ https://www.youtube.com/watch?v=pV-8KGPfIfA

#### Unit IV

**Design of springs:** Types of springs -stresses in coil springs of circular cross sections. Tension and compression springs

**Design of Mechanical Joints:** Riveted Joints -Types, rivet materials, Failures of Riveted joints (Problems on Longitudinal joints only), Welded Joints - Eccentrically loaded welds.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=QfhIea6KzZA https://www.youtube.com/watch?v=C5ZPaCvoigw https://www.youtube.com/watch?v=Ih6h\_c2zkh0

#### Unit V

**Design of Gears and gear trains:** Introduction to Spur gears. Design of spur gear, Lewi's equation, Lewi's form factor- dynamic and wear load.

Types of gear trains, problems on simple, compound and epicyclic gear trains, tabular column method only.

- Pedagogy: Chalk board, power point presentations
- Links: https://www.digimat.in/nptel/courses/video/112105234/L33.html https://www.digimat.in/nptel/courses/video/112105234/L39.html https://www.digimat.in/nptel/courses/video/112105219/L01.html

#### **Text Books**

- 1. Shigley, Joseph Edminister -Theory of Machines, Oxford University press 2011.
- 2. Sadhu Singh Theory of Machines, Pearson Education, 2008.
- R. S. Khurmi & J. K. Gupta -Theory of machines, Eurasia Publishing House, 2008
- 4. Joseph Edward Shigley -Mechanical Engineering Design, Tata McGraw Hill, 7<sup>th</sup> edition, 2008.
- 5. Robert .L. Norton -Machine Design, Pearson Education Asia, 3<sup>rd</sup> edition, 2009.

#### **Design Data Hand Books**

 K. Lingaiah -Design Data Hand Book, Suma Publications, 2<sup>nd</sup> edition 2006, Vol.1 & Vol.2.

#### References

- 1. Thomas Bevan -Theory of Machines, Pearson 2011
- 2. Ballaney Theory of Machines, Khanna Publication 2003
- 3. R S Khurmi and J K Gupta -A text book of Machine Design, Eurasia Publishing House, 13th edition, 2005.
- 4. V B Bahandri Design of Machine Elements, Tata McGraw Hill publishing co, Ltd., 2nd Edition, 2008.
- 5. R. K. Jain Machine Design, Khanna Publications, 2nd edition, 2002.
- 6. JBK Das & P L Srinivasmuthy -Design of Machine Elements Volumes I & II, Sapna book house, 2nd edition, 2012.

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

At the end of the course, students will be able

- 1. Determine the mobility of kinematic mechanisms and understand their applications. (PO-1, 2 & PSO1)
- 2. Analyze the rotating masses and determine the balancing forces in a machine. (PO-1, 2, 3 & PSO1, 2)
- 3. Apply the gyroscopic principles and effects on aeroplane, ship and two wheeler and designing of CAMS (PO-1, 2, 3 & PSO1, 2)
- 4. Design liquid proof riveted/welded joints taking into account the efficiency of the joint and design of springs based on applications. (PO-1, 2, 11 & PSO1)
- 5. Design suitable sized gears as per the standard design procedure and also test for safety of design and apply the law of gearing and determine the suitable gear train combination based on the application. (PO-1, 2, 3, 11 & PSO1, 2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

## FACILITIES PLANNING AND DESIGN LAB

Subject Code: IML56

Credits: 0:0:1

Pre requisites: Nil

Contact Hours: 14

Course Coordinator(s): Dr. M Rajesh / Dr. Siddhartha Kar

## **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

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

## References

- 1. Muther Richard -Practical layout, Mc GrawHill-1955.
- 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)
- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=q8xxKVtRbws https://www.youtube.com/watch?v=P0AW\_kMmI2I https://www.youtube.com/watch?v=cTtu2P9dGqE

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Evaluation-Lab Record	30	CO1,CO2,CO3
Lab Test	20	CO1,CO2,CO3
Semester End Examination (SEE)	50	CO1,CO2,CO3

## **QUALITY ASSURANCE AND RELIABILITY LAB**

Subject Code: IML57

Credits: 0:0:1

Pre requisites: Nil

**Contact Sessions: 14** 

## Course Coordinator(s): Smt. Hamritha / Dr. Niranjan C A

## **Course Content**

## Lab experiments

- 1. Construction of Xbar- R chart using SPC software
- 2. Construction of Xbar- R chart using SYSTAT software
- Construction of Xbar- R chart using Multifunctional Vernier height gauge 3.
- 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, nPchart, 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 12 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
- Juran and Gryna-Quality Planning and Analysis, 3<sup>rd</sup> edition, TMH. 4<sup>th</sup> Edision-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)
- Pedagogy: Chalk board, power point presentations
- Links: https://www.youtube.com/watch?v=RiKUZqW41UM https://www.youtube.com/watch?v=TKTSy6CnZE8 https://www.youtube.com/watch?v=Dgs-k4hfhB4

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Weekly Evaluation-Lab Record	30	CO1,CO2,CO3, CO4
Lab Test	20	CO1,CO2,CO3, CO4
Semester End Examination (SEE)	50	CO1,CO2,CO3, CO4

# RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS

Subject Code: AL58 Pre requisites: Nil Credits: 3:0:0 Contact Sessions: 42 Hours

Course Coordinator(s): Dr. M Shilpa / Dr. Siddhartha Kar

#### **Course Content**

#### Unit I

#### **Research Methodology**

**Introduction:** Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Conceptualizing Research, Critical and Creative Reading.

**Citations:** Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments, and Attributions.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22\_ge08/preview

#### Unit II

**Research Design:** Need for Research Design, Important Concepts Related to Research Design: Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis, Experimental and Control Groups, Treatments.

**Experimental Designs:** Introduction to Randomised Block Design, Complete Randomised Design, Latin Square Design, and Factorial Design.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22\_ge08/preview

#### Unit III

Method of Data Collection: Primary and Secondary Data Collection.

