

**Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY**  
**BANGALORE - 56**  
AIDED BY GOVERNMENT OF KARNATAKA  
&  
AUTONOMOUS INSTITUTION AFFILIATED TO VTU, BELGAUM,



**PROPOSED SYLLABUS**

**For**

**V & VI Semester**  
**(FOR THE ACADEMIC YEAR 2023-2024)**  
**(Batch 2021) NEP1**

**Department of Industrial Engineering & Management**

Website: [www.drait.edu.in](http://www.drait.edu.in)

e-mail id: [principal@drait.edu.in](mailto:principal@drait.edu.in)

**Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY**  
**BANGALORE - 56**  
AIDED BY GOVERNMENT OF KARNATAKA  
&  
AN AUTONOMOUS INSTITUTION AFFILIATED TO VTU, BELGAVI,

## ***Vision***

- ✚ To create Dynamic, Resourceful, Adept and Innovative Technical professionals to meet global challenges.

## ***Mission***

- ✚ To offer state-of-the-art undergraduate, postgraduate and doctoral programs in the fields of Engineering, Technology And Management
- ✚ To generate new knowledge by engaging faculty and students in research, development and innovation.
- ✚ To provide strong theoretical foundation to the students, supported by extensive practical training to meet the industry requirements.
- ✚ To install moral and ethical values with social and professional commitment.

# Department of Industrial Engineering & Management

## *Objective*

- To maintain a Comprehensive curriculum that enables students to become leading engineers and creative researchers in the global marketplace.
- To collaborate with private and public sectors in the search of methodologies and creative solutions to problems that contributes to the advancement of education, technology and professional development.
- To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches, and systems thinking methodologies.
- To maintain high standards of professional and ethical responsibility.
- To provide a broad education necessary to understand the impact of engineering solutions in a global economic, environmental, a societal context.

## *Vision:*

- ✚ To be globally recognized as a leader in industrial engineering education, research and enhance the application of technical knowledge to benefit the society.

## *Mission:*

- ✚ To offer globally recognized programs that equip graduates with strong problem solving ability in the design, analysis and implementation of integrated systems in manufacturing and service sectors.
- ✚ Create state-of-the-art infrastructure for research and training in Industrial Engineering
- ✚ Promoting collaboration with academia, industries and Research organizations at national and international levels for socioeconomic development

## **Program Outcomes (POs)**

1. Ability to apply knowledge of mathematics, science and engineering.
2. Ability to design and conduct experiments related to deterministic or stochastic systems, as well as to analyze and interpret data.
3. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Ability to identify, formulate and solve Industrial and Management Systems Engineering problems.
5. Student will be able to use modern industrial Engineering and management tools necessary for engineering practice.
6. Ability to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Understand the major environmental, social and economic drivers pertaining to the necessity of developing sustainable operations.
8. Student will exhibit professionalism and ethical responsibility.
9. Effectively collaborate and function on multidisciplinary teams.
10. Student will be able to communicate orally and verbally with different sections of society.
11. Manage Project and Finance to satisfy customer expectations.
12. Engage in life-long learning and appreciate the need for continual self-development.

# Program Educational Objectives

**PEO 1:** Have a strong foundation in Mathematics, Science and Engineering fundamentals that prepare them for a successful career in Industrial Engineering, Management and allied fields.

**PEO 2:** Function at a technically competent level in designing a system within realistic constraints such as economic, environmental, social, political, ethical, manufacturability, health and safety and sustainability.

**PEO 3:** To effectively and economically utilize the resources of the Enterprise using various optimization techniques.

**PEO 4:** Exhibit professionalism, good oral & written communication skills, team work and develop an attitude for lifelong learning.

# Department of Industrial Engineering & Management

## Faculty List:

<b>1</b>	<b>Dr. N Mohan</b>	<b>Professor and Head</b>
<b>2</b>	<b>Dr. S K Rajendra</b>	<b>Associate Professor</b>
<b>3</b>	<b>Dr. Rajeshwari P</b>	<b>Associate Professor</b>
<b>4</b>	<b>Dr. C R Mahesha</b>	<b>Assistant Professor</b>
<b>5</b>	<b>Mrs. Suprabha R</b>	<b>Assistant Professor</b>
<b>6</b>	<b>Mr. Chetan N</b>	<b>Assistant Professor</b>
<b>7</b>	<b>Mrs. Sarvamangala S P</b>	<b>Assistant Professor</b>

V SEMESTER

(NEP)

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week					Examination				Credits
					L	T	P	S	Total	Duration in Hours	CIE	SEE	Total	
1	PCC	21IMT501	Statistics for Engineering	IM	03	00	0	0	03	03	50	50	100	3
2	IPCC	21IMT502	Simulation Modeling and Analysis	IM	02	02	02	0	06	04	50	50	100	4
3	PCC	21IMT503	Operations Research	IM	03	00	00	00	03	03	50	50	100	3
4	PCC	21IMT504	Computer Integrated Manufacturing	IM	03	00	00	00	03	03	50	50	100	3
5	PCCL	21IML505	Statistics Laboratory	IM	00	00	02	00	02	03	50	50	100	1
6	AEC	21RMI506	Research Methodology and Intellectual Property Rights	TD: Any Department PSB: As identified by University	03	00	00	00	03	03	50	50	100	2
7	HSSC	21CVT507	Environmental Studies	TD: Civil/ Environmental/ Chemistry/ Biotech. PSB: CivilEngg	01	00	00	00	01	02	50	50	100	1
8	AEC	21IMI508X	Design Thinking Lab	IM	If offered as theory course					00	50	50	100	1
					00	00	00	00	00					
					If offered as lab course					02	02			
9	HSSC	21HSN509	Aptitude and Verbal ability skills	Placement cell.	02	00	00	00	02	02	50	--	50	PP/NP
<b>Total</b>											450	400	850	18

Ability Enhancement Course – V

21IM5081 Design Thinking Lab

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.  
 L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.  
**Integrated Professional Core Course (IPCC):** refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L: T:P) can be considered as (3: 0: 2) or (2: 2: 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Dean (Academic)

Professor & HOD  
 Dept. of Industrial Engineering & Management  
 Dr. Ambedkar Institute of Technology

VI SEMESTER

(NEP - 1)

S.No	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week					Examination Marks				Credits
					L	T	P	S	Total	Duration in Hours	CIE	SEE	Total	
1	HSMC	21IMT601	Operations Management	IM	03	01	00	00	04	03	50	50	100	3
2	IPCC	21IMT602	Quality Assurance & Reliability	IM	02	02	02	00	06	04	50	50	100	4
3	PCC	21IMT603	Materials Management	IM	02	02	00	00	04	03	50	50	100	3
4	PEC	21IMT604X	Professional Elective course -I	IM	03	00	00	00	03	03	50	50	100	3
5	OEC	21IMT605X	Open Elective course- I	Concerned Dept	03	00	00	00	03	03	50	50	100	3
6	PCCL	21IML606	Enterprise Resource Planning Lab.	IM	00	00	02	00	02	03	50	50	100	1
7	MP	21IMM607	Mini Project	IM	Two contact hours /week for interaction between the faculty and students.					-	100	-	100	2
8	INT	21IMI608	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V Semesters.					-	100	-	100	3	
9	HSSC	21HSN609	Analytical and Reasoning Skills	Placement	02	00	00	00	02	02	50	--	50	PP/ NP
										<b>Total</b>	<b>500</b>	<b>300</b>	<b>800</b>	<b>22</b>

## Professional Elective - I

21IMT6041	Composite materials	21IMT6042	PYTHON Programming
21IMT6043	Marketing Management	21IMT6044	Advanced Machining Processes

## Open Elective course- I offered by the Department of Industrial and Management to the other Department students

21IMT6051 Project Management

21IMT6052 Human Resource Management

Dean (Academic)  
Dr. Ambedkar Institute of Technology  
Bengaluru-560 075

Professor & HOD  
Dept. of Industrial Engineering & Management  
Dr. Ambedkar Institute of Technology  
Near Jnanabharathi Campus



Note: HSMC: Humanity and Social Science & Management Courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PEC: Professional Elective, OEC-Open Elective Course, MP-Mini Project, INT-Internship.  
L-Lecture, T-Tutorial, P-Practical / Drawing, S-Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

**Integrated Professional Core Course (IPCC):** Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching-Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

**Professional Elective Courses(PEC):**

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

**Open Elective Courses:**

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. Selection of an open elective shall not be allowed if,

- (i) The candidate has studied the same course during the previous semesters of the program.
- (ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- (iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

**Mini-project work:** Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.


Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.


**CIE procedure for Mini-project:**

- (i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
- (ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project:

  
Dean (Academic)  
Dr. Ambedkar Institute of Technology  
Bengaluru-560 056.

