Maulana Azad National Institute of Technology, Bhopal – 462003

Mechanical Engineering Department

M. Tech. (Industrial Engineering and Management)

PROPOSED SCHEME M TECH (IEM) – wef July 2024

FIRST SEMESTER

Course No	Course Name	Periods per week			Credits
		L	T	P	
IEM24511	Work System Design and Ergonomics	3	-	-	3
IEM24512	Supply Chain Management	3	-	-	3
IEM24513	Production and Operations Management	3	-	-	3
IEM24551-24565 & ME24524	Department Elective -1	3	-	-	3
	Department Elective -2	3	-	-	3
SM24514	Modelling and Simulation Laboratory	-	-	2	1
AR24513	Automation and Robotics Laboratory I	-	-	2	1
IEM24515	Seminar – I	-	-	2	1
IEM24516	Minor Project-1 (Self Learning)	-	-	-	2
HUM24511	Communication Skills (Audit Course)	2	-	-	0
Total Hours – 23 Total Credits – 20		Semester Credits			20

SECOND SEMESTER

Course No	Course Name	Periods per week			Credits
		L	T	P	
IEM24521	Decision Modeling	3	-	-	3
IEM24522	Principles and Practices of Management	3	-	-	3
IEM24551-24565 & ME24524	Department Elective -3	3	-	-	3
	Department Elective -4	3	-	-	3
	Open Elective	3	-	-	3
IEM24523	Decision Modeling Laboratory	-	-	2	1
ID24523	Product Development Laboratory	-	-	2	1
IEM24524	Seminar – II			2	1
IEM24525	Minor Project-2 (Self Learning)	-	-	-	2
Total Hours – 23 Total Credits – 40		Semester Credits			20

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Mechanical Engineering Department

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THIRD SEMESTER

Course No	Course Name	Periods per week			Credits
		L	T	P	
IEM24611	Dissertation Phase –I	-	-	40	20
Total Hours – 40 Total Credits – 60		Semester Credits			20

FOURTH SEMESTER

Course No	Course Name	Periods per week			Credits
		L	T	P	
IEM24621	Dissertation Phase –II	-	-	40	20
Total Hours – 40 Total Credits – 80		Semester Credits			20

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Mechanical Engineering Department

M. Tech. (Industrial Engineering and Management)

List of Department Electives		List of Open Electives	
IEM24551	Marketing Management	ARP24581	Introduction to Urban Planning
IEM24552	Production Planning and Control	BSE24581	Bioprocess Engineering
IEM24553	Lean Manufacturing	BSE24582	Biophysics Tools and Techniques
IEM24554	Reliability, Availability and Maintainability Engineering	CHE24581	Analytical Techniques
IEM24555	Green Logistics	CHE24582	Green Technology & Processes
IEM24556	Total Quality Management	CE24581	Solid Waste Management
IEM24557	ERP and MIS	CE24582	Basic Concept of GIS
IEM24558	Maintenance Management	CE24583	Road Safety
IEM24559	Entrepreneurship & Start up Creation	CSE24581	Machine Learning
IEM24560	Concurrent Engineering	CSE24582	Advanced Data Structures and Algorithms
IEM24561	Design of Experiments	PHY24581	Nanotechnology and Nanoscience
IEM24562	Organizational Behavior	EE24581	Electric Machines & Applications
IEM24563	Industrial Design and Processes	EE24582	Control and Instrumentation
IEM24564	Financial Management and Accouning	ECE24581	Introduction to Fuzzy Logic
IEM24565	Industrial safety and Environment Management System	ECE24582	Neural Networks and its Applications
ME24524	Research Methodology	EC24581	Energy Resource Technologies
		HUM24581	Intellectual Property Rights for Engineers
		HUM24582	Applied Psychology: Human Centered Design and Engineering
		MTH24581	Advanced Operations Research
		MTH24582	Computing Technologies
		MME24581	Advanced Instrumentation Methods for Material Analysis
		MME24582	Smart Materials and their Application
		MBA24581	Engineering Startup Management

MAULANA AZAD NATIONAL INATITUTE OF TECHNOLOGY,
BHOPAL - 462003

Name of Program	**M. Tech. (Industrial Engineering and Management)**	**Semester I**	**Year - First**
Name of Course	**WORK SYSTEM DESIGN AND ERGONOMICS**		
Course Code	**IEM24511**		
Core / Elective / Other	**CORE**		
Prerequisite if any:			
1.	NONE		
Course Outcomes:			
1.	Students shall learn Productivity concept and ways to enhance productivity, through Method Study and Work Measurement.		
2.	Understanding of Human Factor Engineering and related aspects with practice on few techniques of evaluation of human risk.		
3.	Students shall understand theories and models related to Plant Location, Facility Planning, Materials Flow, Facility Management and its application software.		
Description of Contents in brief:			
Unit 1.	Definition of Industrial Engineering, Relevance of Productivity in Industrial Engineering, Work content, Definition, productivity and work content, environmental conditions and work content, techniques to increase work content, Work study, method study, purpose, and work measurement, purpose, wage incentives, criteria etc.		
Unit 2.	Method study steps, recording techniques, analysis methods, principles of motion economy, etc., work measurement techniques, work sampling, sample size calculations, estimation of time, time study, definition of qualified worker, rating, standard time calculations etc.,		
Unit 3.	Overview of ergonomics, Fundamentals of ergonomics, concept of Ergonomic Design, Scope of Ergonomics. Man- the prime system component; Man-machine-environment interaction system and user-friendly design practice, Human compatibility, comfort and adaptability; Physical (Anthropometrics, human body-structure and function, posture, movement and biomechanics)		
Unit 4.	Physiological (work physiology) and Psychological aspects(behavior, cognitive aspects and mental workload); Information processing, human error and risk perception. Visual performance and visual displays; environmental factors influencing human performance; Occupational stress; safety and health issues; and Participatory ergonomics aspects; Supportive experiments.		
Unit 5.	Introduction to Factory Planning, factors to be considered. Levels of plant location, rural, urban and suburban location of plants, factors influencing the plant location, optimum plant location, location theories. Introduction of production system, scope, objectives, importance, and types of plant layout, characteristics of a good plant layout.		
List of Text Books:			
1.	Introduction to Ergonomics, R.S. Bridger, 2nd Ed., Taylor & Francis		

2.	An Introduction to Human Factors Engineering, C. D. Wicknes, S. E. Gordon, and Y. Liu, , Longman, New York
3.	Human Factors in Engineering and Design, Sanders and McCormick, Mc-Graw-Hill, INC.
4.	Facility Planning, Tompkins, White
5.	Facility Layout and Location, R.L. Francis, White
List of Reference Books:	
1.	Indian Anthropometric Dimensions for ergonomic design practice, D. Chakrabarti, National Institute of Design, Ahmedabad, 1997
2.	Handbook of Human Factors and ergonomics, G. Salvendy (ed.), John Wiley & Sons, Inc.
3.	Ergonomics for beginners, a quick reference guide, J. Dul, and B. Weerdmeester, Taylor & Francis,
URLs:	
1.	https://nptel.ac.in/courses/107/103/107103004/
2.	https://nptel.ac.in/courses/112/104/112104222/

Lecture Plan (about 40-50 Lectures):

***Lecture No.**	**Topic**	**Remarks**
1.	Introduction to Industrial Engineering /History and development of I.E.	
2.	Productivity Concepts and Different Measures of Productivity	
3.	Work Content / Measure of Work Content / Ways to improve Productivity	
4.	Work Study: Approach and Methods / Human Factor in Work Study	
5.	Method study: objectives, generic procedure in various charts	
6.	Operations Process Chart, Flow process Charts	
7.	Diagrams – String Diagram, Flow Diagram	
8.	Travel Chart and other charts	
9.	Principles of Motion Economy	
10.	Two Handed Chart	
11.	Therbligs	
12.	Use of photographic techniques etc	
13.	Summary of Method Study	
14.	**MINI TEST**	
15.	Work measurement, purpose, basic procedure, Work sampling	
16.	Various Techniques - PMTS, Time Study, Rating	
17.	Analytical Estimation,	
18.	Case studies	
19.	Overview of ergonomics - Scope of Ergonomics	
20.	Fundamentals of ergonomics	
21.	concept of Ergonomic Design	
22.	Man- the prime system component	
23.		

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24.	Man-machine-environment interaction system and user-friendly design practice	
25.		
26.		
27.	Human compatibility, comfort and adaptability	
28.	Human compatibility, comfort and adaptability	
29.	Physical (Anthropometrics, human body- structure and function, posture, movement and biomechanics)	
30.		
31.		
32.		
33.		
34.	Physiological (work physiology) and Psychological aspects(behavior, cognitive aspects and mental workload)	
35.		
35.		
36.		
37.		
38.	Information processing	
39.	Information processing	
40.	Human error and risk perception, Techniques to evaluate risk	
41.	Human error and risk perception, Techniques to evaluate risk	
42.	Visual performance and visual displays	
43.	Visual performance and visual displays	
44.	Environmental factors influencing human performance	
45.	Environmental factors influencing human performance	
46.	Occupational stress; safety and health issues	
47.	Occupational stress; safety and health issues	
48.	Participatory ergonomics aspects; Supportive experiments.	
49.	Summary of the course	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

Name of Program	M. Tech. IEM	Semester: I	Year: I
Name of Course	**Supply Chain Management**		
Course Code	IEM24512		
Core / Elective / Other	Core		

Prerequisite if any:	
1.	Nil
Course Outcomes:	
1.	Understanding different types of supply chains
2.	Design supply chain network and understating supply chain drivers
3.	Analyse supply chain coordination parameters
Description of Contents in brief:	
Unit 1.	Introduction Of Supply Chain Management, Inbound And Outbound Logistics, Efficient And Responsive Supply Chain, Supply Chain Case Studies
Unit 2.	Different Types Of Supply Chains: Agile And Lean Supply Chains, Green Supply Chain Management, Food Supply Chain Management, Humanitarian Logistics, Local & Global Supply Chain Management
Unit 3.	Supply Chain Drivers, Supply Chain Network Design, Warehousing, Facility Location
Unit 4.	Inventory Strategies and Management, Inventory Systems, Stochastic Inventory Model, Demand Forecasting
Unit 5.	Transportation, Third Party Logistics, Reverse Logistics, Distribution Planning
Unit 6	Supply Chain Coordination, Bullwhip Effect, Information Technology Tools In Supply Chains,
List of Text Books:	
1.	Supply Chain Management Strategy, Planning And Operations, Chopra, S., And Meindl, P., Prentice Hall
2.	Designing And Managing The Supply Chain: Simchi-Levi And Ravi Shankar: Tata Mcgraw Hill
3.	Operations And Supply Chain Management: Russel And Taylor Wiley Publication
List Of Reference Books:	
1.	Logistics And Supply Chain Management, Martin Christopher, Pearson.
2.	Introduction To Supply Chain Management, R.B. Handfield And E.L. Nochols, Jr. Prentice Hall.
3.	Business Logistics And Supply Chain Management- R Ballou, Pearson (Indian Edition)
URLs:	
1.	https://nptel.ac.in/courses/110/107/110107074/
2.	https://nptel.ac.in/courses/110/105/110105141/