**Sampling Design:** Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design.

**Data Analysis:** Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors, Level of Significance. Procedure for Hypothesis Testing: Mean, Variance, Proportions. Chi-square Test, Analysis of Variance (One Way

ANOVA), and Covariance (ANOCOVA)

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc23\_ge36/preview

#### Unit IV

#### **Intellectual Property Rights**

**Introduction to IPR:** Different forms of IPR, Role of IPR in Research and Development. TRIPS Agreement, Patent Cooperation Treaty (PCT).

**Patents:** Brief history of Patents-Indian and Global Scenario, Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Non Patentable Inventions. Rights Conferred to a Patentee, Basmati Rice Patent Case.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

#### Unit V

**Design:** What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design,

**Trademarks:** Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements, Types of Reliefs, Case Studies.

**Copyrights:** Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights, Case studies

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

#### **Text Books:**

- 1. C. R Kothari, Gourav Garg, Research Methodology Methods and Techniques. New Age International Publishers.
- 2. Dr. B L Wadehra Law relating to Intellectual property. Universal Law Publishing Co.
- Dipankar Deb, Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0.

#### **Reference Books:**

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4

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

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

- 1. Possess the knowledge of research and conduct a literature review. (PO-8, PO-10, PO-12)
- 2. Apply the knowledge of research design and design of experiments. (PO-4, PO-8, PO 10, PO-12)
- 3. Analyse data collection methods, analysis, and sampling design. (PO-4, PO-8, PO-10, PO-12)
- 4. Understand the global and Indian scenarios of patents and patent applications. (PO-8, PO-10, PO-12)
- 5. Acquire the requirements of registration and infringements related to trademarks, copyrights, and designs. (PO-8, PO-10, PO-12)

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment tool	Marks	Course outcome attained		
Internal test - 1	30	CO1, CO2, CO3		
Internal test - 2 30 CO4, CO5				
The average of the two internal tests will be taken for 30 marks				
Other Components				
Assignment	10	CO1, CO2		
Quiz 10 CO3, CO4, CO5				
Semester End Examination (SEE)100CO1, CO2, CO3, CO4, CO5				

<b>ABILITY ENHANCEMENT COURSE - V</b>	
Course Code: AEC510	Credits: 1:0:0
Pre – requisites: Nil	Contact Hours: 14L
Course Coordinator: Any Department	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

# ENVIRONMENTAL STUDIES

Course Code: HS59	Credits: 0:0:0
Pre – requisites: Nil	<b>Contact Hours: 14L</b>
Course Coordinator: Dr. Hemavathy S	

#### **Course Content**

#### Unit I

#### Environment, Ecology and Biodiversity

Definition, scope, and importance. Multidisciplinary nature of Environmental studies. Food chain and food web. Energy flow and material cycling in the ecosystem. Biodiversity and threats to biodiversity. Concept of sustainable development: Definition, objectives, and applications.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentations, Videos, Models
- Link: https://youtu.be/I\_bnGkviWOU https://youtu.be/Ar04qG1P8Es

#### Unit II

#### Natural resources

Forest resources: Ecological importance of forests. Water resources: Global water resources distribution. Mineral resources: Environmental effects of extracting and processing Mineral resources. Food resources: Effects of modern agriculture. Land resources: Soil erosion and Desertification.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentations, Videos
- Link: https://youtu.be/vsXv3anIBSU https://youtu.be/1rOVPqaUyv8

#### Unit III

#### **Energy sources**

Growing energy needs. Conventional and non-conventional / Renewable and Nonrenewable energy sources. Bio Energy-Ethanol and Bio mass energy. Energy of the future – Hydrogen fuel cells and Nuclear energy. Environmental Impact Assessment (EIA): Definition, Objectives and benefits. Step by step procedure of conducting EIA.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentations, Animations, Models
- Link: https://youtu.be/mh51mAUexK4 https://youtu.be/XS-eXqppf\_w

#### Unit IV

#### **Environmental pollution**

Definition, Causes, Effects and control measures of Water pollution, Air pollution and Soil/ land pollution. Management of Municipal Solid Waste and treatment methods of municipal solid waste.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentations, Videos
- Link: https://youtu.be/NRoFvz8Ugeo https://youtu.be/DAQapF-F4Vw

#### Unit V

#### **Environmental protection**

Global warming and Climate change, Acid rain, Ozone layer depletion. Salient features of Environmental Protection Act, Air & Water Acts. Functions of Central and State Pollution Control Boards.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentations, Videos, Open source softwares
- Link: https://youtu.be/iV-BvYwl4Y8 https://youtu.be/BYqLRGawoH0

#### **Text Books:**

1. Dr. S M Prakash - Environmental Studies, Elite Publishers, 2007.

#### **Reference Books:**

1. P. Venugopala Rao – Principles of Environmental Science & Engineering Prentice Hall of India, 1st edition, 2006.

#### Web links and video Lectures (e- Resources):

- 1. https://youtu.be/I\_bnGkviWOU
- 2. https://youtu.be/vsXv3anIBSU
- 3. https://youtu.be/mh51mAUexK4
- 4. https://youtu.be/NRoFvz8Ugeo
- 5. https://youtu.be/iV-BvYwl4Y8

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

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

- 1. Describe the importance of environmental studies, sustainable development and biodiversity (PO-1, 7)
- 2. Explain the importance and conservation of impacts of natural resources (PO-1, 7)
- 3. Distinguish the energy sources and identify the alternative energy sources for sustainable development (PO-1, 7)
- 4. Identify the causes, effects and control measures of pollution in developmental activities (PO-1, 7)
- 5. Outline the current environmental issues and the role of the agencies for environmental protection (PO-1, 7)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment tool	Marks	Course outcomes attained	
Internal Test-I	30	CO1, CO2, CO3	
Internal Test-II	30	CO4, CO5	
Average of the two internal test shall be taken for 30 marks			
Other components			
Assignment – MCQ, Objectives	10	CO1, CO2	
Assignment – Quiz, Group presentation	10	CO3, CO4	
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5	

#### **VI Semester**

# **MANAGEMENT & ENTREPRENEURSHIP**

Subject Code: AL61

Credits: 3:0:0

Pre requisites: Nil

**Contact Hours: 42** 

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

#### **Course Content**

#### Unit I

Introduction to Management: Definition of Management, Its nature and purpose, Contributions of F.W. Taylor and Henry Fayol to management theory, Functions of managers.