  
Professor & HOD  
Dept. of Industrial Engineering & Management  
Dr. Ambedkar Institute of Technology,  
Near Manabharathi Campus  
BDA Outer Ring Road  
Mallathahalli, Bangalore-560 056

Course Title	<b>STATISTICS FOR ENGINEERS</b>						
Course Code	<b>2IIMT501</b>						
Category	<b>Professional Core Course (PCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>01</b>	<b>00</b>	<b>00</b>	<b>04</b>	<b>50</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. Apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Evaluate the application of discrete probability distribution to various manufacturing problems.
3. Evaluate the application of Continuous probability distribution to various manufacturing problems.
4. Explain the hypothesis to random experiments of manufacturing processes.
5. Test the statistical parameters by regression and correlation. and test for variance

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<b>THE ROLE OF STATISTICS IN ENGINEERING (DATA SUMMARY AND PRESENTATION):</b> Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display	08
<b>2</b>	<b>DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:</b> Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution and their Applications.	08+ 02(T)
<b>3</b>	<b>CONTINUOUS RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:</b> Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution and their Applications.	08+ 02(T)
<b>4</b>	<b>ESTIMATION THEORY:</b> Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals. <b>STATISTICAL INFERENCE FOR A SINGLE SAMPLE AND TWO SAMPLES:</b> Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion. Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.	10+ 02(T)
<b>5</b>	<b>SIMPLE LINEAR REGRESSIONS AND CORRELATION:</b> Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation. <b>DESIGN OF EXPERIMENTS:</b> Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects	10+2 (T)

model, the randomized complete block design, one way analysis of variance and two way analysis of variance.

**Note 1:**

- SEE question paper shall contain 10 questions having internal choice in each unit and Students shall answer one question from each unit.

**Note 2:**

- Assignments are evaluated for 5 marks.
- CIE shall be evaluated for 20 mark

**Course Outcome:**

At the end of the course students will be able to

1. Apply the statistical data in the form of Tabular and Graphical display.
2. Identify discrete type of probability and solve the various engineering problems.
3. Solve Continuous type of probability and solve the various engineering problems
4. Estimate the hypothesis and give inference to random experiments.
5. Evaluate the statistical parameters by estimation.

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO1,PO2,PO12
CO2	PO1,PO2,PO3,PO12
CO3	PO1,PO2,PO3,PO12
CO4	PO1,PO2,PO3,PO4,PO12
CO5	PO1,PO2,PO3,PO5,PO9,PO12

**TEXT BOOKS:**

1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2<sup>nd</sup> Edition, John Wiley and Sons, ISBN-0-471-17027-5
2. **Statistics for Management** - Richard I Levin, David S Rubin, 6<sup>th</sup> Edition, Prentice HallIndia, ISBN-81-203-0893-X

**REFERENCE BOOKS:**

1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery, 2<sup>nd</sup>Edn, John Wiley and Sons
2. **Business Statistics for Management and Economics** - Daniel, Terrell, 6<sup>th</sup> Edn, HoughtonMifflin Company, ISBN-0-395-62835-0
3. **Probability and Statistics** - Walpole & Mayer, MacMillan Publishing Company, 1989.

Course Title	<b>SIMULATION MODELLING AND ANALYSIS</b>						
Course Code	<b>2IIMT502</b>						
Category	<b>Integrated Professional Core Course (IPCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>02</b>	<b>02</b>	<b>02</b>	<b>00</b>	<b>06</b>	<b>52</b>	<b>4</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

<b>Course Objectives:</b>	
1	Demonstrate the major capabilities and commonly encountered limitations of discrete-event simulation for modeling systems that industrial engineers commonly encounter.
2	Be able to build and run simple discrete-event simulation models in practical situations
3	Illustrate the main assumptions underlying these models; and Explain what can happen when these assumptions do not hold.
4	Be able to communicate the results of the modeling process to management and other non-specialist users of engineering analysis.

Unit No.	Syllabus	No. of Hours
<b>I</b>	<b>INTRODUCTION TO SIMULATION:</b> Simulation, advantages & disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, Monte carlo simulation and Steps in a simulation study.	<b>4 + 2T</b>
<b>II</b>	<b>SIMULATION EXAMPLES:</b> Simulation of Queuing systems, Simulation of Inventory Systems. <b>GENERAL PRINCIPLES:</b> Concepts in discrete - events simulation, event scheduling / Time advance algorithm	<b>8 + 6T</b>
<b>III</b>	<b>RANDOM NUMBERS:</b> Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Auto correlation test, Gap test, Poker test	<b>5+ 3T</b>
<b>IV</b>	<b>INTRODUCTION TO PROBABILITY DISTRIBUTIONS:</b> Weibull and triangular distribution and their applications. <b>RANDOM VARIATE GENERATION:</b> Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance – Rejection Techniques – Poisson Distribution, Gamma Distribution.	<b>6 + 4T</b>
<b>V</b>	<b>ANALYSIS OF SIMULATION DATA:</b> Input Modeling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models <b>OUTPUT ANALYSIS:</b> Stochastic Nature of output data, Measures of Performance and their estimation.	<b>8 + 6T</b>

Expt. No	LABORATORY EXPERIMENTS:	No. of Hours
<b>1</b>	<b>Introduction to Simulation Package.</b> Features of Simulation Package and Input Modelling Identifying probability distributions for given data	<b>14</b>

	Building simulation models for manufacturing operations ( With Common templates) Building simulation models for manufacturing operations ( With Basic templates) Building simulation models for manufacturing operations with transport System Building simulation models for manufacturing operations with layout. Simulation of Multi Product Assembly line System.	
2	<b>Building simulation models for service operations and analysis of data.</b> Building simulation Models for Banking service (Bank teller problem) Building simulation Models for Mortgage application problem Building simulation Models for food processing problem Building simulation Models for Post office animation Statistical Analysis of Simulation models (input analysis) Statistical Analysis of Simulation models (output analysis) Modelling a Live Problem	12

<b>Course Outcomes:</b> At the end of the course the student will be able to	
1	Illustrate basic concepts in modeling and simulation
2	Classify various simulation models and give practical examples for each category.
3	Construct a model for a given set of data and motivate its validity.
4	Generate and test random number variates and apply them to develop simulation models.
5	Fit statistical distributions to input data, obtain parameter estimation and goodness of fit.

COs	Mapping with POs
CO1	PO1,PO2
CO2	PO2,PO3,PO4
CO3	PO4,PO6
CO4	PO4,PO5,PO6
CO5	PO1,PO2,PO4

**TEXT BOOKS:**

- 1. Discrete Event system Simulation** – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, III Edition, Pearson Education, Asia, ISBN - 81- 7808 – 505 - 4.
- 2. Systems Simulation with Digital Computer** – Narsingh Deo; PHI Publication (EEE), ISBN – 0-87692-028-8
- 3. Simulation Modelling & Analysis** – Averill M Law, W David Kelton; McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.

**Suggested software:**

1. Suggested Software Packages: Arena / Flexsim/ Quest / Witness / Extend.

Course Title	<b>OPERATIONS RESEARCH</b>						
Course Code	<b>2IIMT503</b>						
Category	<b>Professional Core Course (PCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>01</b>	<b>00</b>	<b>00</b>	<b>04</b>	<b>50</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>		<b>Total Max. Marks: 100</b>		<b>Duration of SEE: 03 Hours</b>		

<b>Course Objectives:</b>
<ol style="list-style-type: none"> <li>1. To Define and formulate the LPP for different product types with constraints.</li> <li>2. Application of graphical, Simplex and Big M and Duality technique.</li> <li>3. To Define and discuss the Transportation methods to find optimum cost.</li> <li>4. To explain and define the concepts of queuing and Game theory.</li> <li>5. Determine the Critical path and its duration, different types of floats using PERT/CPM.</li> </ol>

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<p><b>INTRODUCTION:</b> OR Methodology, Definition of OR, Application of OR to Engineering and Managerial Problems, Features of OR models, Limitation of OR and Models of OR.</p> <p><b>LINEAR PROGRAMMING-I:</b> Definition, Mathematical formulation, Standard form, Graphical Method, solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal, Redundancy, Degeneracy.</p>	08
<b>2</b>	<p><b>LINEAR PROGRAMMING-II:</b> Simplex method, variants of simplex algorithm – Artificial (Big-M method) basis techniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method.</p>	10+(2T)
<b>3</b>	<p><b>TRANSPORTATION PROBLEM:</b> Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel’s Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems.</p> <p><b>ASSIGNMENT PROBLEM:</b> Formulation of the Assignment problem, unbalanced assignment problem</p> <p><b>TRAVELING SALESMAN PROBLEM:</b> Formulation and solution of the problem</p>	10+(2T)
<b>4</b>	<p><b>QUEUING THEORY:</b> Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model. M/M/K/ Model.</p> <p><b>GAME THEORY:</b> Formulations of games, Two persons zero sum game, games with and without saddle point, graphical solutions (2xn, mx2 game), and dominance property. Solution of game through LPP.</p>	8+(2T)
<b>5</b>	<p><b>PROJECT MANAGEMENT USING NETWORK ANALYSIS:</b> Network construction, determination of critical path and duration, CPM Structured approach, Calculations of schedules and floats, PERT-Estimation of project duration and variance.</p>	8+(2T)

**Note 1:**

- SEE question paper shall contain 10 questions having internal choice in each unit and Students shall answer one question from each unit.