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Remarks
1.	Introduction Of Supply Chain Management	Unit 1
2.	Scope Of Supply Chain Management	
3	Inbound And Outbound Logistics,	
4	Efficient And Responsive Supply Chain,	
5	Supply Chain Case Studies	
6	Supply Chain Case Studies	
7	Supply Chain Case Studies	
8	Agile And Lean Supply Chains,	Unit 2
9	Green Supply Chain Management	
10	Food Supply Chain Management,	
11	Humanitarian Logistics,	

12	Local & Global Supply Chain Management	
13	Supply Chain Drivers,	Unit 3
14	Supply Chain Drivers	
15	Supply Chain Network Design,	
16	Supply Chain Network Design,	
17	Warehousing,	
18	Facility Location	
19	Facility Location	
20	Inventory Strategies And Management,	Unit 4
21	Inventory Systems	
22	Inventory Model	
23	Stochastic Inventory Model	
24	Demand Forecasting	
25	Forecasting Methods	
26	Forecasting Methods	
27	Forecasting Methods	
28	Transportation,	Unit 5
29	Transportation,	
30	Third Party Logistics,	
31	Reverse Logistics,	
32	Distribution Planning	
33	Distribution Planning	
34	Supply Chain Coordination,	Unit 6
35	Bullwhip Effect,	
36	Causes Of Bullwhip Effect	
37	Information Distorsion	
38	Information Technology Tools In Supply Chains	
39	Supply Chain Softwares	
40	Enterprise Resource Planning	
41	ERP implementation	
42	Seminar	
43	Seminar	
44	Seminar	
45	Seminar	
46	Seminar	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	5	
6	Seminar, Viva voce if ay	5	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

Name of Program	M. Tech. Industrial Engineering & Management	Semester: I	Year: I

Name of Course	**Production and Operations Management**
Course Code	IEM24513
Core / Elective / Other	**Core**

Prerequisite:	
1.	Nil
Course Outcomes:	
1.	To enable students to understand scope of operations management
2.	To formulate and solve real world problems related to industries
3.	To design methods to improve quality, competitiveness and effective utilization of resources
Description of Contents in brief:	
Unit 1.	Introduction of Production & Operations Management, competitiveness, Functions of Management, Vision, Mission, Leadership Style, Theories of Motivation
Unit 2.	Operations Strategy, Balance Score card, Production Processes, Selection of Processes, QFD
Unit 3.	Quality Control, Quality control tools, Deming‟s 14 Points, Process control charts, Process Capability, Six Sigma, Acceptance Sampling
Unit 4.	Factors affecting Facility Location decision, Facility Location methods, Facility Layout, Hybrid layout, Cellular Layout, FMS
Unit 5.	Inventory control, Inventory methods, Inventory associated cost, ABC Analysis, Basic Inventory models, safety stock
Unit 6.	Project Management: Planning, scheduling, control, Network, PERT CPM, Crashing
List of Text Books:	
1.	Operations Management by Russell and Taylor, latest edition ,Wiley
2.	Operations Management by William J Stevenson , TMH
3.	Operation Management: Strategy & Analysis, Lee J. Krajewski & Larry P.Ritzman, Pearson Education.
List of Reference Books:	
1.	Principles of Operation Management, Heizer & Render, Pearson Publication
2.	Operations Management by Gaither and Frazier, Cengage Learning
3.	Operations and Supply Management by Chase and Aqilano, TMH
URLs:	
1.	https://nptel.ac.in/courses/112/107/112107238/
2.	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-mg06/

Lecture Plan :

Lecture No.	Topic	Remarks
1.	Introduction of Production & Operations Management,	
2.	Competitiveness	
3.	Functions of Management	
4.	Vision, Mission,	
5.	Leadership Style, Theories of Motivation	
6.	Operations Strategy,	
7.	Balance Score card,	
8.	Selection of Processes,	
9.	Production Processes	
10.	QFD,	

11.	Quality Control,	
12.	Quality control tools,	
13.	Deming‟s 14 points	
14.	Process control charts,	
15.	Process capability	
16.	Six Sigma	
17.	Acceptance Sampling	
18.	Case discussion	
19.	Factors affecting Facility Location decision	
20.	Methods of facility location	
21.	Facility Layout,	
22.	Hybrid layout, Cellular Layout	
23.	FMS	
24.	Case discussion	
25.	Inventory control	
26.	Inventory methods	
27.	ABC Analysis	
28.	Cost associated with Inventory	
29.	Basic Inventory models,	
30.	safety stock	
31.	Case discussion	
32.	Project Management	
33.	Project Planning & Scheduling	
34.	Network	
35.	PERT	
36.	PERT	
37.	CPM,	
38.	**CPM**	
39.	Project Crashing	
40.	Seminar	
41.	Seminar	
42.	Seminar	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

Name of Program	M. Tech (Smart Manufacturing)	**Semester**- I	**Year**- I
Name of Course	Modelling and Simulation Lab		
Course Code	SM24514		
Core / Elective / Other	Core		

Prerequisite if any: NIL

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

CO1	Understand the basic tools of programming.
CO2	Understand the terminology of various software use in manufacturing and optimization methods.
CO3	Solve the complex manufacturing processes using computational techniques.
CO4	Simulate the different supply chain and optimization models.

List of Experiments

1. Study of Basics in ANSYS
2. Stress analysis of a plate with a hole and rectangular L bracket
3. Stress analysis of different beams
4. Stress analysis of an axi-symmetric component
5. Thermal stress analysis of a 2D component
6. Conductive and Convective heat transfer analysis of a 2D component
7. Mode frequency analysis of beams
8. Harmonic analysis of a 2D component
9. Stress analysis of a truss
10. Do it yourself (DIY) experiments (Students should take the real-world issue and they have to think, decide and do things independently)

List of Text Books:

1	Y. P. Kanetkar, Let Us C, BPB, 16th edition, 2018.
2	B. Gottfried and J. Chhabra, Programming with C, Tata Mcgraw Hill, 4th Edition, 2018.
3	RudraPratap, Getting Started with Matlab, Oxford University Press, 7th edition, 2016.

List of Reference Books:

1	Stormy Attaway, Matlab: A Practical Introduction to Programming and Problem Solving, Butterworth-Heinemann Elsevier, 5th edition, 2018.

URLs:

Name of Program	M. Tech. IEM	Semester: I	Year: I

Name of Course	Communication Skills
Course Code	HUM24511
Core / Elective / Other	Other - Audit

Prerequisite: Nil

Course Outcomes:

1.	To help postgraduate students improve their technical communication skills related to listening, speaking, reading, writing
2.	To enable students to organize, comprehend, write, and present short and long forms of any technical work within the broad framework of the scientific method
3.	To help students adhere to ethical norms of scientific communication

Description of Contents in brief:

Unit 1.	**Scientific Method and its Relationship to Technical Communication** Basics of technical communication, formulation of hypothesis, paragraph organisation, argument development, evidence and elaboration
Unit 2.	**Listening and Reading Skills** Note taking, survey of literature, different reading strategies
Unit 3.	**Writing Skills** Report writing, peer review skills, summary and abstract writing, bibliography and references, data analysis and presentation, visual communication
Unit 4.	**Speaking Skills** Elevator pitch, oral presentation, slides for presentation, group discussions, interview skills
Unit 5.	**Ethics in Communication** Ethics in education and research, copyrights and plagiarism, authorship, gender and diversity, net etiquettes and workplace communication

List of Text Books:

1.	V.N. Arora, Lakshmi Chandra. Improve Your Writing, Oxford University Press, 2013
2.	Graff Gerald, Birkenstein Cathy. They Say I Say-The Moves That Matter in Academic Writing, Fourth Edition, W. W. Norton and Company, 2018
3.	V. Raymond, E. Marie, Flatley Lesikar. Basic Business Communication Skills for Empowering the Internet Generation, Ninth Edition, McGraw-Hill, 2002

List of Reference Books:

1.	Graff Gerald, Birkenstein Cathy. They Say I Say-The Moves That Matter in Academic Writing, Fourth Edition, W. W. Norton and Company, 2018
2.	Sanjay Kumar, Pushp Lata. Communication Skills, Oxford University Press, 2011
3.	Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practice, Oxford University Press, 2015

URLs: Nil

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1-2	Basics of technical communication
3.	Formulation of hypothesis

4-5	Paragraph organization
6.	Argument development
7.	Evidence and elaboration
8.	Note taking
9-10	Survey of literature
11.	Different reading strategies
12-13	Report writing
14-16	Peer review skills
17-18	Summary and abstract writing
19-20	Bibliography and references
21-25	Data analysis and presentation
26-27	Visual communication
28.	Elevator pitch
29-33	Oral presentation
34.	Slides for presentation
35-37	Group discussions
38-40	Interview skills
41.	Ethics in education and research
42-43	Copyrights and plagiarism
44.	Authorship
45.	Gender and diversity
46.	Net etiquettes
47- 48	Workplace communication

Evaluation Criteria:

Sl. No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	20	
4	Tutorial if any	Nil	
5	Quiz if any	Nil	
6	Seminar, Viva voce if any	Nil	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)	Nil	
9	Any other	Nil	

Name of Program	M. Tech. Industrial Engineering & Management	Semester: II	Year: I

Name of Course	**Decision Modelling**
Course Code	IEM24521
Core / Elective / Other	Core