Planning: Types of plans, Steps in planning, the planning process, Management By Objectives (MBO)

Organizing: The nature and purpose of organizing, Formal and informal organization. Organization levels and Span of management, Principle of span of management, the structure and process of organizing

- Pedagogy: Chalk and Talk, PowerPoint Presentations ٠
- Links: https://onlinecourses.nptel.ac.in/noc23 mg33/preview • https://www.digimat.in/nptel/courses/video/110107150/L01.html

#### Unit II

Staffing: Situational factors affecting staffing.

Leading: Human factors in managing, definition of leadership, Ingredients of leadership

Controlling: Basic control process, Critical control points and standards, Control as a feedback system, Feed forward control, Requirements for effective controls.

- Pedagogy: Chalk and Talk, PowerPoint Presentations ٠
- Links: https://nptel.ac.in/courses/110107150 ٠

# Unit III

Introduction to Entrepreneurship: The Foundations of Entrepreneurship: What is an Entrepreneurship?, The benefits of Entrepreneurship, The potential drawbacks of Entrepreneurship; Inside the Entrepreneurial Mind: From Ideas to Reality: Creativity, Innovation and Entrepreneurship, Creative Thinking, Barriers to Creativity

- Pedagogy: Chalk and Talk, PowerPoint Presentations ٠
- Links:https://www.youtube.com/watch?v=Hgj kRrvbhQ&list=PL7oBzLzHZ1 • wXW3mtolxV5nIGn48NLKwrb

#### Unit IV

**The Entrepreneurial Journey:** Crafting a Business Plan: The benefits of creating a business plan, The elements of a business plan; Forms of Business Ownership and Buying an Existing Business: Sole proprietorships and partnership.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links:https://www.youtube.com/watch?v=Tzzfd6168jk&list=PLyqSpQzTE6M 8EGZbmNUuUM7Vh2GkdbB1R

#### Unit V

**Launching the Business:** Franchising and the Entrepreneur: Types of Franchising, The benefits of buying a Franchise; E-Commerce and the Entrepreneur: Factors to consider before launching into E-commerce, Ten Myths of E-Commerce.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links:https://www.youtube.com/watch?v=5RMqxtMwejM&list=PLyqSpQzTE 6M9zMKj\_PSm81k9U8NjaVJkR

#### **Text Books**

- 1. Harold Koontz, H. Weihrich, and A.R. Aryasri, Principles of Management, Tata McGraw-Hill, New Delhi, 2004.
- 2. Essentials of Entrepreneurship and Small Business Management Norman Scarborough & Jeffrey Cornwall (Pearson, 2016)

#### References

- 1. Innovation & Entrepreneurship Peter Drucker (Harper, 2006)
- 2. Entrepreneurship: The Art, Science, and Process for Success Charles Bamford & Garry Bruton (McGraw-Hill, 2015)
- Managent and Enterpreneuship-NVR Naidu, T Krishna Rao, I.K. International Publishing House Pvt. Ltd.@ 2008
- 4. Poornima M Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 2006.

#### **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-6,9,11)
- 2. Use staffing Leading and controlling function for the given organization. (PO-6,8,9,10)

- 3. Understand the fundamentals of entrepreneurship with the goal of fulfilling the requirements of the industries and holding the responsibilities towards the society. (PO-6,7,8)
- 4. Design a basic business plan by considering case studies and show the involvement of ownership in Business. (PO-3,7,8,11)
- 5. Start a new small business with the help of E-Commerce and the current available technologies. (PO-5,11)

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tool	Marks	Course outcomes addressed		
Internal test-I	30	CO1, CO2		
Internal test-II	30	CO3, CO4, CO5		
Average of the two internal tests shall be taken for 30marks.				
Other components				
Quiz	10	CO1, CO2		
Assignment	10	CO3, CO4, CO5		
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5		

# SIMULATION MODELING AND ANALYSIS

Subject Code: IM62	Credits: 2:1:0
Pre requisites: Applied Probability and Statistics	Contact Hours: 28L+14T
Course Coordinator(s): Dr. M Shilpa / Dr.Siddhartha Kar	

#### **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.

- Pedagogy: Power Point Presentations
- Links: https://archive.nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=Ej26SZrcPAg https://www.youtube.com/watch?v=od7fWoKjV6E

## Unit II

**Simulation Examples:** Simulation of Queuing systems and Inventory Systems General Principles, Concepts in discrete - events simulation, event scheduling / Time advance algorithm.

- Pedagogy: Power Point Presentations, blackboard teaching
- Links: https://archive.nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=QppldN-t4pQ https://www.youtube.com/watch?v=2P9b6chg\_tY

# Unit III

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

- Pedagogy: blackboard teaching
- Links: https://archive.nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=Wd2ORYzVFZE https://www.techtarget.com/whatis/definition/random-numbers

# 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.

- Pedagogy: blackboard teaching
- Links: https://archive.nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=PZzh3Sv2i-g https://www.youtube.com/watch?v=Q11uUTA-ndY

#### Unit V

Input Modeling - Multivariate 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

- Pedagogy: Power Point Presentations, blackboard teaching
- Links: https://archive.nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=2nv8XMluWrU https://www.youtube.com/watch?v=6bHYlqwtdfM https://www.youtube.com/watch?v=Oomz\_iZ5d-0

#### Text books

- 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.
- 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. Understand how to carry out simulation study for any real life system (PO-1,2,5 & PSO-1,2)
- 2. Apply manual simulation to queuing and inventory problems (PO-2,3, 4 & PSO-1)
- 3. Apply various random numbers tests for simulation applications (PO-1,3,4 & PSO-1,2)

- 4. Develop random variate generator using appropriate generation technique (PO-2,3, 4 & PSO-1,2)
- 5. Develop multivariate and time series input models and analyze the output of the simulation model (PO-1,3,4, 5 & PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30marks.		
Other components		
Surprise Test	10	CO1, CO2, CO3, CO4
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	COI, CO2, CO3, CO4, CO5

## **BIG DATA ANALYTICS**

Subject Code: IME631Credits: 3:0:0Pre requisites: Applied Probability and StatisticsContact Hours: 42Course Coordinator(s): Dr. M Shilpa / Dr. Niranjan C A