**Note 2:**

- Assignments are evaluated for 5 marks.
- CIE shall be evaluated for 20 mark

**Course Outcomes:**

1. Can formulate the LPP using constraints and solve by graphical method.
2. Able to determine the optimum solution using Simplex method.
3. Can find out the optimum transportation and assignment cost.
4. Can identify and apply different queuing model to service and arrival pattern problems and solve the game problems by graphical method and dominance property rule.
5. Able to determine the Critical path and its duration using PERT/CPM.

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO1, PO2, PO3, PO4, PO5, PO12
CO2	PO1, PO2, PO3, PO4, PO5, PO11, PO12
CO3	PO1, PO2, PO3, PO4, PO5, PO11, PO12
CO4	PO1, PO2, PO3, PO4, PO5, PO7
CO5	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11

**TEXT BOOKS:**

1. **Operation Research and Introduction** -Taha H A, Prentice Hall of India, 6<sup>th</sup> edition, 1999
2. **Principles of Operations Research** -Philips, Ravindran and Solberg- – Theory and Practice, PHI, 2<sup>nd</sup> Edition, 2007
3. **Operations Research** -S.D. Sharma – Kedarnath, Ramnath &Co, 1996

**REFERENCE BOOKS:**

1. **Introduction to Operation Research** -Hiller and Libermann, McGraw Hill 5<sup>th</sup> edn,
2. **Operations Research Theory and Application** -J K Sharma, Pearson Education Pvt Ltd ,4<sup>th</sup> Edn, 2009 ISBN-0333-92394-4

Course Title	<b>COMPUTER INTEGRATED MANUFACTURING</b>						
Course Code	<b>2IIML504</b>						
Category	<b>Professional Core Course (PCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>04</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. To study on automating the system, the use of computers in design and manufacturing.
2. To define basic concepts of geometric modeling techniques, Design and exchange of data.
3. To explain modern concepts of manufacturing using NC, CNC and DNC.
4. To express basic concepts of programming for drilling, milling and turning operations.
5. To outline basic concepts of industrial robotics and its applications to industries.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<b>Introduction:</b> Production Systems, Automation in Production Systems, Manual labor in Production Systems, Automated manufacturing systems- types of automation, Reasons and strategies for automation, Computer Integrated Manufacturing, Fundamentals of CAD and CAM, Product cycle and CAD/CAM, Design process, creating the manufacturing database, Advantages of CAD and CAM.	<b>8</b>
<b>2</b>	<b>Numerical control machines:</b> Introduction- basic components of an NC system-the NC procedure- NC coordinate system, NC motion control system, Applications of NC System, Advantages and limitations of NC Machines. <b>Computer controls in NC:</b> Problems with conventional NC, CNC system, Functions and advantages of CNC System. Components of DNC system, Functions and advantages of DNC System	<b>7</b>
<b>3</b>	<b>Group technology</b> -Definition-Advantages and limitations of GT-Part family formation Classification and coding-Opitz coding system, Applications & benefits of GT, Cellular manufacturing-Machining cell designs-Machining cell planning. <b>Computer aided process planning</b> -Approaches to CAPP-Implementation techniques-Essential elements in a retrieval type CAPP system-Essential elements in a generative CAPP system. <b>Flexible manufacturing System</b> -Scope of FMS-FMS compared to other types of manufacturing approaches-Types of FMS-Benefits of FMS-Major elements of FMS.	<b>8</b>
<b>4</b>	<b>CNC Programming:</b> Manual part programming, Methods, Preparatory Functions, Miscellaneous Functions, Program Number, Tool Length Compensation, Canned Cycles, Cutter Radius Compensation, Drilling and milling exercises. Turning Center programming: Axes System, General Programming Functions, Motion Commands, Exercises.	<b>9</b>
<b>5</b>	<b>Introduction to Robotics:</b> Introduction, Robot configuration, Robot motions, End effectors, Robot Sensors, Robot applications. Programming the robots, Robot-Programming Languages.	<b>7</b>

**Note 1:** Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

**Note 2:** Two assignments are evaluated for 5 marks.



**Course Outcomes:**

1. Summarize the role of CAD/CAM in modern design and manufacturing
2. Create and analyze the capabilities of Computer Aided Designing Systems for designing mechanical parts and elements in 2D and 3D dimensions.
3. Compare and distinguish between the modern concepts of manufacturing using NC, CNC and DNC.
4. Compile and illustrate manual part program to carryout drilling, milling, and turning operations on CNC machine tools.
5. To demonstrate the concepts of industrial robotics and its applications to industries

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO5, PO6, PO7
CO2	PO3, PO4, PO5
CO3	PO3, PO5
CO4	PO3, PO5, PO6, PO7
CO5	PO3, PO5, PO6, PO7

**TEXT BOOKS:**

1. Mikel P. Groover and Emory W. Zimmers - **CAD/CAM**, Jr Pearson Education Inc, 2017.
2. P.N. Rao – **CAD/CAM Principles and Applications**, TMH, New Delhi - 2017.

**REFERENCE BOOKS:**

1. Newman and Sproull – **Principles of Interactive Computer Graphics**, Tata McGraw Hill, 1995.
2. Ibrahim Zeid –**CAD/CAM**, Tata McGraw Hill, 2016.
3. P. N. Rao, N. K. Tewari and T. K. Kundra – **Computer Aided Manufacturing**, Tata McGraw Hill, 2016.

<b>Course Title</b>	<b>STATISTICS LAB</b>						
<b>Course Code</b>	<b>21IIML505</b>						
<b>Category</b>	<b>Professional Core Course Laboratory (PCCL)</b>						
<b>Scheme and Credits</b>	No. of Hours/Week						
	L	T	P	SS	Total	Total Teaching Hours	Credits
	0	0	2	0	2	40	1
<b>CIE Marks:50</b>	<b>SEE Marks:50</b>		<b>Total Marks:100</b>		<b>Duration of SEE:03 Hours</b>		

**Objective:**

1. Explain and apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Application of probability distributions to various manufacturing problems.
3. Application of hypothesis to random experiments of manufacturing processes.
4. Test the statistical parameters by regression and correlation.
5. Design an engineering problem as random experiment to solve and test for variance.

<b>Unit No.</b>	<b>Syllabus content</b>	<b>Hrs</b>
<b>1</b>	1. Determining basic statistics (Mean, Median, Mode, and Standard deviation, Range, Harmonic Mean, Geometric Mean, Variance and Coefficient of variation) for the given quality characteristic and interpreting it. 2. Representing the data in graphical forms: Line graph, Bar graph, Pie Chart, Stem and leaf plot, Histogram, Pareto Chart. 3. Construction of Scatter diagram for the given variables and interpretation of different forms of scatter diagrams. 4. Conduction of regression analysis for two variables using least squares method and fitting a straight line. 5. Conduction of multiple regression analysis for the given variables.	<b>15</b>
<b>2</b>	1. Interval estimation and hypothesis testing on mean of a normal distribution. 2. Interval estimation and hypothesis testing on difference in means of two normal distributions. 3. Hypothesis testing on variance of a normal population. 4. Hypothesis testing on variances of two normal populations. 5. Hypothesis testing on a single population proportion. 6. Fitting an appropriate distribution (normal distribution) for the given variable quality characteristic. 7. Conduct One way and two way ANOVA Analysis for the given problem. 8. Design of experiments using CATAPULT.	<b>21</b>

**Course Outcome:**

By the end of the course students will be able to

1. Apply the statistical data in the form of Tabular and Graphical display.
2. Identify discrete type of probability and solve the various engineering problems.
3. Solve Continuous type of probability and solve the various engineering problems
4. Estimate the hypothesis and give inference to random experiments.
5. Evaluate the statistical parameters by estimation.

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO3	PO1,PO2,PO3,PO6,PO7,PO11,PO12
CO4	PO1,PO2,PO3,PO6,PO7,PO11,PO12

**Scheme of Examination:**

ONE question from Unit -1: 15 marks

ONE question from Unit -1: 25 marks

Viva-Voce : 10 marks

**Suggested software:**

1. Statistical Packages : SYSTAT / MINITAB / SPSS/ R- studio and such others

Course Title	<b>RESEARCH METHODOLOGY &amp; INTELLECTUAL PROPERTY RIGHTS</b>						
Course Code	<b>21RMI506</b>						
Category	<b>Ability Enhancement Course(AEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>01</b>	<b>02</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>2</b>
<b>CIE Marks: 40(Quiz)+Assgmt+ GA</b>	<b>SEE Marks: 50 (Quiz)</b>		<b>Total Max. marks=100</b>		<b>Duration of SEE: 03 Hours</b>		

#### COURSE OBJECTIVE

1. Understand the knowledge on basics of research and its types.
2. Learn the concept of Literature Review and technical Reading.
3. Understanding the importance of giving credit to citations and attributions.
4. Learn ethics in Engineering Research.
5. Discuss the concepts of Intellectual Property Rights in engineering.