Prerequisite if any:	
1.	Nil
Course Outcomes:	
1.	Analyse and synthesis the linear programming problem
2.	Simulate the optimization problems and Develop decision making skills
3.	Understanding statistical methods
Description of Contents in brief:	
Unit 1.	Application of statistical tools, Scope of statistics in management, Central tendency, Measure of dispersion, statistical charts
Unit 2.	Data collection methods, Questionnaire preparation, Sampling methods, Correlation and Regression analysis
Unit 3.	Introduction to LP, Formulation of LPP, Graphical Method, Simplex Method,
Unit 4.	Transportation Model & Assignment Model
Unit 5.	Decision Analysis: Decision Trees, Theory of Games – Two Persons Zero Sum Game, Pure and mixed strategy Games.
Unit 6	Waiting Line Model – Single Chanel System, Sequencing problem, Multi Criteria Decision Making Techniques
List of Text Books:	
1.	Introduction to Operations Research, by Frederick S. Hillier and Gerald J. Lieberman, Tata McGraw Hill, New York.
2.	Operations Research: An Introduction, by Hamdy A. Taha, Prentice-Hall, New York.
3.	Operations Research by Heera & Gupta, S Chand Publications
List of Reference Books:	
1.	Operations Research: Applications and Algorithms, Winston, W. L.Duxbury Press, Belmont
2.	Operations Research by Ravindran and Phillip; Wiley publication
3.	Quantitative Techniques in Management by N D Vohra; McGraw Hill Education
URLs:	
1.	https://nptel.ac.in/courses/112/106/112106134/
2.	https://freevideolectures.com/course/2365/fundamentals-of-operations-research
3.	http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	30	
3	Assignment if any	5	
4	Tutorial if any		

5	Quiz if any	5	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

Lecture Plan

Serial Number	Description of Lecture Plan
1.	Application of statistical tools
2.	Scope of statistics in management
3.	Central tendency
4.	Measure of dispersion
5.	statistical charts
6.	Data collection methods
7.	Questionnaire preparation
8.	Sampling methods
9.	Correlation and Regression analysis
10.	Introduction to LP
11.	Formulation of LPP
12.	Graphical Method
13.	Simplex Method
14.	Transportation Model
15.	Assignment Model
16.	Correlation and Regression analysis
17.	Decision Analysis: Decision Trees
18.	Theory of Games
19.	Two Persons Zero Sum Game
20.	Pure strategy Games
21.	Mixed strategy Games
22.	Waiting Line Model
23.	Single Chanel System
24.	Sequencing problem
25.	Multi Criteria Decision Making Techniques
26.	Introduction to LP
27.	Formulation of LPP
28.	Graphical Method
29.	Simplex Method
30.	Transportation Model
31.	Assignment Model
32.	Correlation and Regression analysis
33.	Decision Analysis: Decision Trees
34.	Central tendency
35.	Measure of dispersion
36.	statistical charts
37.	Data collection methods
38.	Transportation Model
39.	Assignment Model
40.	Correlation and Regression analysis

Name of Program	M. Tech. Industrial Engineering & Management	Semester II	Year First

Name of Course	**Principles and Practice of Management**
Course Code	**IEM24522**
Core / Elective / Other	**Core**

Prerequisite if any:	
1.	Nil

Course Outcomes:	
1.	To create an understanding on basic principles, concepts & functions, ethical issues of management.
2.	To comprehend the fundamentals of planning techniques, organizational principles, designs, and structures.
3.	To explain the key competencies and skills required for personnel management, motivation, and leadership.
4.	To explain and assess the importance of effective control system in a changing environment.

Description of Contents in brief:	
Unit 1.	Introduction to the basic concepts of management, definitions, nature, roles, skills , rinciples and practice of management., environment.
Unit 2.	Planning function of management, its nature, purpose componenets and objectives of planning, Strategies. Management by Objectives.
Unit 3.	Organizing function of management, Nature and Purpose of Organizing, Departmentation, Organization Structur
Unit 4.	Staffing function of management, Functions of Personnel Management, Manpower Planning, Selection and Recruitment
Unit 5.	Directing function of management, Training, motivation and leadership., cooperation and coordination.
Unit 6	Controlling function of management, Methods and Evaluation of effective control system,

List of Text Books:	
1.	Robbins, S. Fundamentals of Management. 11th ed., Pearson Education, Canada, 2015.
2.	Prasad L.M., Principles and Practice of Management, Sultan Chand & Sons, India, 2019.
3.	Chhabra T.N., Principles and practice of management, Dhanpat Rai and Co., 2014

List Of Reference Books:	
1.	Koontz H. and O"Donnel H., Essential of Management, 8th ed., McGraw-Hill, New elhi, 2009
2.	Terry & Francklin, Principles of Management, Richard – Erwin.

URLs:	
1.	https://nptel.ac.in/courses/110/105/110105146/
2.	https://nptel.ac.in/content/storage2/courses/122106031/Pdfs/1_1.pdf

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Units
1.	Introduction and Definitions of management	Unit 1
2.	Nature of management	
3.	Roles of management	
4.	Functions of management	
5.	Principles of management	

6.	Skills of management	
7.	vels of management	
8.	Schools of Management Thought	
9.	Schools of Management Thought	
10.	Effects of External environment	
11.	Ethical issues	
12.	Organizational culture on management	Unit 2
13.	Nature and Purpose of Planning	
14.	Components of Planning	
15.	Objectives of planning	
16.	Types and Barriers to Effective Decision-Making	
17.	Bounded Rationality	
18.	Policy Formulation and Strategies	\Unit 3
19.	Management by Exception	
20.	Management by Objectives	
21.	Nature and Purpose of Organizing	
22.	Depart mentation	
23.	Organization Structures-Line organization	
24.	Functional Organization	
25.	Line and Staff Organization	
26.	Other structures like Mixed and Matrix organization	
27.	Delegation of Authority.	
28.	Functions of Personnel Management	Unit 4
29.	Manpower Planning	Unit 5
30.	Selection and Recruitment	
31.	Methods & Types of Training	
32.	Motivation Theories	
33.	Leadership theories	
34.	Performance Appraisal Process	
35.	Performance appraisal Methods	
36.	Evaluation of effective control system	
37.	Developing and compensating employees	
38.	Feedback & Feed-forward System	
39.	Effective Communication	
40.	Barriers to effective communication	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	5	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	5	
6	Seminar, Viva voce if ay	10	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

Name of Program	M. Tech. (IEM)	SEMESTER II	YEAR-I
Name of Course	**DECISION MODELING LABORATORY**		
Course Code	**IEM24523**		
Core / Elective / Other	**CORE – LABORATORY COURSE**		
Prerequisite:			
1.	None		
Course Outcomes:			
1	Analyse and synthesis the Decision Making problems		
2	Simulate the optimization problems and Develop decision making skills		
3	Analysis of Different Statistical methods		
LIST OF EXPERIMENTS			
1	To write and solve LPP problems using MS EXCEL software.		
2	To solve LPP problems using LINGO / LINDO software.		
3	To write and solve Transportation problems using MS EXCEL software.		
4	To write and solve Transportation problems using TORA/LINGO/LINDO software		
5	To write and solve Assignment problems using TORA software		
6	To write and solve Assignment problems using TORA/LINGO/LINDO software		
7	Correlation and relation analysis using MATLAB/EXCEL		
8	Testing Random Number Generators using MATLAB		
9	Test for Standard Normal Distribution using MATLAB		
10	Data Collection & Analysis for any Industry Specific case		

Name of Program	M Tech IEM	Semester: II	Year: I

Name of Course	Product Development Laboratory
Course Code	ID24523
Core / Elective / Other	Core

Prerequisite if any:	
1.	Understanding of conceptual design phase, problem solving methodology
2.	Knowledge of working on CAD platforms
Course Outcomes:	
CO 1	Enable to conceptualize and envision the novelty in the existing products
CO 2	Enable to develop the new part/ product or variants with complete design specifications.
CO 3	Apply Industrial design knowledge and skills for investigating and development of promising product using CAD applications
Description of Contents in brief:	
Unit 1.	Study of Product Aesthetics and development of alternatives, design thinking –Case of a Selected Product
Unit 2.	Find the variants available, enlist the parts, components, and sub-assemblies with pictures
Unit 3.	Explain the function and identify the material for every part, component, and sub-assembly.
Unit 4.	Analyze and design the product using the application of various computer aided design software packages
Unit 5.	Study about the product ergonomics, reverse engineering, and conceptually provide the feasible solution
List of Text Books:	
1.	Engineering Design, George E. Dieter and Linda C. Schmidt, Mc Graw hill.
2.	Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Mc Graw Hill.
3.	Product Design for Engineers, Devdas Shetty, Cengage Learning.
List of Reference Books:	
1.	Engineering Design Methods, Nigel Cross, Wiley.
2.	Materials Selection in Mechanical Design, Michael F. Ashby
3.	Product Design, Techniques in Reverse Engineering and New Product Development, Kevin Otto, Kristin wood, Pearson Education
URLs:	
1.	https://www.digimat.in/nptel/courses/video/112104230/L01.html
2.	https://nptel.ac.in/courses/110/105/110105087/

Lecture Plan:

*Lecture No.	Topic	Remarks
1.	Introduction – Brainstorming on identification of part/product for design and development (Feasibility, social, environmental, and economical considerations)	

2.	Describe the product using CAD applications. Explain the working principle and process	
3.	Find the variants available. Discussions on their pros and cons.	
4.	Enlist the parts, components, and sub-assemblies with pictures	
5.	Identify the materials for parts, components, and sub-assemblies	
6.		
7.	Steps for disassembly and reassembly of the product (finding obstructed access, time required etc.) – Reverse Engineering	
8.	Discuss ergonomics (including no. of operators required, comfort, vibrations, holding requirements etc.)	
9.	Identify the general problems with this product	
10.	Suggest the solutions for those problems and conceptually provide the proposed alteration/modification for the existing product	

Evaluation Criteria:

Sl. No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test		
2	Mid Semester Test		
3	Assignment if any		
4	Tutorial if any		
5	Quiz if any	20	
6	Seminar, Viva voce if any		
7	End Semester Examination	60	
8	Experiments if any (for practical courses)	20	
9	Any other		

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Name of Program	**M. Tech. (IEM)**	**Semester I / II**	**Year - First**
Name of Course	**MARKETING MANAGEMENT**		
Course Code	**IEM24551**		
Core / Elective / Other	**ELECTIVE**		
Prerequisites if any:			
1.	NIL		
Course Outcomes:			
1.	Enables to understand Marketing Scope and Concepts, marketing		
2.	Enables to understanding the market place and consumers		
3.	Enables to understand Consumer markets and consumer buyer Behaviour		
4.	Enables to understand Services and brands		
5.	Enables to understand Integrated Marketing Communication		
6.	Enables to understand Sustainable marketing		
7.	Enables to understand recent concepts in Marketing, Global Marketing Strategies for Indian Firms		
Description of Contents in brief:			
Unit 1.	Marketing Scope and Concepts, marketing: creating and capturing customer value, partnering to build customer relationship. Understanding the market place and consumers: analysing the marketing environment, managing marketing information to gain customer insight		
Unit 2.	Consumer markets and consumer buyer Behaviour, business markets and business buyer Behaviour. Designing a customer driven strategy and mix: creating value for target customer, products, services and brands, building customer values, new product development and product life cycle strategies.		
Unit 3.	Services and brands: building customer value, new product development and product life. Managing Marketing Channels, Logistics and Supply Chain Management, Retailing and Wholesaling		
Unit 4.	Integrated Marketing Communication, Sales Promotions, Advertising and Public Relations, Sales Management, Personal Selling, Direct and online Marketing. Sustainable marketing: Social Responsibility and Ethics.		
Unit 5.	Marketing Evaluation and Control, Marketing of services. Recent concepts in Marketing, Global Marketing Strategies for Indian Firms.		