#### **Course Content**

#### Unit I

**Introduction to Big data & Descriptive Analytics:** Data Science: Definition, Skills for Data Science, Data scientist, Characteristics of Big Data, Relationship between data science and big data, Categorization of Analytical methods

- Pedagogy: Power Point Presentations
- Links: https://www.youtube.com/watch?v=XohgKT13FKY (NPTEL) https://nptel.ac.in/courses/106104189

#### Unit II

**Data Visualization:** Effective Design Techniques (Data-Ink ratio), Tables: Table Design Principles, Cross Tabulation, Bubble Chart Word cloud, Heat Maps, Multiple Scatter Plot, Growth Curves, Stars, Chernoff Faces, Advanced Charts (Non Analytical treatment): Parallel Coordinates Plot, Tree maps, Geographic Information Systems Charts, Data Dashboard

- Pedagogy: Power Point Presentations
- Links: https://www.youtube.com/watch?v=NOIfMY0KajE https://www.youtube.com/watch?v=eFByJkA3ti4

#### Unit III

**Data Reduction Technique** :Principal components methods : Procedure for computation of principal components (Non Analytical Treatment), Summarizing Sample Variation by principal components : Variance of Components, Scree Plot; Standardization of Principal Components Factor Analysis: Assumptions of factor analysis, Orthogonal factor model : Common Factors, specific factors, factor loading, Estimation of Parameters of model using PCA (Non analytical methods (Only Procedure)), Communalities, Factor Rotation (Varimax method), Estimation of Factor Scores(Non analytical)

- Pedagogy: Power Point Presentations
- Links: https://www.youtube.com/watch?v=ykZUGcYWg&list=PLLspfyoOYo QcI6Nno3gPkq0h5YSe81hsc

#### Unit IV

#### Predictive analytics (Supervised Learning Methods):

Multiple Linear Regression Analysis for Non Categorical variables and Categorical variables: Building a regression model, multicollinearity, variable selection procedure (Non analytical): Stepwise, forward and backward regression, Logistic Regression (Non Analytical): Introduction (Non Analytical), Logit model (Non Analytical) Classification Accuracy, k-Nearest Neighbors (Simple Problems), Classification and Regression Trees (Non Analytical Treatment)

- Pedagogy: PPT, Blackboard teaching, Statistical software
- Links: https://www.youtube.com/watch?v=1c9vwzaZHzI

#### Unit V

**Unsupervised Learning:** Cluster Analysis (Simple Problems): Measures of Association for Continuous Variables (Euclidean Distance, Canberra Metric, Czekanowski Coefficient), Measures of Association for Binary Variables: Similarity coefficients for clustering items; Agglomerative Hierarchical Clustering: single linkage, complete linkage, average linkage; Cluster Description; Non Hierarchical Clustering Methods: K means method (Simple Problems)

- Pedagogy: PPT, Blackboard teaching, Statistical software
- Links: https://www.youtube.com/watch?v=NhimXdFenrg https://www.youtube.com/watch?v=ODIIDHudgfo

#### **Text books**

- Applied Multivariate Statistical Analysis (6th Edition) 6th Edition Richard A.Johnson (Author), Dean W. Wichern (Author), Eastern Economy Edition,2015
- Essentials of Business Analytics 1st Edition, by Jeffrey D.Camm (Author), James J. Cochran (Author), Michael J. Fry (Author), Jeffrey W. Ohlmann (Author), David R. Anderson (Author), Jan2014.

#### References

- 1. Multivariate Data Analysis: Joseph F. Hair Jr (Author), William C. Black (Author), BarryJ. Babin (Author), Rolph E. Anderson (Author), Pearson Education Limited, 2013.
- 2. Statistical and Machine-Learning, Data Mining Techniques for Better Predictive Modeling Techniques and Analysis of Big Data: Bruce Ratner, Second Edition, CRCPress Taylor & Francis Group.
- 3. The Elements of Statistical Learning, Data Mining, Inference, and Prediction, Trevor Hastie, Robert Tinsirani, Jerome Friedman.

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

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

- 1. Understand the need for analyzing the big data and classify the analysis methods (PO-1,2,4,5&PSO1,2)
- 2. Apply visualization methods for multivariate data and relate to various real time applications (PO-1,2&PSO1,2)
- 3. Apply data reduction techniques to real time data (PO-1,2,4,5&PSO1,2)
- 4. Analyze the real time data using predictive models (PO-1,2,4,5 &PSO1,2)
- 5. Develop clustering methods for real time data (PO-1,2,3,5 &PSO1,2)

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tool	Marks	Course outcomes addressed		
Internal test-I	30	CO1, CO2		
Internal test-II 30 CO3, CO4, CO5				
Average of the two internal tests shall be taken for 30marks.				
Other components				
Surprise Test	10	CO1, CO2, CO3, CO4		
Assignment	10	CO1, CO2, CO3, CO4, CO5		
Semester End Examination (SEE)	100	COI, CO2, CO3, CO4, CO5		

# LEAN MANUFACTURING

Subject Code: IME632Credits: 3:0:0Pre requisites: NilContact Hours: 42Course Coordinator(s): Dr. R Shobha/ Smt. Hamritha S

#### **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.

- Pedagogy: PPT, Blackboard teaching
- Links: https://www.youtube.com/watch?v=HQEkn-mJnas

#### 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. Setup-Reduction Methodology, Techniques for Setup Reduction, setup-Reduction Projects. Case studies. (Problems to be discussed)

- Pedagogy: PPT, Blackboard teaching
- Links: https://www.youtube.com/watch?v=0yhlpFdC8cI

#### 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.

- Pedagogy: PPT, Blackboard teaching
- Links: https://www.youtube.com/watch?v=UOuTBCrW2kY https://www.youtube.com/watch?v=VN5bb7\_Jacw

#### 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. (Problems to be discussed)

- Pedagogy: PPT, Blackboard teaching
- Links: https://www.youtube.com/watch?v=toTYb7Sirm0 https://www.youtube.com/watch?v=kaL5KLvAKA4