Unit No.	Syllabus Content	No of Hours
<b>UNIT I</b>	<b>Introduction:</b> Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	<b>8</b>
<b>UNIT II</b>	<b>Literature Review and Technical Reading:</b> New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. <b>Attributions and Citations:</b> Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	<b>8</b>
<b>UNIT III</b>	<b>Introduction to Intellectual Property:</b> Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. <b>Patents:</b> Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. <b>Process of Patenting.</b> Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be obtained. Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.	<b>8</b>
<b>UNIT IV</b>	<b>Copyrights and Related Rights:</b> Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright.	<b>8</b>

	<p>Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.</p> <p><b>Trademarks:</b> Eligibility Criteria. Who Can Apply for a Trade mark? Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.</p>	
<b>UNIT V</b>	<p><b>Industrial Designs:</b> Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.</p> <p><b>Geographical Indications:</b> Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.</p>	<b>8</b>

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Understand the meaning of engineering research.  
**CO2:** Recognize the procedure of literature review and technical reading.  
**CO3:** Know the fundamentals of patent laws and drafting procedure.  
**CO4:** Understand the copyright laws and subject matters of copyrights and designs.  
**CO5:** Realize the basic principles of design rights

### TEXT BOOKS

- 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>
- Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwaj.

### REFERENCE BOOKS

- David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488- 4.
- Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9.

### ONLINE RESOURCES

- <https://www.slideshare.net/indravi/intellectual-property-rights-ipr-in-engineering>
- [http://bspublications.net/downloads/050e6a699258c8\\_IPR\\_chapter1.pdf](http://bspublications.net/downloads/050e6a699258c8_IPR_chapter1.pdf)

### SCHEME FOR EXAMINATIONS

- The question paper will have 50 objective questions carrying 1 mark each.
- There will be questions from each module.
- The students have to answer all questions.

### MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1				2		3		1				3	1
CO2		1				2		3		1				3	1
CO3		1				2		3		1				3	1
CO4		1				2		3		1				3	1
CO5		1				2		3		1				3	1
<b>Strength of correlation:</b> Low-1, Medium-2, High-3															



Course Title	<b>ENVIRONMENTAL STUDIES</b>						
Course Code	<b>21CV507</b>						
Category	<b>HSSC</b>						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>15</b>	<b>01</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 hours</b>		

**Course Learning Objective:**

LO1- Understand the interdisciplinary nature of environmental studies and its importance in addressing global and local environmental challenges.

LO2- Comprehend the basic ecological principles, components of ecosystems, and the impacts of human activities on ecosystems and biodiversity.

LO3- Recognize the classification and sustainable management of natural resources, along with the sources and consequences of environmental pollution.

LO4- Gain knowledge of climate change, renewable energy sources, and their role in mitigating climate change, as well as understand the importance of environmental conservation and sustainable practices for a more sustainable future.

<b>UNIT-I</b>	<b>3 Hours</b>
<b>INTRODUCTION TO ENVIRONMENTAL STUDIES:</b>	
Definition and scope of environmental studies. Interdisciplinary nature of environmental studies. Environmental issues and challenges at the global and local levels. Importance of sustainable development and environmental conservation.	
<b>UNIT-II</b>	<b>3 Hours</b>
<b>ECOLOGICAL CONCEPTS AND ECOSYSTEMS:</b>	
Basic ecological principles and concepts. Components of an ecosystem: biotic and abiotic factors. Ecological relationships and interactions. Human impacts on ecosystems and biodiversity loss	
<b>UNIT-III</b>	<b>3 Hours</b>
<b>NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION:</b>	
Classification and importance of natural resources (water, air, soil, minerals, forests, agricultural land, marine resources). Sustainable use and management of natural resources. Types and sources of environmental pollution (water, air, soil, noise). Impact of pollution on human health and the environment	
<b>UNIT-IV</b>	<b>3 Hours</b>
<b>CLIMATE CHANGE AND RENEWABLE ENERGY:</b>	
Causes and consequences of climate change. Mitigation and adaptation strategies for climate change. Introduction to renewable energy sources (solar, wind, hydro, geothermal, biomass, hydrogen fuel). Role of renewable energy in combating climate change	
<b>UNIT-V</b>	<b>3 Hours</b>
<b>ENVIRONMENTAL CONSERVATION AND SUSTAINABLE PRACTICES:</b>	
Biodiversity conservation and endangered species protection. Waste management and recycling practices. Sustainable agriculture and food systems. Environmental policies, regulations, and international agreements	
<b>Teaching &amp; Learning Process:</b>	
Chalk and talk, Power point presentations, Animations and Videos and experiential learning.	

<b>Course Outcomes:</b> The students will be able to	
CO1	Develop a comprehensive understanding of the interdisciplinary nature of environmental studies and its significance in addressing global and local environmental challenges.
CO2	Apply ecological principles and concepts to analyse and evaluate the components of ecosystems, as well as assess the impacts of human activities on ecosystems and biodiversity.
CO3	Demonstrate knowledge of the classification and sustainable management of natural resources, and evaluate the sources and consequences of environmental pollution.

CO4	Recognize the causes and consequences of climate change, identify renewable energy sources, and evaluate their role in mitigating climate change. Additionally, demonstrate an understanding of the importance of environmental conservation and sustainable practices for creating a more sustainable future.
-----	--

#### Text Books and References

1	R. Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005.
2	Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Universities Press (India) Private Limited, 2019.
3	Singh, J.S., Singh, S.P., and Gupta, S.R.). "Ecology, Environmental Science and Conservation". S. Chand Publishing, New Delhi, 2017.
4	D K Asthana, "Text Book of Environmental Studies", S Chand Publishing, 2010
5	Dr. J. P Sharma, "Environmental Studies", Laxmi Publications Pvt Ltd, 2017.
6	Benny Joseph, "Environmental Studies", Tata McGraw-Hill Publishing company Limited, 2008.
7	G.T.Miller Jr., "Environmental Science", 11th Edition, Cengage Learning Pvt. Ltd., 2008.
8	Singh, J.S., Singh, S.P., and Gupta, S.R.). "Ecology, Environmental Science and Conservation". S. Chand Publishing, New Delhi, 2017.
9	<a href="https://onlinecourses.swayam2.ac.in/cec19_bt03/preview">https://onlinecourses.swayam2.ac.in/cec19_bt03/preview</a>
10	<a href="https://onlinecourses.nptel.ac.in/noc23_hs155/preview">https://onlinecourses.nptel.ac.in/noc23_hs155/preview</a>
11	<a href="https://nptel.ac.in/courses/122102006">https://nptel.ac.in/courses/122102006</a>
12	<a href="http://nptel.ac.in/courses/122102006/7">http://nptel.ac.in/courses/122102006/7</a>

#### CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓					✓
CO2	✓					✓	✓					✓
CO3	✓					✓	✓					✓
CO4	✓					✓	✓					✓



Course Title	<b>DESIGN THINKING LAB</b>						
Course Code	<b>2IIML5081</b>						
Category	<b>Ability Enhancement Course (AEC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>13</b>	<b>1</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

<b>Course Objectives:</b> To enable the students to:	
<b>1</b>	<b>Knowledge Application:</b> Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to provide solutions of societal concern
<b>2</b>	<b>Communication:</b> Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
<b>3</b>	<b>Collaboration:</b> Acquire collaborative skills through working in a team to achieve common goals.
<b>4</b>	<b>Independent Learning:</b> Learn on their own, reflect on their learning and take appropriate action to improve it.

### Guidelines for Design Thinking Lab:

1. The Design Thinking Lab (DTL) is to be carried out by a team of two-three students.
2. Each student in a team must contribute equally in the tasks mentioned below.
3. Each group has to select a theme that will provide solutions to the challenges of societal concern. Normally three to four themes would be identified by the department.
4. Each group should follow the stages of Empathy, Design, Ideate, prototype and Test for completion of DTL.
5. After every stage of DTL, the committee constituted by the department along with the coordinators would evaluate for CIE. The committee shall consist of respective coordinator & two senior faculty members as examiners. The evaluation will be done for each student separately.
6. The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee.

The Design Thinking lab tasks would involve:

1. Carry out the detailed questionnaire to arrive at the problem of the selected theme. The empathy report shall be prepared based on the response of the stakeholders.
2. For the problem identified, the team needs to give solution through thinking out of the box innovatively to complete the ideation stage of DTL.
3. Once the idea of the solution is ready, detailed design has to be formulated in the Design stage considering the practical feasibility.
4. If the Design of the problem is approved, the team should implement the design and come out with prototype of the system.
5. Conduct thorough testing of all the modules in the prototype developed and carry out integrated testing.
6. Demonstrate the functioning of the prototype along with presentations of the same.
7. Prepare a Digital poster indicating all the stages of DTL separately. A Detailed project report also should be submitted covering the difficulties and challenges faced in each stage of DTL.
8. Methods of testing and validation should be clearly defined both in the Digital poster as well as the report.

The students are required to submit the Poster and the report in the prescribed format provided by the department.