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List of Text Books:	
1.	Marketing Management Philip kotler
2.	Marketing Management Rajan Saxena
3.	Marketing Management SHH Kazmi
List of Reference Books:	
1.	Marketing Management Ramasamy &Namakumari
2.	Marketing Management S. Jayachandran
URLs:	
1.	https://nptel.ac.in
2.	http://www.netmba.com/marketing/concept/
3.	http://www.jimnovo.com/Relationship-Marketing-more.htm

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Remarks
1.	Marketing Scope and Concepts	
2.	Marketing Scope and Concepts	
3.	Marketing: creating and capturing customervalue	
4.	Marketing: creating and capturing customervalue	
5.	Marketing: creating and capturing customervalue	
6.	Partnering to build customer relationship	
7.	Partnering to build customer relationship	
8.	Partnering to build customer relationship	
9.	Understanding the market place and consumers	
10.	Understanding the market place and consumers	
11.	Understanding the market place and consumers	
12.	Analysing the marketingenvironment	
13.	Managing marketing information to gain customer insightthe marketingenvironment	
14.	Managing marketing information to gain customer insightthe marketingenvironment	
15.	Managing marketing information to gain customer insightthe marketingenvironment	
16.	Consumer markets and consumer buyer Behaviour	
17.	Consumer markets and consumer buyer Behaviour	

18.	Consumer markets and consumer buyer Behaviour	
19.	Business markets andbusiness buyer Behaviour	
20.	Business markets andbusiness buyer Behaviour	
21.	Business markets andbusiness buyer Behaviour	
22.	Designing a customer driven strategy and mix	
23.	Designing a customer driven strategy and mix	
24.	Designing a customer driven strategy and mix	
25.	Creating value for targetcustomer	
26.	Creating value for targetcustomer	
27.	Creating value for targetcustomer	
28.	Products, services and brands	
29.	Products, services and brands	
30.	Building customer values	
31.	Building customer values	
32.	New product development and product life cycle strategies	
33.	New product development and product life cycle strategies	
34.	New product development and product life cycle strategies	
35.	Services and brands	
36.	Building customer value	
37.	New product development andproduct life	
38.	New product development andproduct life	
39.	Managing Marketing Channels	
40.	Managing Marketing Channels	
41.	Logistics and Supply Chain Management	
42.	Logistics and Supply Chain Management	
43.	Retailing and Wholesaling	
44.	Integrated Marketing Communication, Sales Promotions, Advertising and Public Relations	
45.	Integrated Marketing Communication, Sales Promotions, Advertising and Public Relations	
46.	Sales Management, Personal Selling, Direct and	

	online Marketing	
47.	Sustainable marketing: Social Responsibility and Ethics	
48.	Marketing Evaluation and Control, Marketing of services	
49.	Recent concepts in Marketing, Global Marketing Strategies for Indian Firms	
50.	Recent concepts in Marketing, Global Marketing Strategies for Indian Firms	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	10	
5	Quiz if any		
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

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Name of Program	**M TECH**	**Sem I / II**	**Year Ist**
Name of Course	**Production Planning and Control**		
Course Code	IEM24552		
Core / Elective / Other	**Elective**		
Prerequisite if any:			
1.	NIL		
Course Outcome:			
1.	To understand different methods of production planning		
2.	To understand inventory, forecasting, capacity planning		
3.	To understand the advance production planning and control tools.		
Description of Contents in brief:			
Unit 1.	Objective of manufacturing planning and control, Functions, Organisation of PPC department		
Unit 2.	Types of production systems, Routing, Scheduling, Loading, Dispatching, Gantt chart,		
Unit 3.	Production control, Master production Schedule, Capacity Planning, Material requirement planning (MRP). Inventory control, KANBAN, Just in time and Continuous improvement		
Unit 4.	Sequencing, line balancing, Quality assurance, Six Sigma		
Unit 5.	Forecasting techniques, Regression Analysis		
Unit 6.	ERP, SAP, Theory of constraints, Industry 4.0 tools		
List of Reference Books:			
1.	1. Operations Management by Russell and Taylor, latest edition ,Wiley		
2.	Operation Management: Strategy & Analysis, Lee J. Krajewski & Larry P.Ritzman, Pearson Education.		
3.	Production planning and control: Text and cases by S.K. Mukhopadhyay, PHI publication		
URLs:			
1.	https://www.youtube.com/watch?v=Fxow6-LeQc8		
2.	https://www.youtube.com/watch?v=PRjExZxWsNc		

Lecture Plan

Lecture Number	Description of Topic
1.	Objective of manufacturing planning and control
2.	Organization of PPC department
3.	Types of production systems
4.	Routing
5.	Loading
6.	Gantt chart

7.	Production control
8.	Capacity Planning,
9.	Material requirement planning (MRP)
10.	Inventory control,
11.	Scheduling
12.	Dispatching
13.	Master production Schedule
14.	Theory of constraints
15.	Industry 4.0 tools
16.	Objective of manufacturing planning and control
17.	Organization of PPC department
18.	Six Sigma
19.	Forecasting techniques
20.	SAP
21.	Theory of constraints
22.	Six Sigma
23.	Routing
24.	Loading
25.	Gantt chart
26.	Production control
27.	KANBAN
28.	Just in time
29.	Continuous improvement
30.	Sequencing, line balancing
31.	Quality assurance
32.	Six Sigma
33.	Forecasting techniques
34.	Regression Analysis
35.	ERP
36.	SAP
37.	Theory of constraints
38.	Industry 4.0 tools
39.	Objective of manufacturing planning and control
40.	Organization of PPC department

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

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Name of Program	**PG / IEM**	**Semester – I / II**	**Year I**
Name of Course	Lean Manufacturing		
Course Code	IEM24553		
Core / Elective / Other	Elective		
Prerequisite if any:			
1.	Industrial Engineering		
2.	Production Management		
Course Outcomes:			
1.	Students shall understand the distinction between Mass Production and Lean Manufacturing in industries.		
2.	Students shall be able to describe the value adding, non value adding activities/elements and types of waste with their elimination from production processes/ manufacturing systems		
3.	Students shall be able to identify and implement lean tools or techniques like continuous flow, pull systems, 5S, Visual Control, Kanban, TPM, JIT etc.		
Description of Contents in brief:			
Unit 1	Review of manufacturing paradigm, Objectives of lean manufacturing, Main Lean Principles and Wastes, traditional versus lean manufacturing characteristics, Value creation and waste elimination-major kinds of manufacturing waste, Toyota/Lean production system.		
Unit 2	Fundamentals of Kaizen, Just In Time (JIT) production system; Pull/flow production, cell layout, takt time, Jidoka, 5S (Five S) Japanese approach.		
Unit 3	Standardized work, Visual control, Level production, Kanban and replenishment strategies.		
Unit 4	Concept of Poka Yoke, Cross functional team &Total Productive Maintenance.		
Unit 5	Concept of Single-Minute Exchange of Die (SMED), Value stream mapping (VSM).		
Unit 6	Various case studies of implementation of lean manufacturing tools in the industries.		
List of Reference Books:			
1.	E book: Lean Manufacturing Tools, Techniques; William M. Feld, The CRC press series on resource management, 2000.		
2.	E book: Just in Time Factory Implementation Through Lean Manufacturing Tools, Springer International Publishing AG, Susana Garrido Azevedo, Kannan Govindan 2018		
3.	E book: Value Stream Management for the Lean Office, Don Tapping and Tom Shuker ,CRC Press Taylor & Francis Group		

URLs:

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1.	http://microsoft.com/dynamics/ax (Lean Manufacturing: Kanban and Pull Based Manufacturing)
2.	http://www.qad.com, (Training Guide Lean Manufacturing)

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1	Craft Production, Mass Production/Ford System
2	Birth of Lean Production/The Toyota Production System
3	The Ultimate Goal and Benefits of Lean Manufacturing
4	Components of Lean Philosophy; waste elimination, simplicity, continuous improvement, visibility, flexibility
5	Culture of continuous improvement; Kaizen advantages
6	Kaizen and Deming Cycle for Continuous improvement
7	Basic image of Lean production , Customer Focus; PQCDSM
8	Lean Thinking Principals; Value & Waste Definition, Flow, Pull , Perfection
9	Muda explanation
10	Mura, and Muri explanation
11	Lean activities/ house of lean/lean tools-techniques
12	4M Stabilization for improvements at Gemba using visual management, 5S system, Standardized work and Total Productive Maintenance (TPM)
13	Visual Management systems-I (Cont.)
14	Visual Management systems-II
15	Standard Work: Documenting the Interaction between People and Their Environment
16	Elements of Standardized Work; Takt time and Cycle Time, Work sequence, In-process stock
17	Charts Used to Define Standardized Work; Production capacity chart, Standardized work combination table, Standardized work analysis chart
18	5S System-I (Cont.)
19	5S System-II (Cont.)
20	5S System-III (Cont.)
21	Spaghetti plots & Layouts ; Fixed-position, Process , Product & Cellular or combination layout
22	Just-in-Time Production
23	Pull System of Manufacturing
24	One-Piece Flow and Cellular Manufacturing
25	Production leveling or heijunka
26	Multifunctional Workers
27	Kanban a visual tool to achieve JIT production; Benefits; Forms/types
28	Kanban Rules
29	Design of kanban-I (Cont.)
30	Design of kanban-II (Cont.)
31	Total Productive Maintenance
32	Six Big Losses

33	Overall equipment effectiveness-I (Cont.)
34	Overall equipment effectiveness-II
35	Concept of Zishu Hozen
36	Concept of Jidoka, Poka-Yoke & Andon
37	SMED based Case studies
38	Value Stream Mapping
39	Value Stream Mapping based Case study -I
40	Value Stream Mapping based Case study-II

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

Name of Program	M. Tech. (IEM)	Semester: I / II	Year: Ist

Name of Course	Reliability, Availability and Maintainability Engineering
Course Code	IEM24554
Core / Elective / Other	Elective

Prerequisite if any:	
1.	Little knowledge of probability
2.	Some mathematical knowledge

Course Outcomes:	
1.	Learners will be able to understand and interpret the problem related to reliability.
2.	Able to understand and calculate combined reliability of a system in series and parallel.
3.	Able to solve problems of availability in individual component and system
4.	Will be able to identify, classify and apply proper maintenance method for the individual components.