#### Unit V

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

- Pedagogy: PPT, Blackboard teaching
- Links: https://www.youtube.com/watch?v=TRW\_iAEJVjU

#### **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, TomLuyster 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. Designing work of cells and Implementing group technology. (PO-1,2 & PSO-2)
- 5. Design and implement value stream mapping. (PO- 3 & PSO-2,3)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# PROJECT MANAGEMENT

Subject Code: IME633	Credits: 3:0:0
Pre requisites: Nil	<b>Contact Hours: 42</b>
Course Coordinator(s): Dr. M R Shivakumar / Sri	. Sudheer D Kulkarni

#### **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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: The Basics of Project Management:

https://www.youtube.com/watch?v=5d16JwWwjKo How to Estimate Project Costs: A Method for Cost Estimation: https://www.youtube.com/watch?v=YQ2Wi3Jh3X0

#### 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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Management Organizational Structures:

https://www.youtube.com/watch?v=Ocm4kvLx6d4 Project Management Organizational Structure - 3 Types: Functional, Matrix & Projectized https://www.youtube.com/watch?v=0vPCN6X3FUI

# Unit III

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

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Scheduling PERT/CPM | Finding Critical Path:

https://www.youtube.com/watch?v=-TDh-5n90vk Project Scheduling: https://www.youtube.com/watch?v=Rq19ga0U\_jQ

#### 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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Management Key Performance Indicators:

https://www.youtube.com/watch?v=fjhlmuLecDA

Project Risk Management - How to Manage Project Risk:

https://www.youtube.com/watch?v=xXV\_gjtXMSk

#### 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

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Finance Concepts for Project Managers: https://www.youtube.com/watch?v=m4KU7Mo1Iqw

#### Text books

- 1. Project Management: Choudhry S., Tata McGraw-Hill, 2010
- Projects: Planning, Analysis, Financing, Implementation and Review: Prasanna Chandra, 5<sup>th</sup> edition, Tata McGraw-Hill publishing company limited, 2005.
- 3. Operations Research- N V R Naidu, G. Rajendra, T Krishna kumar, I K international Publishing house, Pvt. Ltd. 2011.
- 4. Operations Research and Engineering Management, S. D. Sharma, Kedar Nath Ram Nath & Co., 2010

# References

 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)
- 4. Identify, analyze, quantify and mitigate risks (PO- 11 & PSO 3)
- 5. Evaluate the sources of finance (PO- 11 & PSO 3)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3,CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components Marks Course outcomes addressed			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject Code: IME634

Credits: 3:0:0

Pre requisites: Nil

Contact Hours: 42

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

# **Course Contents**

# Unit I

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

- Pedagogy: PPT
- Links: https://nptel.ac.in/courses/106105077

https://www.youtube.com/watch?v=SSE4M0gcmvE

https://www.youtube.com/watch?v=4jmsHaJ7xEA

# Unit II

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

- Pedagogy: PPT, Black board teaching
- Links: https://nptel.ac.in/courses/106105077
   https://www.youtube.com/watch?v=J9Olp6YqQhw
   https://www.youtube.com/watch?v=CvL-KV3IBcM

# Unit III

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

- Pedagogy: PPT, Black board teaching
- Links: https://nptel.ac.in/courses/106105077

https://www.youtube.com/watch?v=\_62wGXvbaS0 https://www.youtube.com/watch?v=GXLURYcP33k

# Unit IV

Machine Learning: Introduction, learning association, classification, regression, unsupervised learning and reinforcement learning

- Pedagogy: PPT, Black board teaching
- Links: https://www.youtube.com/watch?v=h0e2HAPTGF4 https://onlinecourses.nptel.ac.in/noc23\_cs18/preview

#### Unit V

**Supervised Machine Learning:** learning class from example, vapnik-chervonenkis dimension, probably approximately correct learning, noise, learning multiple classes, regression, dimensions of supervised machine learning algorithm.

- Pedagogy: PPT, Black board teaching
- Links: https://www.mathworks.com/videos/introduction-to-machine-learningpart-3-supervised-machine-learning-1542879641780.html https://intellipaat.com/blog/supervised-learning-vs-unsupervisedlearning-vs-reinforcement-learning/

#### **Text Books**

- 1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education Pvt. Ltd., 2013
- 2. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence" 3<sup>rd</sup> edition, Tata McGraw Hill Publication, New Delhi.
- Introduction to machine learning by Ethem Alpaydin, MIT Press, 3<sup>rd</sup> edition, 2014

#### **Reference books**

- 1. Nils J. Nilsson, Nils Johan Nilsson, Artificial Intelligence: A New Synthesis, MK Publishers, California, 2000
- 2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial intelligence, Prentice Hall, 2003
- 3. Introduction to machine learning with Phython by Andreas C. Müller, Sarah Guido · O'reilly 2016

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

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

- 1. Identify intelligent decisions taken up by AI and understand symbolic reasoning in AI (PO-2,5 PSO 1,2)
- 2. Establish communication and integration models among the AI agents (PO-1,2,5 PSO 1,2)
- 3. Identify how expert systems work and how they acquire knowledge. (PO-1,2,3,4,5 PSO 1,2)
- 4. Understand concept of machine learning and evaluate models generated by data (PO-1,2,3,4 PSO 1,2)
- 5. Develop an appreciation for what is involved in Learning models from data (PO-1,2,3,4 PSO 1,2)

Course rissessment and Louisant			
Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1,CO2	
Internal test-II	30	CO3,CO4,CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1,CO2	
Assignment	10	CO3,CO4,CO5	
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5	

# PRODUCT DESIGN AND DEVELOPMENT

Subject Code: IME641

Credits: 3:0:0

Pre requisites: Nil

Contact Hours: 42

Course Coordinator(s): Dr. Sridhar B S/ Dr. M R Shivakumar

#### **Course Content**

#### Unit I

**INTRODUCTION:** Need for IPPD-Strategic importance of Product development integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements -Organization process management and improvement

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=d6pnSAQL9mo https://www.youtube.com/watch?v=9WPZStQp03Q&list=PLSGws\_74 K01- KPzaLUtCV7R-CognwVoP8 https://www.youtube.com/watch?v=HN9GtL21rb4&list=PLSGws\_74K 018yZOnbSaqWJZ837QyBB7vu