<b>Course Outcomes: After completing the course, the students will be able to</b>	
<b>CO 1:</b>	Interpreting and implementing the empathy, ideate and design should be implemented by applying the concepts learnt.
<b>CO 2:</b>	The course will facilitate effective participation by the student in team work and development of communication and presentation skills essential for being part of any of the domains in his / her future career.
<b>CO 3:</b>	Applying project life cycle effectively to develop an efficient prototype.
<b>CO 4:</b>	Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

Scheme of Evaluation for CIE Marks:

Evaluation will be carried out in three phases:

Phase	Activity	Weightage
I	Empathy, Ideate evaluation	10M
II	Design evaluation	15M
III	Prototype evaluation, Digital Poster presentation and report submission	25M
<b>Total</b>		<b>50M</b>

**Scheme of Evaluation for SEE Marks:**

Sl. No.	Evaluation Component	Marks
1.	Written presentation of synopsis: Write up	5M
2.	Presentation/Demonstration of the project	15M
3.	Demonstration of the project	20M
4.	Viva	05M
5.	Report	05M
<b>Total</b>		<b>50M</b>

<b>CO-PO Mapping</b>												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>
<b>CO2</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>
<b>CO3</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>H</b>	<b>M</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>
<b>CO4</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>L</b>

## VI SEMESTER

Course Title	<b>OPERATIONS MANAGEMENT</b>						
Course Code	<b>2IIMT601</b>						
Category	<b>Humanity and Social Science &amp; Management (HSMC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>01</b>	<b>00</b>	<b>0</b>	<b>04</b>		
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>		<b>Total Max. Marks: 100</b>		<b>Duration of SEE: 03 Hours</b>		

### Course Objectives :

1. Introduction of operations management and its importance in production operations and decision making.
2. To apply the knowledge of forecasting of production demand.
3. To study and apply the knowledge of Aggregate planning, MPS and MRP
4. To study and apply different scheduling methods to determine the idle times of the machines.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<p><b>OPERATIONS MANAGEMENT CONCEPTS:</b> Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations. Manufacturing and service systems.</p> <p><b>OPERATIONS DECISION MAKING:</b> Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology.</p>	<b>07</b>
<b>2</b>	<p><b>FORECASTING DEMAND:</b> Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.</p>	<b>07</b>
<b>3</b>	<p><b>AGGREGATE PLANNING:</b> Introduction- planning and scheduling, Objectives of aggregate plan, Aggregate planning methods.</p> <p><b>MASTER PRODUCTION SCHEDULING:</b> Master scheduling objectives, Master scheduling methods. Developing a master production schedule, Reconciling the MPS with sales operation.</p> <p><b>RESOURCE PLANNING FOR SERVICE PROVIDERS:</b> Dependent demand for services, Bill of resources. Case study-ERP implementation by SAP</p>	<b>08</b>
<b>4</b>	<p><b>MATERIAL AND CAPACITY REQUIREMENTS PLANNING:</b> Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.</p>	<b>08</b>
<b>5</b>	<p><b>SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES:</b> Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guidelines, Scheduling methodology, priority control, capacity control.</p> <p><b>SINGLE MACHINE SCHEDULING:</b> Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs.</p> <p><b>FLOW -SHOP SCHEDULING:</b> Introduction, Johnson's rule for V jobs on 2 and 3 machines, CDS heuristic.</p> <p><b>JOB-SHOP SCHEDULING:</b> Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.</p>	<b>09</b>

**Note 1: Each unit has internal choice. A total of 10 questions i.e. one full questions from each unit.**

**2: Two assignments are evaluated for 5 marks.**

**Course Outcomes:**

- 1. Able to memorize history and describe importance of OM to take decision based on different models.**
- 2. Able to calculate forecasted values using different forecasting methods**
- 3. Will be able to operate the production activities on Aggregate planning, MPS and MRP**
- 4. Will be able to operate the production activities based on priorities and capacity.**
- 5. Will be able to select the best course of action for better production quality and quantity based on new methods of production.**

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO2,PO4,PO5,PO6,PO9,PO10,PO12
CO2	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO12
CO3	PO2,PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO4	PO1,PO2,PO3,PO4,PO6,PO9,PO10,PO11,PO12
CO5	PO2,PO3,PO4,PO5,PO8,PO9,PO12

**TEXT BOOKS:**

- 1. Operations Management- Monks, J.G., McGraw Hill; Second edition (8 January 2020)**
- 2. Production and Operations Management- Pannerselvam. R, Prentice Hall India Learning Private Limited; 3rd edition (1 January 2012).**
- 3. Production and Operations Management- Chary S.N, McGraw-Hill; Sixth edition (10 April 2019)**

**REFERENCE BOOKS:**

- 4. Modern Production/ Operations Management- John Wiley & Sons Inc; 7th edition (1 January 1983)**
- 5. Operations Management for Competitive Advantage by Chase and Jacobs, McGraw-Hill Education; 11th edition (16 May 2005)**
- 6. B. Mahadevan Operations Management: Theory and Practice, Pearson (1 January 2018)**

Course Title	<b>QUALITY ASSURANCE AND RELIABILITY</b>						
Course Code	<b>2IIMT602</b>						
Category	<b>Humanity and Social Science &amp; Management (IPCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>02</b>	<b>02</b>	<b>02</b>	<b>0</b>	<b>06</b>	<b>50</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 04 Hours</b>		

Course Objectives:

1. To explain and define the basic concepts of Quality, Quality Assurance and discuss the ISO series.
2. To introduce the Statistical process control and process capability.
3. Application of control charts for variables and attributes.
4. To determine the customer's and producer's risk using sampling distribution.
5. To explain and define the concepts of failure models and reliability of the system.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<p><b>INTRODUCTION:</b>  Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems. Introduction to Seven QC tools.</p> <p><b>QUALITY ASSURANCE:</b>  Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program. ISO Series.(BIS standards/ ISO 9000 series standards)</p>	<b>08</b>
<b>2</b>	<p><b>STATISTICAL PROCESS CONTROL:</b>  Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula, relation to product tolerance and six sigma concept of process capability.</p> <p><b>CONTROL CHARTS FOR VARIABLES:</b>  Control charts for X bar and Range, Statistical basis of the charts, Development and use of X bar R charts, Interpretation of charts for X bar and Standard Deviation (S), Development and use of X bar S control charts with Variable sample size,  Control charts for individual measurements, cumulative-sum chart, and moving-range charts.</p>	<b>12+(3T)</b>
<b>3</b>	<p><b>CONTROL CHARTS FOR ATTRIBUTES:</b>  Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variable sample size. Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for Implementing control charts.</p>	<b>08</b>

<b>4</b>	<p><b>SAMPLING INSPECTION:</b>  Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling.  Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk.  <b>USE OF PUBLISHED SAMPLING PLANS:</b>  Gauge Repeatability &amp; Reproducibility &amp; Measurement system analysis.</p>	<b>12+(3T)</b>
<b>5</b>	<p><b>RELIABILITY AND LIFE TESTING:</b>  Failure models of components, definition of reliability, MTTF, MTBF, MTTR, 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.</p>	<b>06</b>

**Note 1: Each unit has internal choice. A total of 10 questions i.e. one full questions from each unit.**

**Note 2: Two assignments are evaluated for 5 marks.**

<b>Course Outcomes:</b>	
1.	Able to identify the Quality products using dimensions of quality and be Aware of Quality Assurance and relate the ISO series
2.	Can determine six sigma and process capability and construct control charts for variables.
3.	Can determine control limits and construct control charts for attributes.
4.	Can evaluate the acceptance criteria using sampling distribution.
5.	Can Explain and evaluate the failure models and reliability of the system.

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO3, PO5, PO6, PO7, PO8, PO9, PO12
CO2	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO3	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO4	PO1, PO2, PO3, PO5, PO8, PO9, PO12
CO5	PO1, PO2, PO3, PO5, PO8, PO9, PO12

### **TEXT BOOKS**

- 1. Introduction to statistical Quality Control - D C Montgomery 3<sup>rd</sup> Edition, JohnWiley and Sons.**
- 2. Statistical Quality Control - Grant and Leavenworth, McGraw Hill, 6<sup>th</sup> Edition**

### **REFERENCE BOOKS**

- 1. The QS9000 Documentation Toolkit -Janet L Novak and Kathleen C Bosheers, Prentice Hall PTR, 2<sup>nd</sup> Edition**
- 2. ISO 9000 a Manual for Total Quality Management - Suresh Dalela and Saurabh, SChand and Co. 1<sup>st</sup> Edition**
- 3. Total Quality Management – NVR Naidu, KM Babu and G. Rajendra – New Age International Pvt. Ltd – 2006**
- 4. Quality Planning & Analysis - J M Juran, Frank M Gryna; Tata McGraw Hill, 3<sup>rd</sup> edition**

Course Title	<b>MATERIALS MANAGEMENT</b>						
Course Code	<b>21IMT603</b>						
Category	<b>Humanity and Social Science &amp; Management (PCC)</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>02</b>	<b>02</b>	<b>00</b>	<b>00</b>	<b>04</b>	<b>50</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Objective:**

1. Define the concepts of modern materials management and aims to increase profitability.
2. Explain the purchasing principles and relationships with vendors.
3. Define the Application of different systems of codification and analysis of stores management and selective control techniques.
4. Determine basic concepts of Inventory management and their applications to industry.
5. Develop inventory models for different manufacturing situations along with price breaks.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<b>Introduction:</b> Importance of Materials Management – Definition, scope, organization for Materials Management, Objectives of materials management, an overview of system concepts, Benefits of an integrated system approach.  <b>Materials Planning:</b> Making the materials plan work, the materials cycle and flow control system, Materials budget.	<b>10</b>
<b>2</b>	<b>Purchasing:</b> Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing, Scope, Preparation of forms and records for purchasing, Methods of Purchasing, reciprocity, Cost-Plus Contracts, Hedging, Sources of Supply and Supplier Selection, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Vendor-Vendee Relations, Vendor Development, Vendor Rating.	<b>10</b>
<b>3</b>	<b>Stores Management and Operation:</b> Storage System, Stores Location and Layout, Development of Storing, Centralization and Decentralization of Stores. The Systems classification and Codification of Materials, ABC, FSND, VED Analysis. Case studies on ABC Analysis	<b>08</b>
<b>4</b>	<b>Inventory Management:</b> : Definition of inventory, Need of inventory and its management, functions of inventory management, types of inventories, inventory control, cost elements, Economic Order Quantity, Max - Min system. Inventories and demand uncertainty.	<b>08</b>
<b>5</b>	<b>Deterministic Inventory models:</b> Dynamic inventory models, Instantaneous and finite rate of replenishment with and without shortage. Models with Price breaks & quantity discounts, (Numerical Exercises on EOQ) Determining safety stock. Q-system & P-system.	<b>10</b>

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

Note 2: Two assignments are evaluated for 5 marks.