Description of Contents in brief:	
Unit 1.	Introduction to Reliability Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, down time consequences.
Unit 2.	Reliability engineering fundamentals and applications, Historical perspectives, Definition of Reliability, Role of Reliability evaluation, Reliability assessment, relationship between different Reliability functions, typical Hazard functions, Mean time to failure, Cumulative Hazard function and average failure rate,
Unit 3.	Application of Probability distribution function in Reliability evaluation combinational Aspects of Reliability, Markov models optimization of system Reliability, Heuristic Methods applied to optimal system Reliability.
Unit 4.	Maintainability: Definition and application of Maintainability Engineering, Factors affecting Maintainability. Maintainability design criteria, operating and down time categories, Maintainability and its quantification,
Unit 5.	Mean time to activity restore anequipment, Mean Maintenance man houurs, Mean time for corrective and Preventive Maintenance, Replacement Policies. Availability, types of Availability, approaches to increase equipment Availability.

List of Text Books:	
1.	SERC School on RAM Engineering for Manufacturing servicing and Process Industries.
2.	2. Reliability Engineering Fundamentals R. Ramakumar
3.	3. Maintainability, Availability and Dimitri Kececelogu
4.	4. Reliability Engineering Govil 5. Reliability Engineering Balguruswamy

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Remarks
1.	Introduction to Reliability Availability and Maintainability (RAM),	
2.	Introduction to Reliability Availability and Maintainability (RAM),	
3.	Development of RAM Engineering	
4.	Development of RAM Engineering	
5.	Reliability Availability and Maintainability utilization factors	
6.	Reliability Availability and Maintainability utilization factors	
7.	down time consequences.	
8.	Application of Probability distribution function in Reliability evaluation combinational	
9.	Application of Probability distribution function in Reliability evaluation combinational	
10.	Aspects of Reliability	
11.	Markov Model	
12.	Heuristic Methods applied to optimal system Reliability	
13.	Heuristic Methods applied to optimal system Reliability	
14.	Maintainability : Definition and application of Maintainability Engineering	
15.	Maintainability : Definition and application of Maintainability Engineering	
16.	Factors affecting Maintainability	
17.	Factors affecting Maintainability	
18.	Maintainability design criteria,operating and down time categories	
19.	Maintainability design criteria,operating and down time categories	
20.	Maintainability and its Quarantification	
21.	Mean time to activity restore anequipment	
22.	Mean time to activity restore anequipment	
23.	Mean Maintenance man houurs	
24.	Mean Maintenance man houurs	
25.	Mean time for corrective and Preventive Maintenance	
26.	Mean time for corrective and Preventive Maintenance	

27.	Replacement Policies	
28.	Replacement Policies	
29.	Availability, types of Availability	
30.	Availability, types of Availability	
31.	approaches to increase equipment Availability	
32.	approaches to increase equipment Availability	
33.	approaches to increase equipment Availability	
34.	Case Studies	
35.	Case Studies	
36.	Case Studies	
37.	Case Studies	
38.	Case Studies	
39.	Case Studies	
40.	Case Studies	

Evaluation Criteria:

Sl. No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	Nil	
5	Quiz if any	10	
6	Seminar, Viva voce if any	Nil	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)	Nil	
9	Any other	Nil	

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Name of Program	**M.Tech IEM**	**Semester: II**	**Year: Ist**
Name of Course	**GREEN LOGISTICS**		
Course Code	**IEM24555**		
Core / Elective / Other	**Elective**		
Prerequisite: None			
Course Outcomes:			
1.	To learn about supply chain and logistics from different perspectives & understand the impact of logistics and supply chain on the environment.		
2.	To understand why the traditional logistic and supply chain needs to be responsible for the product throughout its life cycle.		
3.	To identify the scope of reuse and recycling to make the manufacturing process environmentally sustainable.		
Description of Contents in brief:			
1.	Introduction of Logistics, Introduction of Logistics & supply chain,Green Logistics,Green issues in Inbound & Outbound Logistics.		
2.	Network design & Reverse Logistics,Traditional Network Design,Green Network Design,ClosedLoop Supply Chain, Circular economy		
3.	Sustainability & Environmental legislation,Sustainability,Sustainable development goals,Triplebottom line,Environmental legislation,Carbon foot print,Lifecycle Analysis		
4.	Green Transportation, Environmental effects of freight transport mode,Greener transportation modes, Optimization of routing of vehicles ,Increase the Fuel Efficiency of Road Freight,Green Design and manufacturing,Eco Design,Green packaging,Green disposal,Green warehousing,Green manufacturing		
5.	Green multi-tier supplier management,Green multi-tier supplier management,Green Manufacturing,Green Procurement,Green supplier development,Green performance measurement		
6.	Role of government in promoting green logistics,Role of government in promoting green logistics,Green policies,Environmental standards & Green CSR activities		

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List of Text Books:	
1.	McKinnon, A. Browne, M. Whiteing, A. (2015). Green Logistics: improving the environmental sustainability of logistics. (3rd edn). London: Kogan Page.
2.	Chopra and Mandle, "Supply chain management" Pearson publication
List of Reference Books:	
1.	Womack, James and Jones, Daniel. "Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Revised and Updated". Free Press (a division of Simon & Schuster), 2003.
2.	Palevich, Robert. "The Lean Sustainable Supply Chain: How to Create a Green Infrastructure with Lean Technologies". FT Press, 2012

Lecture plan

1. Introduction of Logistics,
2. Introduction of Logistics & supply chain,
3. Green Logistics,
4. Green issues in Inbound & Outbound Logistics
5. Network design
6. Reverse Logistics
7. Traditional Network Design
8. Green Network Design
9. Closed Loop Supply Chain
10. Circular economy
11. Environmental legislation
12. Sustainability,
13. Sustainable development goals
14. Triple bottom line
15. Environmental legislation
16. Carbon foot print
17. Lifecycle Analysis
18. Green Transportation
19. Environmental effects of freight transport mode
20. Greener transportation modes
21. Optimization of routing of vehicles
22. Increase the Fuel Efficiency of Road Freight
23. Green Design and manufacturing,
24. Eco Design
25. Green packaging,Green disposal
26. Green warehousing,
27. Green manufacturing
28. Green multi-tier supplier management
29. Green multi-tier supplier management
30. Green Manufacturing,
31. Green Procurement
32. Green supplier development
33. Green performance measurement
34. Role of government in promoting green logistics
35. Green policies
36. Environmental standards &
37. Green CSR activities

38. Presentations by students
39. Presentations by students
40. Presentations by students

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Attendence	10	
5	End Semester Examination	50	

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Name of Program	M.TECH (IEM)	Semester I / II	Year IST
Name of Course	TOTAL QUALITY MANAGEMENT		
Course Code	IEM24556		
Core / Elective / Other	Elective		

Prerequisite if any:	
1.	NONE
2.	

Course Outcomes:	
1.	Prioritize quality goals based on customer expectations and competition.
2.	Identify improvement areas based on cost of poor quality.
3.	Organize for quality and development of quality culture through small group activities.

Description of Contents in brief:	
Unit 1.	INTRODUCTION:- Introduction, Need for quality, Evolution of quality, Definitions of quality, Dimensions of product and service quality, Basic concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customer retention, Costs of quality.
Unit 2.	TQM PRINCIPLES: - Leadership, Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal, Continuous process improvement, PDCA cycle, 5S, Kaizen.
Unit 3.	TQM TOOLS AND TECHNIQUES I: - The seven traditional tools of quality, New management tools, Methodology, applications to manufacturing and service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA and FTA.
Unit 4.	TQM TOOLS AND TECHNIQUES II: - Control Charts, Process Capability, Concepts of Six Sigma, Quality Function Development (QFD), Taguchi quality loss function, TPM Concepts, Performance measures.
Unit 5.	QUALITY MANAGEMENT SYSTEMS: - Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000, ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

List of Text Books:	
1.	Total Quality Management by Dale H. Besterfield
2.	Total Quality Management by John S. Oakland, Butterworth - Heinemann
3.	Total Quality Management by Suganthi L. , Anand Samuel

List of Reference Books:

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1.	Total Quality Management by Janakiraman B. R.K. Gopal
2.	Total Quality Management by Girish Pathak
3.	Total Quality Management by P.N. Mukherjee
URLs:	
1.	www.swayam.gov.in
2.	www.nptel.ac.in

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Remarks
1.	Introduction of TQM	
2.	Introduction of TQM	
3.	Need for quality	
4.	Need for quality and various definition of quality	
5.	Evolution of quality,	
6.	Dimensions of product and service quality	
7.	Basic concepts of TQM	
8	TQM Framework	
9.	Contributions of Deming, Juran and Crosby	
10.	Contributions of Deming, Juran and Crosby	
11.	Customer focus	
12.	Customer orientation	
13.	Customer satisfaction	
14.	Customer complaints, Customer retention, Costs of quality.	
15.	Leadership	
16.	Strategic quality planning	
17.	Quality Councils	
18.	Quality circles Recognition and Reward,	
19.	Employee involvement	
20.	Motivation, Empowerment, Team and Teamwork	
21.	Performance appraisal, Continuous process improvement, PDCA cycle, 5S, Kaizen.	
22.	The seven traditional tools of quality	
23.	New management tools, Methodology	
24.	Applications to manufacturing and service sector including IT	
25.	Bench marking	
26.	Reason to bench mark, Bench marking process	
27.	FMEA and FTA	
28.	FMEA and FTA	
29.	Control Charts	
30.	Process Capability	
31.	Concepts of Six Sigma	
32.	Concepts of Six Sigma	
33.	Concepts of Six Sigma	

34.	Concepts of Six Sigma	
35.	Quality Function Development (QFD)	
36.	Quality Function Development (QFD)	
37.	Quality Function Development (QFD)	
38.	Quality Function Development (QFD)	
39.	Taguchi quality loss function, TPM Concepts, Performance measures	
40.	Taguchi quality loss function, TPM Concepts, Performance measures	
41.	Need for ISO 9000	
42.	ISO 9001-2008 Quality System	
43.	Elements, Documentation, Quality Auditing	
44.	QS 9000, ISO 14000	
45.	Concepts, Requirements and Benefits	
46.	TQM Implementation in manufacturing and service sectors	
47.	TQM Implementation in manufacturing and service sectors	
48.	TQM Implementation in manufacturing and service sectors	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