#### Unit II

**CONCEPT GENERATION, SELECTION AND TESTING**: Plan and establish product specifications. Task - Structured approaches - clarification - search-externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability - Concept Testing Methodologies.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=PN-yhUrFFbw https://www.youtube.com/watch?v=pnYRp-QG9iA

#### Unit III

**PRODUCT ARCHITECTURE**: Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -

architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=QraDkKncbSA https://www.youtube.com/watch?v=g9PeRZALrN4

#### Unit IV

**INDUSTRIAL DESIGN**: Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=eRHBdEIrh\_g&t=14s https://www.youtube.com/watch?v=pHzV\_uJMCq4&t=26s

#### Unit V

#### DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT:

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=V5NMJywHS9M https://www.youtube.com/watch?v=1daLs0r2cOU

#### **Text Books**

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw-Hill International Edns.1999

#### References

 Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM Associates, 6/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book

- 2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4
- Tool Design Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5 4. www.me.mit/2.7444

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

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

- 1. Analyse the knowledge of product development and approaches to product design and the steps involved. (PO:1,2,3; PSO: 1,2)
- 2. Apply the knowledge of concept generation, selection and testing (PO: 1,2; PSO: 1,2)
- 3. Analyze the product architecture and management of product design problems (PO: 1,2,3; PSO: 1,2)
- 4. Apply and optimize the role of industrial designers in product design. (PO: 1,2,3; PSO: 1,2)
- 5. Analyze the procedure for manufacturing and development in product design. (PO: 1,2,3; PSO: 1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# INNOVATION AND TECHNOLOGY MANAGEMENT

Subject Code: IME642	Credits: 3:0:0
Pre requisites: Nil	<b>Contact Hours: 42</b>
Course Coordinator(s). Dr. M. Raiesh / Dr. Hemayathy S	

**Course Content** 

#### Unit I

**Innovation:** Concepts, Types of innovation, Linear, Cyclic and Network models of innovation, Global industrial competition: Changes in World industry, Dominant trends and issues in World business, Relationship between Business strategy and technology strategy, To Innovate or Not to Innovate. Innovation Planning Process, Factors that aid Innovation Planning, Dynamics of innovation process.

- Pedagogy: Chalk board, power point presentations.
- Links: https://nptel.ac.in/courses/110107094

https://www.youtube.com/watch?v=7dHahNW-RzQ https://www.youtube.com/watch?v=7dHahNW-RzQ

#### Unit II

New R&D strategies, Core competencies and business strategy, Building innovation culture in organizations, Key Initial Questions for Implementation, Organizational roles for innovation, Facilitators and impediments of innovation, Strategic issues in innovation management, developing a Climate for Innovation, Management of technological innovation, Case study.

- Pedagogy: Chalk board, power point presentations.
- Links: https://nptel.ac.in/courses/110108047

youtube.com/watch?v=M9Rot4AWOWY https://www.youtube.com/watch?v=flnmTI1iAWA

#### Unit III

The concept of technology: Introduction, concept and meaning of technology, the nature of technology change, life cycle. Economics of technology: Introduction, meaning, engineering economics, concept of optimum size, corporate technological strategy, business mission, competitive technology, technology crisis, Technology Forecasting, technological convergence.

- Pedagogy: Chalk board, power point presentations.
- Links: https://nptel.ac.in/courses/109103121 https://www.youtube.com/watch?v=zmU9j0l9ORA https://www.youtube.com/watch?v=xCeAcDZhrwk

#### Unit IV

**The adoption of new manufacturing technology:** Introduction, strategy, challenges and opportunities, yield of technology forecasting, realization of new technology, concept of R& D, effectiveness of R& D, Analysis for technology strategy: Introduction, technology assessment, forecasting, techniques.

- Pedagogy: Chalk board, power point presentations.
- Links: https://onlinecourses.nptel.ac.in/noc20\_mg70/preview https://onlinecourses.nptel.ac.in/noc22\_mg79/preview https://www.youtube.com/watch?v=KvrVVLrGAN8

#### Unit V

**Project management for new technology:** Introduction, project preparation, risks, project planning, cost management, technology: an instrument of competition, technology competition analysis (TCA), technology leadership, adoption of new technology, change management, work structure. Stages of factory automation, FMS, CIM, CAD/CAM, IMS, Case Study.

- Pedagogy: Chalk board, power point presentations.
- Links: https://nptel.ac.in/courses/110104073 https://onlinecourses.nptel.ac.in/noc22\_mg71/preview https://www.youtube.com/watch?v=PqQqTAu FiM

#### **Text Books**

- 1. P.N.Rastogi, Management of Technology and Innovation, Sage Publications, New Delhi, 1995.
- 2. Paul Lowe The Management of Technology, perception & opportunities, Chapman & Hall, London, 1995.

#### **Reference Books**

- 1. M. White and G.D. Bruton, The Management of Technology and Innovation, Cengage learning, 2007
- 2. Frederick Betz Strategic Management of Technology, Mc Graw Hill inc 1993

#### Course Outcomes (COs):

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

- 1. Understand the global industrial competition to adopt the new technology to build the relationship bridge between business strategy and technology strategy. (PO: 5,7)(PSO: 2,3)
- 2. Apply the various innovation concepts and models in organization to their strategic issues in innovation management. (PO: 5,6) (PSO: 2,3)

- 3. Analyze the trends in Innovation Management, engineering economics strategies to build innovation culture to strengthen the activities of employees. (PO: 4,7) (PSO: 2,3)
- 4. Evaluate, adapt and select new manufacturing technologies. (PO: 7,8) (PSO: 2,3)
- 5. Develop skills to setting up a small business enterprise and implement projects for new technologies. (PO: 9,11) (PSO: 2,3)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1,CO2	
Internal test-II	30	CO3,CO4,CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	COI,CO2,CO3,CO4,CO5	
Assignment	10	COI,CO2,CO3,CO4,CO5	
Semester End Examination (SEE)	100	COI,CO2,CO3,CO4,CO5	