**Outcome:**

1. Explain the concepts and Importance of Integrated Materials Management
2. Elaborate about the concepts of purchasing, types, objectives, procedure including vendor rating.
3. Design and layout for a stores, do codification, use selective control techniques to stock the items in stores.
4. Explain the basic concepts on inventory, inventory costs, EOQ.
5. Use the inventory models in practical applications.

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO3,PO9,PO10
CO2	PO4,PO8,PO9,PO12
CO3	PO3,PO4,PO9
CO4	PO2,PO3,PO4
CO5	PO2,PO3,PO4,PO9,PO11

**TEXTBOOK:**

1. Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002
2. Materials Management, A.K. Datta., PHI Pvt. Ltd, New Delhi, 2001.
3. Operations Research, Kanti Swaroop, S Chand & Co. 2003

**REFERENCE BOOK:**

1. Handbook of Materials Management, P. Gopalakrishnan, PHI Pvt. Ltd, New Delhi, 2002.
2. Operations Research, Taha, McMillan, 4<sup>th</sup> edition.
3. Gupta and hira, problems on operations research



## Professional Elective – I

<b>Course Title</b>	<b>Composite materials</b>						
<b>Course Code</b>	<b>21IMT6041</b>						
<b>Category</b>	<b>Professional Elective-I</b>						
<b>Scheme and Credits</b>	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	0	0	0	3	30	3
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

### Objectives:

1. To introduce composite materials and its different types.
2. To explain the advanced methods of the manufacturing of composite material and different fabrication techniques.

Unit No.	Syllabus Content	No of Hours
1	Introduction To Composite Materials: Definition-Classification and characteristics of composite materials- fibrous composites, laminated composites and particulate composites	06
2	FIBER REINFORCED PLASTIC PROCESSING: Primary and secondary manufacturing of composites – Layup and curing, fabricating process-open and closed mould process-hand layup techniques-structural laminate bag molding, Autoclave Molding filament Winding, Pultrusion, Compression Molding, RTM, RIM, SRIM, machining, drilling and routing	08
3	<b>FIBER REINFORCED PLASTIC PROCESSING: Production procedures for bag molding- filament winding, pultrusion, pulforming, thermo-forming, injection, injection molding, liquid injection molding, blow molding</b>	06
4	<b>FABRICATION OF COMPOSITES:</b> Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment.	08
5	<b>METAL MATRIX COMPOSITES (MMC'S):</b> Reinforcement materials, types, characteristics, and selection base metals selection-Need for production MMC's and its application. <b>CERAMIC MATRIX COMPOSITES</b> – Manufacturing routes and application	09

**Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.**

**Note 2: Two assignments are evaluated for 5 marks.**

### Course Outcomes:

1. Students are able to explain the different concepts of manufacturing of fiber reinforced composites.
2. Laminate design for different combinations of plies with different orientations of the fiber.
3. To Explain the machining of composite materials
4. To Explain the Manufacturing routes and application of Metal matrix and Ceramic matrix composites

Cos	Mapping with POs
CO1	PO3,PO8,PO10
CO2	PO3,PO8,PO10
CO3	PO3
CO4	PO3,PO8,PO10

**TEXT BOOKS:**

1. Mein Schwartz, "Composite Materials Handbook", McGraw Hill, 1992
2. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.
3. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 1994, 2nd Edition - CRC press in progress.
4. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998.

**REFERENCE BOOK:**

1. "ASM Hand book on Composites", Volume 21, 2001
2. Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.
3. Issac M. Daniel and Oriilshai, "Engineering Mechanics of Composite Materials", Oxford University Press, 2006, First Indian Edition, 2007.
4. Mallick, P.K., Fiber,"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
5. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

Course Title	: PYTHON PROGRAMMING						
Course Code	21IMT6042						
Category	Professional Elective-I						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	30	3
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. Understanding the syntax and semantics of the Python language
2. To create Functions in Python.
3. To handle Files & Regular expressions in Python.
4. To apply Object Oriented Programming concepts in Python

Unit No.	Syllabus Content	No of Hours
1	<p><b>INTRODUCTION TO PYTHON PROGRAMMING:</b>  Variables, Expressions and Statements: Values and types, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, Asking the user for input, Comments, Choosing mnemonic variable names. Conditional Execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Catching exceptions using try and except, Short circuit evaluation of logical expressions.</p>	7
2	<p><b>FUNCTIONS ITERATION, STRINGS :</b>  Function calls, Built-in functions, Type conversion functions, Random numbers , Math functions, Adding new functions, Dentitions and uses, Flow of execution, Parameters and arguments, Fruitful functions and void functions.  <b>ITERATION:</b>  Updating variables, The while statement, Infinite loops and break, Finishing iterations with continue, Definite loops using for, Loop patterns.  <b>STRINGS:</b>  Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods, Parsing strings, Format operator</p>	8
3	<p><b>FILES, LISTS, DICTIONARIES, TUPLES, AND REGULAR EXPRESSIONS:</b>  Persistence, Opening files, Reading files, Writing files.  <b>LISTS:</b>  A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments.  <b>DICTIONARIES:</b>  Dictionary as a set of counters, Dictionaries and files, Looping and dictionaries, Advanced text parsing.  Tuples: Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignments with dictionaries, The most common words, Using tuples as keys in dictionaries, Sequences: strings, lists, and tuples.  <b>REGULAR EXPRESSIONS:</b>  Character matching in regular expressions, Extracting data using regular expressions, Combining searching and extracting, Escape character</p>	8
4	<p><b>CLASSES AND OBJECTS, CLASSES AND FUNCTIONS, CLASSES AND METHODS:</b>  User-defined compound types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying.</p>	8

	<b>CLASSES AND FUNCTIONS:</b> Time, Pure functions, Modifiers, Prototyping development versus planning. <b>CLASSES AND METHODS:</b> Object-oriented features, Printing	
5	objects, Another example, A more complicated example, The init method, Operator overloading, Polymorphism Linked Lists and Stack: Embedded references, The Node class, Lists as collections, Lists and recursion, Infinite lists, The fundamental ambiguity theorem, Modifying lists, Wrappers and helpers, The Linked List class, Invariants. Stacks: Abstract data types, The Stack ADT, Implementing stacks with Python lists, Pushing and popping, Using a stack to evaluate postfix, Parsing, Evaluating postfix, Clients and Providers. Queues: The Queue ADT, Linked Queue, Performance characteristics, Priority queue, The Golfer class	8

**Note 1: No questions on Review portions from Unit 1**

**Note 2: Assignment-1 & 2 Programming examples**

<b>Course Outcomes:</b>
<b>COURSE OUTCOMES:</b> On Completion of the course the students should be able to: CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions. CO2: Demonstrate proficiency in handling Strings and File Systems. CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions. CO4: Interpret the concepts of Object-Oriented Programming as used in Python. CO5: Implement exemplary applications related to Network Programming, Web Services and Databases in Python

### Mapping of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	2									1		1
CO2	1	1	1	1									1		1
CO3	3	3	3	3									1		1
CO4	2	1	2	1									1		2
CO5	2	2	3	1									1		1
<b>Strength of Correlation:</b> Low-1, Medium-2, High-3															

### TEXT BOOKS:

1. **Python for Informatics**, Charles Severance, 1st Edition, Create Space Independent Publishing Platform, 2013.
2. **How to Think Like a Computer Scientist: Learning with Python**, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers 2nd Edition, Open Book Project, 2012.