Name of Program	M. Tech. IEM	Semester I / II	Year First
Name of Course	**ERP and MIS**		
Course Code	**IEM24557**		
Core / Elective / Other	**Elective**		

Prerequisite if any: None	
1.	NIL
Course Outcomes:	
1.	To understand fundamentals of MIS and be able to compare it with other approaches.
2.	To Identify and describe important features of Computer Based Information System for an organizations in order to build and use information systems successfully.
3.	To understand fundamentals of enterprise resource planning (ERP) systems concepts, and the importance of integrated information systems in an organization.
4.	To Understand the Business Process Re-Engineering, and apply in ERP Implementation.
Description of Contents in brief:	
Unit 1.	Introduction and characteristics of Information and Management Information Systems and Sub-systems, Data, Information and system.
Unit 2.	Planning, Designing and Implementation of MIS, Organization and controlling of MISonnel. Data Collection, Evaluation, Control and applications.
Unit 3.	Computer Based Information System (CBIS), Transaction Processing System, Decision Support Systems, Executive Information Systems, Knowledge Work systems.
Unit 4.	Enterprise Resource Planning. Evolusion, Need, , Implementaion, designa dn control of ERP, MRP and MRP-II.
Unit 5.	Introduction to Business Process Re-engineering (BPR), implementation, strategic advantage through ERP, ERP Domain., Case studies
List of Text Books:	
1.	Chhabra, Ahuja and Jain, Planning Men at Work. Enterprise Resource Planning, Concept and Practice, PHI
2.	Michael Hammer and James Champy, Reengineering the Corporation: A Manifesto for Business Revolution, Harper Business, 1993..
3.	Murdick and Ross, Management Information System, PHI, 1977.
List Of Reference Books:	
1.	Alexis Leon , Enterprise Resource Planning, Tata McGraw-Hill Education,
2.	Kanter J., Management Information System, PHI. 1983
URLs:	
1.	https://nptel.ac.in/courses/110/105/110105148/
2.	https://freevideolectures.com/course/4539/nptel-operations-management/60

Lecture Plan (about 40-50 Lectures):

*Lecture No.	Topic	Units

1.	Introduction: Characteristics and Importance of information	Unit 1
2.	Search, Storage and Retrieval of Information	
3.	Information Feedback system	
4.	Introduction to Management Information System (MIS)	
5.	Objectives & Cost Benefits of MIS	
6.	Management and System	
7.	Management and System concept	
8.	Decision Environment Model	
9.	Functional Applications	
10.	Production Subsystem	
11.	Marketing Subsystem	
12.	Personnel Subsystem	
13.	Financial Subsystem	
14.	Planning and Designing MIS	Unit 2
15.	Planning Techniques	
16.	Project Proposal and Reporting of MIS	
17.	Controlling of MIS	
18.	Sources of Inforation	
19.	Detailed Design. Selection of Final Design,	
20.	Organization for implementation,	
21.	Evaluation, Control of information system	
22.	Maintenance of Information Systems	
23.	Computer Based Information System (CBIS	Unit 3
24.	Hierarchy of C.B.I.S., M.I.S	
25.	Reporting and Controlling,	
26.	Transaction Processing System (TPS)	
27.	Decision Support Systems (DSS)	
28.	Enterprise Resource Planning: Evolutionary stages of ERP	
29.	Executive Information Systems	
30.	Knowledge Work Systems	Unit 4
31.	Enterprise Resource Planning (ERP) and its need	
32.	Strategic and operational issues in ERP	
33.	Integrated and Business model of ERP	
34.	Zachmann enterprise architecture	
35.	MRP and MRP-II	
36.	Computer based Office Communication System	
37.	Business Process Re-Engineering	
38.	ERP Implementation and role of consultants	Unit 5
39.	Procedures for ERP	
40.	strategic advantage through ERP and BPR	
41.	Case Study	
42.	Case Study	
43.	Case study	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	5	
2	Mid Semester Test	20	
3	Assignment if any	10	

4	Tutorial if any		
5	Quiz if any	5	
6	Seminar, Viva voce if ay	10	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

Name of Program	M.Tech IEM	Semester- I / II	Year-I
Name of Course	Maintenance Management		
Course Code	IEM24558		
Core / Elective / Other	Elective		
Prerequisite if any: Manufacturing Processes			
Course Outcomes:			
1.	To acquire knowledge about the maintenance function management, organization, planning & various strategies of maintenance.		
2.	To understand failure statistics, replacement decisions & optimum PM interval.		
3.	To get acquainted with CBM, opportunity & design out maintenance, and TPM.		
4.	To understand maintenance project planning using CPM & PERT.		
5.	To be aware of spare parts management, maintenance performance measurement & human errors in maintenance management.		
Description of Contents in brief:			
Unit 1.	Introduction: Objectives and Functions of maintenance. Factors influencing plant availability, Maintenance control, Maintenance Strategies, Organization for Maintenance. Failure Statistics: Breakdown time distributions, Running-in failures, Time independent failures, Wear-out failures, Failure Probability, Survival Probability and age specific failure rates.		
Unit 2.	Overhaul and Repair: Meaning and difference, optimal overhaul / Repair / Replace maintenance policy for equipment subject to breakdown. Replacement Decisions: Deterministic and stochastic replacement situations, failure and preventive replacement, Optimal Interval between preventive replacement of equipment subject to breakdown, group replacement.		
Unit 3.	Maintenance Techniques: Fixed time maintenance, Condition based Maintenance, Operate to failure, Opportunity Maintenance, Design out maintenance, Total Productive Maintenance. Maintenance Planning: Establishing maintenance plan and maintenance scheduling.		
Unit 4.	Inspection Decisions: Optimal Inspection frequency (for maximization of profit and minimization of downtime). Shut down planning using CPM & PERT. Maintenance practices on production machines lathe, drilling, milling, welding, shaper etc.		
Unit 5.	Spare Parts Management: Capacity utilization, cost reduction approach to spares, reliability and quality of spares, spare parts procurement, and inventory control of spare parts. Maintenance performance/ effectiveness- audit, inspection, replacement, overhaul and repair decisions, role of human in maintenance- likely errors and contributing factors.		
List of Text Books:			
1.	Handbook of Maintenance Management and Engineering- Ben-**Daya**,M.,**Duffuaa**, S.O.,**Raouf**,A., **Knezevic**, J., **Ait-Kadi**, D. (Eds.)		
2.	Engineering Maintenance Management-by Benjamin W. Niebel, 1994		

3.	Dhillon B.S., "Engineering Maintenance: a Modern Approach". 1 edition, CRC. 2002
List of Reference Books:	
1.	Maintenance & Spare Parts Management- by P. Gopal Krishnan & A.K. Banerji
2.	Hand Book of Reliability Engineering & Management- by W. Grant Ireson and Clyde F, Mc-Graw Hill
	URL
1.	https://onlinecourses.swayam2.ac.in/nou21_me10/preview
2.	https://www.reliableplant.com/maintenance-management-31856

Lecture Plan	
Lecture No.	Topic
01 – 03	Introduction on objectives and functions of maintenance, Factors influencing plant availability.
04 – 05	Organization for Maintenance.
06 – 07	Introduction to various maintenance strategies
08	Breakdown time distributions
09 – 10	Running-in failures, Time independent failures, Wear-out failures
11 – 12	Failure Probability, Survival Probability and age specific failure rates.
13-14	Overhaul and Repair: Meaning and difference, optimal overhaul / Repair / Replace maintenance policy for equipment subject to breakdown
15-17	Replacement Decisions: Deterministic and stochastic replacement situations, failure and preventive replacement
18 – 20	Optimal Interval between preventive replacement of equipment subject to breakdown & group replacement
21- 24	Condition based Maintenance techniques
25 – 26	Opportunity Maintenance, Design out maintenance
27 – 30	TPM
31- 32	Establishing maintenance plan and maintenance scheduling
33 – 34	Optimal Inspection frequency (for maximization of profit and minimization of downtime)
35 – 37	Shut down planning using CPM & PERT
38 – 40	Spare Parts Management
41 – 43	Maintenance performance/ effectiveness measurements
44 – 45	Role of human in maintenance- likely errors and contributing factors
46 – 50	Maintenance practices on production machines lathe, drilling, milling, welding, shaper etc.

Evaluation Criteria:

Sl. No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	Nil	
5	Quiz if any	10	
6	Seminar, Viva voce if any	Nil	
7	End Semester Examination	50	

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Name of Program	**M TECH (IEM)**	**Sem I / II**	**Year Ist**
Name of Course	Entrepreneurship & Start up Creation		
Course Code	IEM24559		
Core / Elective / Other	**Elective**		
Prerequisite if any:			
1.	NIL		
Course Outcome:			
1.	To understand different essentials of entrepreneurship.		
2.	To understand different parameters of product design and Services for start-ups.		
3.	To design a business plan and develop leadership Skills.		
Description of Contents in brief:			
Unit 1.	**INTRODUCTION TO ENTREPRENEUSHIP:** The Entrepreneurial Perspective Introduction to entrepreneurship, need and importance of entrepreneurship, charms of becoming entrepreneur, evolution of entrepreneurship, characteristics of an entrepreneur, barriers of entrepreneurship, achievement motivation to become entrepreneur, creativity & innovation, decision making and other behavioural aspects of entrepreneurship.		
Unit 2.	**BUSINESS & FUNDING OPPORTUNITY:** Opportunity Recognition and Planning to establish Micro and Small Enterprises, Opportunity identification process, opportunity evaluation process. Sources of finance, Debt financing. Venture capital sources, Lease finance, Banking policies & incentives available to entrepreneurs, Loans-types and benefits, Book keeping and accountancy, working capital management, various financial ratios, Costing, Break-Even-Analysis.		
Unit 3.	**ASSESSMENT OF MARKET:** Market research, market survey, Identification of relevant resources, Steps in establishing an enterprise /industry, procedure and formalities to establish a SSI or business enterprise.		
Unit 4.	**BENEFITS & INCENTIVES:** Incentives and benefits available to MSEs and new entrepreneurs, Information about various support agencies.		
Unit 5.	**BUSINESS PLAN:** Formulation of Business Plan Preparation of market survey report, techno economic feasibility assessment, preparation of preliminary and detailed business plan.		
Unit 6.	**MANAGEMENT OF MICRO & SMALL ENTERPRISE:** Marketing Management Marketing and sales management, demand forecasting, advertising, product mix, characteristics of a good sales person. Govt. support in marketing, Financial Management of small scale industries, Business Ethics		
List of Reference Books:			
1.	Managing innovation and entrepreneurship in technology-based firms: Martin, Michael J. C.		
2.	Technological entrepreneurism: enterprise formation, financing and growth: Cardullo Mario W.		
3.	Growing new ventures, creating new jobs: Rice, Mark P		
URLs:			
1.	https://nptel.ac.in/courses/110106141		
2.	https://nptel.ac.in/courses/110107094		