# ADVANCED OPERATIONS RESEARCH

Subject Code: IME643

Credits: 3:0:0 Contact Hours: 42

Pre requisites: NilContact HoCourse Coordinator(s): Dr. Sridhar B S/ Dr. M R Shivakumar

#### **Course Content**

#### Unit I

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

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=xrGVe6gMRyk https://www.youtube.com/watch?v=Uo6aRV-mbeg https://www.youtube.com/watch?v=drU7dOa836M

## Unit II

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

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=yMhY7ZcP-Y8 https://www.youtube.com/watch?v=yMhY7ZcP-Y8 https://www.youtube.com/watch?v=p4RKLq6dBI4

#### 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.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=H81oy\_a7t5I https://www.youtube.com/watch?v=d9hpfrrZXac

#### 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.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- $\bullet \ \ Links: https://www.youtube.com/watch?v=opycAyG4Yo&list=PLwdnzlV3og$

oXEZ6rpZLKzzlypKnsa-ySx https://www.youtube.com/watch?v=arxmRnAdLy4 https://www.youtube.com/watch?v=zVCB49HYIxM

#### Unit V

**Goal Programming:** Formulation, Algorithms: weights method, preemptive method Metaheuristics (Non Analytical): Tabu search (Basic concepts, Oultine of algorithm), Simulated annealing (Basic concepts, Oultine of algorithm), Genetic algorithm (Basic concepts, Oultine of algorithm) NOTE: Numerical problems to be set starting from optimal tables for the topics – sensitivity analysis and integer programming

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=3\_hxxVOMwoE https://www.youtube.com/watch?v=aHt4OqyVjRU https://www.youtube.com/watch?v=fRGAepxtN0M

#### **Text Books**

- Taha H. A Introduction to Operation Research, Prentice Hall of India-10<sup>th</sup> edition, 2016.
- 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 9th edition, 2009.
- 2. S.D. Sharma Operations Research, Kedarnath, Ramnath & Co -1996
- 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)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# INDUSTRIAL ROBOTICS Subject Code: IME644 Credits: 3:0:0 Pre requisites: Nil Contact Hours: 42 Course Coordinator(s): Dr. Sridhar B S/ Dr. M R Shivakumar

#### **Course Content**

#### Unit I

Introduction: Automation and robotics, brief history of robotics, Social and economic aspects of robots, Advantages and disadvantages of using robots in industries, Overview of robots –present and future applications.

Classification and c: Classifications, Geometrical configurations, Wrist and its motions, End effectors and its types, Links and joints.

Robot drive systems: Hydraulic, Electric and Pneumatic drive systems, Resolution, accuracy and repeatability, Advantages and disadvantages of drive systems.

- Pedagogy: Chalk and talk, Power point presentation, Videos.
- Links: https://www.youtube.com/watch?v=xrwz9IxpMJg https://nptel.ac.in/courses/112101098 https://theteche.com/robot-drive-system-and-its-types-theteche-com/

#### Unit II

Control systems and components: Basic control system concepts and models, Transformation and block diagram of spring mass system, Controllers – ON and OFF, Proportional integral, Proportional and integral, Transient and response to second order system, Robot Actuation and Feedback components: Position, Velocity sensors, Actuators.

- Pedagogy: Chalk and talk, Power point presentation, Videos.
- Links: https://onlinecourses.nptel.ac.in/noc20\_me03/preview https://archive.nptel.ac.in/courses/108/108108147/

#### Unit III

Robot Arm Kinematics: Kinematics – Introduction, Direct and Inverse kinematics, Rotation matrix, Composite rotation matrix, Rotation matrix about an arbitrary axis, Euler angles representation, Homogeneous transformations, Links, joints and their parameters, D-H representation, Introduction to robot dynamics

- Pedagogy: Chalk and talk, Power point presentation, Videos.
- Links: https://onlinecourses.nptel.ac.in/noc21\_me108/preview https://www.digimat.in/nptel/courses/video/112106304/L10.html
### Unit IV

Trajectory planning: Introduction, General considerations on trajectory planning, Joint interpolated trajectories, 4-3-4 trajectory example, Planning of Cartesian path Trajectories.25Robot programming: Introduction, Manual teaching, Lead through teaching, Programming languages – AML and VAL [simple examples], Programming with graphics, Storing and operating, Task programs.

- Pedagogy: Chalk and talk, Power point presentation, Videos.
- Links: https://archive.nptel.ac.in/courses/112/104/112104308/ https://nfryexp.deutsch-consulting.de/

### Unit V

Sensors: Internal state sensors, Tactile sensors, Proximity sensing, Range sensing and forcetorque sensors. Elements of computer vision. Sensing and digitizing function in machine vision – image devices – lighting techniques – analog to digital signal conversion – sampling –quantization – encoding – image storage. Image processing and analysis, Feature Extraction and Object recognition.

- Pedagogy: Chalk and talk, Power point presentation, Videos.
- Links: https://archive.nptel.ac.in/courses/112/101/112101098/ https://nptel.ac.in/courses/108103174

### **Text Books:**

- Industrial Robotics Mikell Groover, Mitchell Weiss, Roger Nagel, Nicholas Odrey. Tata Mc Graw Hill 2<sup>nd</sup> Edition 2008
- 2. K.S. Fu, R.C. Gonzales and Lee -Robotics, Mc Graw Hill International 1987.