### REFERENCE BOOKS:

1. **Learning Python**, Mark Lutz, 5th Edition, O'Reilly Media, 2013.
2. **Core Python Applications Programming** Wesley Chun 3rd Edition, 2012
3. **Python in a Nutshell**, Alex Martelli, 2nd Edition, 2006.
4. <http://openbookproject.net/thinkcs/python/english2eGardner>

Course Title	<b>MARKETING MANAGEMENT</b>						
Course Code	<b>21MT6043</b>						
Category	<b>Professional Elective-I</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. To understand the concepts of marketing management.
2. To comprehend marketing decisions, based upon the combination of product, price, promotion, and distribution elements.
3. Identify the roles of advertising, sales promotion, public relations, personal selling
4. To understand fundamental premise underlying advertising and sales promotion

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<p><b>INTRODUCTION TO MARKETING</b> Introduction, Definitions of market and marketing, Selling Vs marketing, The Exchange Process, Elements of Marketing Concept, Functions of Marketing, Old Concept or Product oriented Concept, New or Modern or Customer- oriented Concept, Marketing Myopia, Marketing Environment analysis, (Micro and Macro), Marketing in the 21st century opportunities, challenges &amp; Ethics.</p> <p><b>BUYER BEHAVIOUR ANALYSIS</b> Meaning and Characteristics, Importance, Factors Influencing Consumer Behaviour, Consumer Purchase Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. B2B marketing Vs Consumer Marketing.</p>	<b>08</b>
<b>2</b>	<p><b>MARKET SEGMENTATION, TARGETING &amp; POSITIONING (STP):</b> Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Branding - Concept of Branding, Types, Brand Equity, Branding strategies.</p> <p><b>Managing the Product:</b> Pricing decisions, Marketing Channels, Promotion Strategy, Sales Promotion: Marketing Planning, Case Study on “Facebook”, Marketing Management Concept, product hierarchy, product line, product mix, product mix strategies,</p>	<b>08</b>
<b>3</b>	<p><b>PRODUCT PLANNING AND DEVELOPMENT:</b> Product life cycle and its strategies, New Product Development, packing as a marketing tool, Role of labeling in packing. Services Marketing &amp; its Characteristics</p> <p><b>INTRODUCTION TO E-MARKETING:</b> Landscape – Past – Today – Future – Internet Marketing Paradigm, Internet Infrastructure Stack Business Models &amp; Strategies: Strategic Planning, Strategy to Electronic Planning, Strategic Drivers of the Internet Economy, Business Models to E-Business Models.</p>	<b>07</b>
<b>4</b>	<p><b>BRANDING:</b> Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name.</p> <p><b>LABELLING:</b> Types, functions, advantages and disadvantages</p> <p><b>PACKAGING:</b> Meaning, growth of packaging, function of packaging, kinds of packaging.</p> <p><b>PRICING:</b> Importance of Price, pricing objectives, factors affecting pricing decisions,</p>	<b>10</b>

	procedure for price determination, kinds of pricing, pricing strategies and decisions. <b>DISTRIBUTION:</b> Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.	
5	<b>ADVERTISING AND SALES PROMOTION:</b> Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. <b>PERSONAL SELLING:</b> Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.	06

**Note 1:** Each unit has internal choice. Total of 10 questions i.e. 2 full questions from each unit.

**Note 2:** Assignments are evaluated for 5 marks comprising of the following:

**Course Outcomes:**

1. Develop an ability to assess the impact of the environment on marketing function.
2. To use the STP model in marketing to analyze the product, its price.
3. Identify and analyze the strategic elements of product development processes
4. Understand the role of packaging, labeling, pricing and distribution in the brand-building process
5. Understand the effectiveness of advertising and sales promotion.

**TEXT BOOKS:**

1. Principles of Marketing - Philip Kotler , Prentice – Hall. 11<sup>th</sup> Edn.
2. Marketing Management - Philip Kotler , Prentice – Hall. 12<sup>th</sup> Edn.
3. Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 14/e, Pearson Education, 2012.
4. Marketing- Lamb, Hair, Mc Danniel, 7/e, Cengage Learning 2012.
5. Marketing Management, Tapan Panda, 2/e, Excel Publication
6. Marketing Management – An Indian perspective – Prof. Vijay Prakash Anand

**REFERENCE BOOKS:**

1. **Fundamentals of Marketing** - Wiliam J Stanton, McGraw Hill, 1994
2. **Marketing Management** - S.A Sherlaker”, 1999.
3. **Rajagopal, Marketing Management Text& Cases** - Vikas Publishing House, ISBN 81-259-0773-4

Course Title	<b>ADVANCED MACHINING PROCESSES</b>						
Course Code	<b>21MT6044</b>						
Category	<b>Professional Elective-I</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>	<b>Total Max. Marks: 100</b>			<b>Duration of SEE: 03 Hours</b>		

**Course objectives:**

**1. Explain the basic concepts of Advanced Machining Process.**

Determine the factors influencing process parameters and their performance and applications

Unit No.	Syllabus Content	No of Hours
<b>1.</b>	<b>INTRODUCTION TO ADVANCED MACHINING PROCESS-</b> Introduction to advanced machining, need for advanced machining process, Comparison between traditional and non-traditional machining, general classification of advanced machining processes, classification based on nature of energy employed in machining, selection of advanced machining processes, Specific advantages, limitations and applications of non-traditional machining processes.	<b>08</b>
<b>2</b>	<b>ULTRASONIC MACHINING PROCESS, ABRASIVE JET MACHINING PROCESS AND WATER JET MACHINING (WJM):</b> <b>Ultrasonic Machining Process:</b> Working Principles – equipment used and operations of Ultrasonic Machining, -USM Process Parameters-Amplitude and frequency and vibration, Effect of grain diameter, Effect of applied static load, Effect of slurry and tool and work material Applications, Advantages and Limitations of USM <b>Abrasive Jet Machining Process:</b> AJM Variables and accuracy- carrier Gas Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, standoff distance (SOD), shape of cut & surface finish, Nozzle wear, accuracy & surface finish. Applications, advantages & Limitations of AJM. <b>Water Jet Machining (WJM):</b> Equipment & process, Operation, applications, advantages and limitations of WJM	<b>12</b>
<b>3</b>	<b>ELECTRIC DISCHARGE MACHINING PROCESS (EDM)-</b> Introduction, Mechanism of metal removal, EDM equipment, dielectric medium- its functions & desirable Properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM.	<b>10</b>
<b>4</b>	<b>ELECTRO CHEMICAL AND CHEMICAL MACHINING PROCESS:</b> Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. Electrolytes functions and properties – MRR, accuracy, surface finish and Process Parameters.	<b>12</b>
<b>5</b>	<b>LASER BEAM MACHINING (LBM), ELECTRON BEAM MACHINING (EBM) AND PLASMA ARC MACHINING (PAM)</b> Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations. <b>Hybrid Manufacturing Process and Additive Manufacturing Process</b> (Introduction aspects only)	<b>05</b>

**Course Outcome:**

1. Explain the modern manufacturing process and define the concepts of non-conventional machining process.
2. Describe the working principle, process parameters and variables in mechanical energy-based machining process.
3. Define the concepts of electrical energy-based metal removal process.
4. Illustrate the process of chemical and electro chemical machining
5. Explain the machining process of thermal energy-based machine tools.

**Note 1:** SEE Question paper contains total seven Questions and student should answer any one question from Unit I and Unit II and student shall answer total five questions.

**Note 2:** Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2. Assignment - 2 from units 3, 4 and 5.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓					✓		✓	✓	
CO2					✓			✓		✓	✓	
CO3		✓			✓					✓	✓	
CO4	✓		✓					✓		✓	✓	
CO5	✓		✓		✓			✓		✓		

**TEXT BOOKS:**

1. **Modern machining process - PANDEY AND SHAH, TATA Mc Graw Hill 2000.**
2. **New technology - BHATTACHARAYA 2000**

**REFERENCE BOOKS:**

1. **Production Technology**, by HMT TATA McGraw Hill 2001.
2. **Modern Machining Process - ADITYAN 2002.**
3. **Thermal Metal cutting processes - B G Ranganath - I K International Publishing house Pvt. Ltd,**
4. **Fundamentals of Machining and Machine Tools - R.K.Singal - I K International Publishing house Pvt Ltd,**
5. **Wohlers Report 2001-Terry Wohlers, Wohlers Associates, 2008.**

**Process of Ascertaining (both CIE and SEE):**

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

**Continuous Internal Evaluation (CIE):**

Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.

First test at the end of 5<sup>th</sup> week of the semester and Second test at the end of the 10<sup>th</sup> week of the semester. The makeup test at the end of the 15<sup>th</sup> week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.

Two assignments each of 05 Marks (taken average at the end)

First assignment at the end of 4<sup>th</sup> week and Second assignment at the end of 9<sup>th</sup> week of the semester.

Group discussion/Activities / Seminar/Quiz will be planned suitably to attain the Co<sup>s</sup> and PO<sup>s</sup> and PS<sup>o</sup>.

At the end of the 13<sup>th</sup> week of the semester the sum of two tests, two assignments and Group discussion/Activities /Seminar/Quiz will be Scaled out of 50 marks.

(For each CIE, the portion of the syllabus should not be common/repeated). CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**Semester End Examination (SEE):**

Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration **03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from



each units/module. Each of the two questions under a unit/module should have a maximum of 3 sub-questions, should have a mix of topics under the unit/module. The students have to answer 5 full questions. Selecting one full question from each unit/module.