Lecture Plan

Lecture Number	Description of Topic
1.	The Entrepreneurial Perspective Introduction to Entrepreneurship
2.	Need And Importance of Entrepreneurship
3.	Charms Of Becoming Entrepreneur
4.	Evolution Of Entrepreneurship
5.	Characteristics Of an Entrepreneur
6.	Barriers Of Entrepreneurship
7.	Achievement Motivation to Become Entrepreneur
8.	Creativity & Innovation
9.	Decision Making and Other Behavioural Aspects of Entrepreneurship.
10.	Opportunity Recognition and Planning to Establish Micro and Small Enterprises
11.	Opportunity Identification Process
12.	Opportunity Evaluation Process
13.	Sources Of Finance
14.	Debt Financing
15.	Venture Capital Sources
16.	Lease Finance
17.	Banking Policies & Incentives Available to Entrepreneurs
18.	Loans-Types and Benefits
19.	Book Keeping And Accountancy
20.	Working Capital Management
21.	Various Financial Ratios
22.	Costing
23.	Break-Even-Analysis
24.	Market Research
25.	Market Survey
26.	Identification Of Relevant Resources
27.	Steps In Establishing an Enterprise /Industry
28.	Procedure And Formalities to Establish an SSI Or Business Enterprise
29.	Formulation Of Business Plan Preparation of Market Survey Report
30.	Techno Economic Feasibility Assessment
31.	Preparation Of Preliminary and Detailed Business Plan
32.	Banking Policies & Incentives Available to Entrepreneurs
33.	Loans-Types and Benefits
34.	Book Keeping And Accountancy
35.	Marketing Management Marketing and Sales Management
36.	Demand Forecasting
37.	Advertising, Product Mix

38.	Characteristics Of a Good Sales Person. Govt. Support In Marketing
39.	Financial Management of Small-Scale Industries
40.	Business Ethics

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		

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Name of Program	M Tech IEM	**Semester: I / II**	**Year I**
Name of Course	Concurrent Engineering		
Course Code	IEM24560		
Core / Elective / Other	Elective		
Prerequisite if any:			
1.	Elementary Knowledge of conceptualization and idea generation		
2.	Improvised thought process to understand the design attributes		
Course Outcomes:			
1.	Ability to synthesis the information, analysis and interpretation of data to find valid conclusion of the problem.		
2.	Ability to synthesis the information, analysis and interpretation of data to find valid conclusion of the problem.		
3.	Ability to model, simulate and analyze engineering activities using software tools and to understand limitation of use.		
Description of Contents in brief:			
Unit 1.	Engineering Design		
Unit 2.	Concurrent Engineering Process		
Unit 3.	Design For X		
Unit 4.	Design For Experiments		
Unit 5.	Modeling and Simulation		
Unit 6	TQM Techniques and Tools		
List of Text Books:			
1.	Engineering Design by George E. Dieter and Linda C. Schmidt		
2.	Concurrent Engineering Fundamentals by Biren Prasad		
3.	Design And Analysis of Experiments by Douglas C. Montgomery		
List of Reference Books:			
1.	Concurrent Engineering by Chanan s. syan and UnnyMenon		
2.	Design For Manufacturability and Concurrent Engineering by Dr. David M.A		
3.	Product Design and Development by Karl T. Ulrich and Steven D. Eppinger		
URLs:			
1.	https://www.digimat.in/nptel/courses/video/112104230/L01.html		
2.	https://nptel.ac.in/courses/110/105/110105087/		
Lecture Plan (about 40-50 Lectures):			
***Lecture No.**	**Topic**		**Remarks**
1.	Engineering Design Process		

2.	Types of Design	
3.	Problem Solving Methodology	
4.	Achievement of Performance Requirements	
5.	Total Life Cycle	
6.	Conceptual Design	
7.	Embodiment Design	
8.	Detail Design	
9.	Planning for Manufacture	
10.	Planning for Distribution	
11.	Planning for Use	
12.	Planning for Retirement of the Product	
13.	Designing to Codes and Standards	
14.	Societal Considerations in Engineering Design	
15.	Concurrent Engineering Vs Sequential Engineering	
16.	Cross Functional Teams	
17.	Team Behavior and Tools part 1	
18.	Team Behavior and Tools part 2	
19.	Decision Making	
20.	Decision Making Tools	
21.	Parallel Design	
22.	Design for Manufacture	
23.	Design for Assembly	
24.	Design for Function Factors	
25.	Design With Materials	
26.	Design for Reliability	
27.	Design for safety	
28.	Design for Serviceability	
29.	Design for Quality and Robustness	
30.	Design for Economy and Marketing	
31.	Design for Environment	
32.	Design for Reuse and Recyclability	
33.	Quality Function Deployment	
34.	House of Quality	
35.	Design for Experiments	
36.	Pillars of DOE	
37.	Factorial Designs	
38.	Fractional Factorial Designs	
39.	Response Surface Methods	
40.	Central Composite Designs	
41.	Mixture Designs	
42.	Taguchi Fractional Factorial Designs	
43.	Statistical Techniques for Analysis	
44.	Analysis of 2D and 3D Plots and Graphs	
45.	Computational Modeling	
46.	Optimization Techniques Part 1	
47.	Optimization Techniques Part 2	

48.	Total Quality Management	
49.	Description of Quality Tools	
50.	Redesign Analysis	
	Summary of Subject	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	05	
4	Tutorial if any	10	
5	Quiz if any	05	
6	Seminar, Viva voce if ay	--	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

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Name of Program	**M. Tech. (IEM)**	**Semester I/II**	**Year - I**
Name of Course	**DESIGN OF EXPERIMENTS**		
Course Code	IEM24561		
Core / Elective / Other	Elective		
Prerequisite if any:			
1.	Basic knowledge of statistics		
Course Outcomes:			
1.	Able to learn how to plan, design and apply experimental design techniques to practical problems.		
2.	Able to understand and build the appropriate models for designed experiments, perform data analysis using statistical methods		
3.	Able to improve quality of processes / products by optimizing the parameters		
Description of Contents in brief:			
Unit 1	Introduction to design and analysis of experiments with basic concepts and applications, fundamentals of statistics, Analysis of Variance (ANOVA)		
Unit 2	Mathematical modeling, regression analysis, generation of experimental designs		
Unit 3	Randomization, replication and blocking, randomized complete block design (RCBD), Full factorial designs, design resolutions, fractional factorial designs		
Unit 4	Response surface methodology, central composite designs; CCRCD, CCRFCD, CCRID, Box – Behnken design, Plackett-Burman design		
Unit 5	Orthogonal designs, Taguchi robust designs, signal-to-noise (S/N) analyses, main effect plots		
Unit 6	Optimization of process / product parameters, Introduction to experimental design softwares		
List of Text Books:			
1.	Design and Analysis of Experiments, Douglas C. Montogomery, Eighth edition, Wiley, 2014		
2.	Design of Experiments for Engineers and Scientists, second Edition, Jiju Antony, Elsevier, 2014		
3.	Experiments, Planning, Analysis, and Optimization, C. F. Jeff Wu, Michael S. Hamada, Wiley, 2021		
List of Reference Books:			
1.	Statistics for Experimenters: Design, Innovation, and Discovery, George E. P. Box, J. Stuart Hunter, William G. Hunter, Wiley, 2005		
2.	DOE Simplified, Practical Tools for Effective Experimentation, Third Edition, Mark J. Anderson, Patrick J. Whitcomb, CRC Press, 2017		

3.	Design and Analysis of Experiments, Volume 1, Introduction to Experimental Design, Klaus Hinkelmann, Oscar Kempthorne, wiley, 2007
URLs:	
1.	https://nptel.ac.in/courses/110/105/110105087/
2.	https://nptel.ac.in/courses/111/104/111104075/

Lecture Plan (about 40 – 50 Lectures):		
S. No.	**Topic**	**Remarks**
1.	Introduction, Subject information	
2.	Experimentation with best guess approach, why and when it is required, process robustness	
3.	Objectives of experimental designs, Strategy of experimentation, Confounding effect experimentation	
4.	Guidelines for designing experiments, present situation analysis	
5.	Choice and types of factors, potential design factors, held-constant factors, allowed-to-vary factors, noise factors	
6.	Selection of levels and range, process knowledge, factor screening, and process characterization	
7.	Cause-and-effect analysis in process variable selection, case analysis	
8.	Mechanistic vs Empirical models, first-order or main effect model, second-order models	
9.	Principles of DOE, replication, replication vs repetition,	
10.	Randomization, blocking or local control of error, CRD, RCBD, split-plot CRD and RCBD	
11.	Experimental units and observational units, case analysis	
12.	Full factorial designs, synthesis of 2^k and 3^k factorial designs, graphical forms with levels	
13.	Fractional factorial designs, synthesis of 2^{k-p} designs, loss of information, synthesis of fractional factorial design with base design and additional factors	

14.	Design generators and their resolutions, case analysis	
15.	Taguchi (highly fractionated) vs fractional factorial design case analysis	
16.	Taguchi's robust parameter designs, quality loss of function	
17.	Robust design process, system design, parameter design, tolerance design	
18.	Standard orthogonal arrays, Signal-to-noise analysis, main effect plots, case analysis	
19.	Interaction explanation, selection, and application of orthogonal arrays case analysis	
20.	Plackett-Burman designs, resolution III fractional factorial designs	
21.	Response surface methodology, the sequential approach of experimentation	
22.	Central composite rotatable circumscribed design (CCRCD), case analysis	
23.	Central composite rotatable face-centered design (CCRFCD), case analysis	
24.	Central composite rotatable inscribed design (CCRID), case analysis	
25.	Box- Behnken experimental designs, case analysis	
26.	Fundamentals of statistics, data visualization, types of data	
27.	Dot diagram, experimental run, and error	
28.	Frequency diagram and bar chart, case analysis	
29.	Box-and-whisker plot, outliers, case analysis	
30.	Scatter plots, trend analysis, case analysis	
31.	Pareto chart, case analysis	
32.	Statistics of probability, probability mass function, probability density function	
33.	Parameters and statistics	
34.	Distribution plots, normal, uniform, skewed	
35.	Covariance, correlation R- square	
36.	t-distribution, F distribution, inferences	
37.	Paired comparison design	
38.	ANOVA, model adequacy checking	