### References

1. Richard Paul -Robot Manipulators, Mathematics, Programming and Control, 2000.

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

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

- 1. Analyze areas of applications structure and drive in robot systems. (PO:1, 2, 3) (PSO:1,2)
- 2. Identify the control systems and components of robots. (PO:1,2,3) (PSO:1,2)
- 3. Apply the mathematical concepts in robot kinematics. (PO:1,2,3,4,5) (PSO:1,2)
- 4. Develop the trajectory planning and robot programme. (PO:1,2,3,4,5) (PSO:1,2)
- 5. Identify the sensors used in robots. (PO:1,2,3) (PSO:1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4, CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components			
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# SIMULATION MODELING AND ANALYSIS LAB

Subject Code: IML65

Credits: 0:0:1

Pre requisites: Nil

Contact Sessions: 14

# Course Coordinator(s): Dr. M Shilpa,/ Dr. Siddhartha Kar

### **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 12 experiments have to be conducted from the above list of experiments

Software Packages: MS Excel, ARENA simulation software package

### **Text Books**

- 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. NarsinghDeo -Systems Simulation with Digital Computer; PHI Publication (EEE), ISBN- 0-87692-028-8

### Reference

- 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, RandollSadowski, 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)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment tool	Marks	Course outcomes attained	
Weekly Evaluation-Lab Record	30	CO1,CO2,CO3	
Lab Test	20	CO1,CO2,CO3	
Semester End Examination (SEE)	50	CO1,CO2,CO3	

# ENTERPRISE RESOURCE PLANNING LAB

Subject Code: IML66

Credits: 0:0:1

Pre requisites: Nil

**Contact Sessions: 14** 

Course Coordinator(s): Sri. Sudheer D Kulkarni/ Smt. Hamritha S

# **Course Content**

# Laboratory Exercises

- Introduction to ERP & its Software packages 1.
- 2. Forecasting problems (Moving average method and Exponential Smoothing method)
- 3. Determining the economic order quantity
- 4. Inventory ABC analysis
- 5. Vendor rating using AHP
- 6. Creation of pivot tables for the given data
- 7. Development of MIS report for the given data
- 8. Resource allocation and planning
- 9. Preparation of Bill of Materials
- 10. Creation of Sales Order from E-Commerce website
- 11. MRP Run- Generating of Various reports for confirmed orders
- 12. Creating Production Run for the items
- 13. Carrying out business process cycles Purchase

# Software – ofbiz, Excel

# Text books

- 1. Integrated Business Process with ERP Systems Simha R Magal and Jeffrey Word (John Wiley & Sons, 2010)
- 2. Monks J.G -Operations Management, McGraw-Hill International, Editions 1987
- 3. Steve Chapman & Tony Arnold Introduction to Materials Management, Pearson, 2016.

# Reference books

- 1. Enterprise Systems for Management Luvai Motiwalla & Jeffrey Thompson (Pearson, 2000)
- 2. P Gopalakrishna & M Sundaresan Materials Management: An Integrated Approach, PHI, 2012.

3. Buffa-Modern Production / Operations Management, Wiely India Ltd.- 4th edition.

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

- 1. Students will be able to forecast the demand and determine the required EOQ. (PO 2, 5 PSO 2)
- 2. Students will be able to analyze the inventory, vendor performance and plan the resource allocation (PO 2, 5 PSO 2)
- 3. Students will be able to create the bill of materials for the given product and generate sales order, purchase order and MRP. (PO 2, 5 PSO 2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment tool	Marks	Course outcomes attained	
Weekly Evaluation-Lab Record	30	CO1,CO2,CO3	
Lab Test	20	CO1,CO2,CO3	
Semester End Examination (SEE)	50	CO1,CO2,CO3	

# PROJECT MANAGEMENT (Institutional Open Elective – 1) Subject Code: IMOE01 Credits: 3:0:0 Pre requisites: Nil Contact Hours: 42

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

### **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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: The Basics of Project Management:

https://www.youtube.com/watch?v=5d16JwWwjKo How to Estimate Project Costs: A Method for Cost Estimation: https://www.youtube.com/watch?v=YQ2Wi3Jh3X0

# 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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Management Organizational Structures: https://www.youtube.com/watch?v=Ocm4kvLx6d4
   Project Management Organizational Structure - 3 Types: Functional, Matrix & Projectized
   https://www.youtube.com/watch?v=0vPCN6X3FUI

### 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).

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Scheduling PERT/CPM | Finding Critical Path: https://www.youtube.com/watch?v=-TDh-5n90vk
   Project Scheduling: https://www.youtube.com/watch?v=Rq19ga0U jQ

### 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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Management Key Performance Indicators:

https://www.youtube.com/watch?v=fjhlmuLecDA Project Risk Management - How to Manage Project Risk: https://www.youtube.com/watch?v=xXV\_gjtXMSk

### 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.

- Pedagogy / Course Delivery Tools: Chalk & talk, Power Point Presentation, Videos
- Links: Project Finance Concepts for Project Managers: https://www.youtube.com/watch?v=m4KU7Mo1Iqw

### **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- N V R Naidu, G. Rajendra, T Krishna kumar, I K international Publishing house, Pvt. Ltd. 2011.
- 4. 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, -KhannaPublishers

### **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)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tool	Marks	Course outcomes addressed	
Internal test-I	30	CO1, CO2	
Internal test-II	30	CO3, CO4. CO5	
Average of the two internal tests shall be taken for 30marks.			
Other components	Marks	Course outcomes addressed	
Quiz	10	CO1, CO2, CO3, CO4, CO5	
Assignment	10	CO1, CO2, CO3, CO4, CO5	
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5	

# **MINI PROJECT** Subject Code: IMP67 Credits: 0:0:3

### Pre requisites: Nil

### Course Coordinator(s): Dr. Sridhar B S/ Dr. M R Shivakumar

### 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. ٠
- Identify the problem area in order to carry out the project work. ٠
- Expected outcomes should be clearly stated. ٠
- Applying any one of the engineering tools and techniques to solve the problem. ٠
- 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 ٠ 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 ٠ 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)

# INNOVATION/SOCIETAL/ ENTREPRENEURSHIP BASED INTERNSHIP

Subject Code: INT68	Credits: 0:0:2	
Pre requisites: Nil	<b>Contact Duration: 1 Month</b>	
Course Coordinator(s): Dr. Sridhar B S/ Dr. Niranjan C A		

### **Course Content**

Students should undergo industrial training in the form of Internship for one month in reputed industries.

### Assessment and Evaluation

**Note:** Students have to undergo one month internship in an industry between  $4^{\text{th}}$  and  $5^{\text{th}}$  or  $6^{\text{th}}$  and  $7^{\text{th}}$  semester. The student has to compulsorily submit a report in his/her  $7^{\text{th}}$  semester and the evaluation will be done by a committee constituted by the HOD. Each student must give a presentation for about 30 minutes, comprising of:

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

### Course Outcomes (COs):

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