# Open Elective Course-1

Course Title	<b>PROJECT MANAGEMENT</b>						
Course Code	<b>21IMT6051</b>						
Category	<b>Open Elective Course -I</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>		<b>Total Max. Marks: 100</b>		<b>Duration of SEE: 03 Hours</b>		

<b>Course Objectives:</b>	
1	To introduce concepts of project management with a strong emphasis on issues and problems associated with delivering successful projects.
2	To Define and study the project planning and estimating its cost.
3	To determine the elapsed time and idle time through project scheduling
4	To determine the critical path for the projects through project management tools and techniques

<b>Unit No.</b>	<b>Syllabus</b>	<b>No. of Hours</b>
<b>I</b>	<p><b>CONCEPTS OF PROJECT MANAGEMENT:</b> Introduction, meaning of project, features of project, types of project, benefits of project management,, obstacles in project management, pm a profession, pm and his role, project consultants, what is operation, difference between project and operation,what is process in project management and process groups, what is scope, differencebetween project group objectives and project scope</p> <p><b>PRODUCT LIFE CYCLE:</b> Phases of project life cycle, project planning, project execution, project closure, project risks.</p>	<b>6</b>
<b>II</b>	<p><b>PROJECT IDENTIFICATION:</b> Sources of project ideas, purpose and need for project identification, steps of project identification, methodology for project identification, project identification for an existing company.</p> <p><b>FEASIBILITY STUDY AND PROJECT REPORT:</b> Nature of project feasibility analysis, need for feasibility studies, components of feasibility study, commercial and economic feasibility, technical, financial, managerial, social feasibility. Format of feasibility report, checklist for feasibility report, project report.</p>	<b>7</b>
<b>III</b>	<p><b>PROJECT PLANNING:</b> Nature of project planning, need for project planning, functions of project planning,steps in project planning, project planning structure, project objectives and policies,tools of project planning.</p> <p><b>PROJECT SCHEDULING:</b> Purpose of scheduling, time monitoring efforts, bounding schedules, project monitoring and implementation, situation analysis and problem definition, setting goals and objectives , implementation, project evaluation, importance and challenges in monitoring and project evaluation.</p>	<b>6</b>
<b>IV</b>	<p><b>PROJECT CONTROL:</b> Projected control purposes, problems of projected control, Gantt Charts, Critical Path Method (CPM), advantages of CPM, main obje4ctives of CPM, advantages of CPM, PERT, advantages of PERT, differences in PERT and CPM.</p> <p><b>PROJECT RISK:</b></p>	<b>10</b>

	Risk, Risk vs Uncertainty, types of risk, Risk Analysis, objectives, activities involved in risk analysis, risk assesment, risk management.	
V	<b>PROJECT MANAGEMENT SOFTWARE:</b> Project management software's general factors, factors influencing price of project software, Insta Plan III, Yojana, Prism project manager, Primavera, Agile methods, Scanner Master. <b>ENVIRONMENTAL IMPACT ASSESMENT AND ENVIRONMENT ANALYSIS :</b> EIA in different countries, Environmental analysis, components of environmental analysis, economic environment, political, governmental, legal environment, social and cultural environment, natural, global, technological environment.	10

**Note 1:** Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

**Note 2:** Two assignments are evaluated for 5 marks.

<b>Course Outcomes:</b> At the end of the course the student will be able to	
1	Apply the concept, tools and techniques for managing large projects.
2	Construct project plans for different types of organizations.
3	Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities
4	Will be able to explain on resource and time planning, controls, communication mechanisms, reviews and other project management tools.
5	Analyze and evaluate risks in large and complex project environments

COs	Mapping with POs
CO1	PO3,PO4,PO5,PO7,PO8,PO9,PO11
CO2	PO3,PO4,PO5,PO7,PO8,PO9,PO11,PO12
CO3	PO3,PO4,PO5,PO6,PO11
CO4	PO4,PO5,PO11
CO5	PO4,PO10,PO11,PO12

**TEXT BOOKS:**

1. **Project management**, Dr. Lalitha Balakrishnan, Dr Gowri Ramachandran , Himalaya Publishing House, 2019 edition
2. **Project Management a System approach to Planning Scheduling & Controlling** - Harold Kerzner, CBS Publishers and Distributors. 2016.
3. **Project Execution Plan: Plan for project Execution interaction** - Chaudhry S.2016
4. **Project Management Institute, "A guide to the project management body of knowledge (PMBOK Guide)"**.5<sup>th</sup> edition, 2013, ISBN: 978-1-935589-67-9. 2015

**REFERENCES BOOKS:**

1. **Project Planning Analysis selection financing Implementation and Review-** Tata Mc Graw Hill Publication, 7th edition 2010, Prasana Chandra.
2. **PERT & CPM.-** L.S. Srinath, Affiliated East West Press Pvt. Ltd. 2002.
3. **Project Management** – Benington Lawrence McGraw Hill 1970.

Course Title	<b>HUMAN RESOURCE MANAGEMENT</b>						
Course Code	<b>21IMT6052</b>						
Category	<b>Open Elective Course -I</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>		<b>Total Max. Marks: 100</b>		<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. An ability to evaluate and apply theories of social science disciplines to workplace issues
2. Use of HRM functional capabilities to select, develop, and motivate workers
3. To develop strong analytical, communication, and decision making skills.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	<b>INTRODUCTION:</b> Definition, objectives and Functions. <b>HUMAN RESOURCE PLANNING:</b> Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification.	<b>07</b>
<b>2</b>	<b>RECRUITMENT:</b> Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.	<b>06</b>
<b>3</b>	<b>SELECTION:</b> Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group Discussion, Interviews)	<b>10</b>
<b>4</b>	<b>TRAINING AND DEVELOPMENT:</b> Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. <b>PERFORMANCE APPRAISAL:</b> Components (all round performance appraisal), Methods, Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.	<b>10</b>
<b>5</b>	<b>INDUSTRIAL RELATIONS:</b> Meaning Characteristics of Industrial Relations, Factors of Industrial, Relations, the Three Actors of Industrial Relations, Importance of Harmonious Industrial Relations, Objectives of Industrial Relations, Functions of Industrial Relations, Code of Industrial Relations, Conditions for Congenial Industrial Relations	<b>06</b>

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.

Note 2: Two assignments are evaluated for 5 marks.

**Outcomes:**

1. Apply the knowledge and skills needed to effectively manage human resources
2. Examine current issues, trends, practices, and processes in HRM
3. Compare the common methods for recruiting and selecting human resource
4. Contribute to employee performance management and organizational effectiveness
5. Evaluate employee orientation, training, and development programs

<b>Cos</b>	<b>Mapping with POs</b>
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

### **TEXT BOOKS**

1. **Human Resources Management** – Dr. K Ashwathappa, Tata McGraw Hill, Edition 2016
2. **Management of Human Resources** – CB Mamoria – Himalaya Publication House, 2003

### **REFERENCES BOOKS**

1. **Essentials of HRM and industrial relationc** – Subbarao,P , Himalaya publishing house 2016
2. **Personnel / Human resource Management** – Decenoz and robbins PHI, 2002
3. **Industrial Acts** by Jain, 2004
4. **Industrial Relations** – Arun Monappa – TMH, ISBN – 0-07-451710-8

Course Title	<b>ENTERPRISE RESOURCE PLANNING LAB</b>						
Course Code	<b>21IMT606</b>						
Category	<b>PCCL</b>						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	<b>00</b>	<b>00</b>	<b>02</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>3</b>
<b>CIE Marks: 50</b>	<b>SEE Marks: 50</b>		<b>Total Max. Marks: 100</b>		<b>Duration of SEE: 03 Hours</b>		

**Course Objectives:**

1. To provide an determining of the managerial issues involved in the design and implementation of Enterprise Resource Planning Systems
2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry;
3. Use of statistical tools for data analysis.

Unit No.	Syllabus Content	No of Hours
<b>1</b>	Creating Item Master for various Engineering Designs Creating Supplier Master for Items Creating customer Master for Items Generating Bill of Materials for Various Engineering Designs Creating Purchase order for Items Creating Work order / job card for Items and Dispatch Instruction for Items	24
<b>2</b>	Optimization problems using OR packages Linear programming Transportation problem Assignment problem PERT/CPM	12

**Course Outcomes:**

CO1: Develop the skills and knowledge to support the implementation and maintenance of Enterprise Resource Planning (ERP) systems.

CO2: Formulate and solve Linear programming problems, transportation and assignment Problems

Cos	Mapping with POs
CO1	PO3,PO5,PO6,PO11
CO2	PO2,PO4,PO5

**Scheme of Examination:**

ONE question from Unit -1 : 30 marks

ONE question from Unit -2 : 10 marks

Viva-Voce: 10 marks.

**Suggested Software Packages**

1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others
2. ERP Packages : SIXTH SENSE / RAMCO / MAARSMAN / CIMAS / UNISOFT
3. OR Packages : Lindo / Lingo / Storm

<b>Sub Title : Project Work Phase I</b>	
<b>Sub Code : 21IMM607</b>	<b>No. of Credits: 0</b>

<b>Sl. No.</b>	<b>Syllabus</b>
1	Phase I – 00 Credits in VII Semester
2	Student shall give a report on the following: <ul style="list-style-type: none"> <li>• The company chosen for dissertations work.</li> <li>• The field chosen for the same</li> <li>• Literature review about chosen subject</li> </ul>