39.	Regression modeling	
40.	Optimization, conventional and unconventional approach	

***Min 48 (for four credit course)**
***Min 36 (For Three credit Course)**

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	Nil	
5	Quiz if any	10	
6	Seminar, Viva voce if ay	Nil	
7	End Semester Examination	50	
8	Experiments if any (for practical courses)	Nil	
8	Any other	Nil	

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Name of Program	M.Tech IEM	**Semester** I/II	**Year Ist**

Name of Course	**ORGANIZATIONAL BEHAVIOUR**
Course Code	IEM24562
Core / Elective / Other	ELECTIVE
Prerequisite if any: NONE	
	NIL
Course Outcomes:	
1.	The student will understand how behavioral factors affect organizations.
2.	The student will be able to apply theories to practical problems in a critical manner for analyzing organizational issues for solving them.
Description of Contents in brief:	
Unit 1.	FOCUS AND PURPOSE: The Organizational basics for behavior, Definition, need and importance of organizational behavior – Nature and scope Systems, approach to organization. Organizational structure, Making Organizing effective. Organizational culture
Unit 2.	INDIVIDUAL BEHAVIOUR Personality: types, Factors influencing personality, Theories Learning: Types of learners, The learning process, Learning theories Organizational behavior modification. Misbehavior: Types, Management Intervention. Emotions: Emotional Labour, Emotional Intelligence, Theories. Attitudes: Characteristics, Components, Formation, Measurement, Values. Perceptions: Importance, Factors influencing perception, Interpersonal perception Impression Management. Motivation: Importance, Types, Effects on work behavior.
Unit 3.	GROUP BEHAVIOUR Organization structure: Formation, Groups in organizations, Influence Group dynamics: Emergence of informal leaders and working norms Group decision making techniques: Team building**,** Interpersonal relations Communication: types, means of commutations and Control. Work group behavior and productivity. Team Management.
Unit 4.	LEADERSHIP, COMMUNICATION AND POWER Meaning, Importance of leader, Leadership styles, Theories, Leaders Vs Managers Styles and skills in communication, Power and politics in organization, Managing differences and conflicts, Managing change, Organization and society
Unit 5.	DYNAMICS OF ORGANIZATIONAL BEHAVIOUR

	Organizational culture and climate: Factors affecting organizational climate, Importance. Job satisfaction: Determinants, Measurements, Influence on behavior. Organizational change: Importance, Stability Vs Change, Proactive Vs Reaction change, the change process, Resistance to change, Managing change. Stress: Work Stressors, Prevention and Management of stress, Balancing work and Life. Organizational development: Characteristics, objectives , Organizational effectiveness

List of Text Books:

1.	Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
2.	Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2001.
3.	

List of Reference Books:

1.	Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley, 9th Edition, 2008.
2.	Udai Pareek, Understanding Organisational Behaviour, 2nd Edition, Oxford Higher Education, 2004
3	Mc Shane & Von Glinov, Organisational Behaviour, 4th Edition, Tata Mc Graw Hill, 2007.
4	Hellrigal, Slocum and Woodman, Organisational Behavior, Cengage Learning, 11th Edition 2007.

Lecture Plan (about 40-50 Lectures):

***Lecture No.**	**Topic**	**Remarks**
1.	The Organizational basics for behavior	
2.	Definition, need and importance of organizational behavior	
3.	Nature and scope Systems	
4.	Approach to organization.	
5.	Organizational structure	
6.	Making Organizing effective	
7.	Organizational culture	
8.	Personality: types, Factors influencing personality	
9.	Different Theories	
10.	Learning: Types of learners	
11.	The learning process	
12.	Learning theories	
13.	Organizational behavior modification.	

14.	Misbehavior: Types, Management Intervention	
15.	Emotions: Emotional Labour,	
16.	Emotional Intelligence, Theories.	
17.	Attitudes: Characteristics, Components, Formation, Measurement, Values.	
18.	Perceptions: Importance, Factors influencing perception,	
19.	Interpersonal perception Impression Management.	
20.	Motivation: Importance, Types Effects on work behavior	
21.	Motivation: Importance, Types Effects on work behavior	
22.	Organization structure: Formation, Groups in organizations, Influence	
23.	Group dynamics: Emergence of informal leaders and working norms	
24.	Group decision making techniques: Team building**,** Interpersonal relations	
25.	Communication: types, means of commutations and Control. .	
26.	Work group behavior and productivity	
27.	Team Management	
28.	Meaning, Importance of leader, Leadership styles,	
29.	Theories, Leaders Vs Managers	
30.	Styles and skills in communication, Power and politics in organization,	
31.	Managing differences and conflicts, Managing change, Organization and society	
32.	Organizational culture and climate: Factors affecting organizational climate, Importance.	
33.	Job satisfaction: Determinants, Measurements, Influence on behavior.	
34.	Organizational change: Importance, Stability Vs Change, Proactive Vs Reaction change, the change process, Resistance to change, Managing change.	
35.	Stress: Work Stressors, Prevention and Management of stress, Balancing work and Life.	
36.	Organizational development: Characteristics, objectives	

37.	Organizational effectiveness	
38.	Tutorial	
39.	Tutorial	
40.	Tutorial	
41.	Tutorial	
42.	Tutorial	
43.	Tutorial	
44.	Tutorial	
45.	Tutorial	
46.	Tutorial	
47.	Tutorial	
48.	Tutorial	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	10	
5	Quiz if any		
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

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Name of Program	**M. Tech. IEM**	**Semester I / II**	**Year - First**
Name of Course	**Industrial Design and Processes**		
Course Code	**IEM24563**		
Core / Elective / Other	**Elective**		

Prerequisite if any:	
1.	NONE
Course Outcomes:	
1.	To understand morphology and design for X guidelines
2.	To understand and apply creative design techniques
3.	To relate design with manufacturing processes
4.	To understand operations management aspects related with product design
Description of Contents in brief:	
Unit 1.	.Idea Generation: Design by Evolution and Innovation. Design process and morphology of design. Needs analysis, Design for production, Distribution, Consumption and Retirement. Environmental Factors and Resources.
Unit 2.	Design Methods: Creative design process, Brain storming, Synectics, Compatibility Matrix approach to design. Physical Reliability. Design Tree. Utility Analysis Economic Analysis. Role of Proportions. Visual Balance.
Unit 3.	Type of Model: Scale Models, Prototype and Mockups. Methods of Optimum Design. Reliability based design.
Unit 4.	Study of Primary and Secondary Production Processes: Designing of physical configurations for production purpose. Casting, Joining, powder metallurgy.
Unit 5.	Production System: Input output model. Productivity, manning for optimum production, Group Technology, Standardization, Coding and classification of parts types, Quality Assurance, Failure model and effects analysis, Value Engineering: Introduction, Cost V/s Price, Type of values, Functions and costs. Job plan, Scientific approach to VA, Organizing VE Program, Case Studies.
List of Text Books:	
1.	Dieter G.E., Engineering Design: A Material Processing Approach, McGraw Hill. 1986.
2.	Roy A. Lindberg, Production Process, Prentice Hall
3.	Jones J.C. Design Method-Seeds of Human Future. Prentice Hall

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List of Reference Books:	
1.	Chitale A.K. and Gupta R.C, Product Design & Manufacturing, PHI, 2011.
2.	Ullamn H. Engineering Design. McGraw Hill.

Lecture Plan (about 40-50 Lectures):

***Lecture No.**	**Topic**	**Remarks**
1.	.Idea Generation: Design by Evolutio	
2.	Design by Innovation	
3.	Design process	
4.	Design process	
5.	Morphology of Design	
6.	Needs analysis	
7.	Design for Production and Distribution	
8.	Design for Consumption and Retirement	
9.	Environmental Factors and Resources	
10.	Environmental Factors and Resources	
11.	Design Methods: Creative design process	
12.	Design Methods: Creative design process	
13.	Brainstorming and Synactics	
14.	Compatibility Matrix approach to design	
15.	Pysical Reliability	
16.	Utility Analysis Economic Analysis. Role of Proportions. Visual Balance.	
17.	Economic Analysis	
18.	Role of Proportions. Visual Balance.	
19.	Type of Model. Methods of Optimum Design. Reliability based design.	
20.	Scale Models, Prototype and Mockups	
21.	Scale Models, Prototype and Mockups	
22.	Study of Primary and Secondary Production Processes	
23.	Study of Primary and Secondary Production Processes	
24.	Designing of physical configurations for production purpose	
25.	Designing of physical configurations for production purpose	
26.	Designing of physical configurations for production purpose	
27.	Casting	
28.	Casting	
29.	Joining	
30.	Joining	
31.	Powder Metallurgy	
32.	Powder Metallurgy	
33.	Production System: Input output model.	
34.	Production System: Input output model.	
35.	Productivity, manning for optimum production	
36.	Productivity, manning for optimum production	
37.	Grpup Technology	

38.	Group Technology	
39.	Standardixation	
40.	Coding and Classification for	
41.	Quality Assurance	
42.	, Failure model and effects analysis,	
43.	Value Engineering	
44.	Cost V/s Price, Type of values	
45.	Functions and Costs	
46.	Job plan	
47.	Scientific approach to VA, Organizing VE Program, Case Studies.	
48.	Scientific approach to VA, Organizing VE Program, Case Studies.	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

Name of Program	M. Tech. (IEM)	Semester: I / II	Year: Ist

Name of Course	Financial Management and Accounting
Course Code	IEM24564
Core / Elective / Other	Elective

Prerequisite if any:	
1.	None
Course Outcomes:	
1.	The students will learn the basic fundamentals and overview of Financial Management.
2.	The students shall be able to read and interpret various financial documents/reports.
3.	The students shall be able to learn the fundamentals of accounting.
Description of Contents in brief:	
Unit 1.	Financial management-an overview, Financial decisions in the firms, the fundamental principles of finance, goals of financial management, building blocks of modern finance.Risk-return trade off, Organization of finance functions, Emerging role of financial managers' in India, Over view of financial statements – Income statement, Balance Sheet, Cash flow statement, Analysis of financial statements
Unit 2.	Financial Planning & forecasting, Tools & techniques of Financial Planning & Forecasting, Sources of finance.Time Value of Money, Future value of a single amount, Present value of a single amount, Future value of Annuity, Present value of Annuity & Perpetuity
Unit 3.	Capital Budgeting –Concept and overview, Capital budgeting process, Project classification, Techniques of capital budgeting, Investment criteria Net present value, internal rate of return, Modified Internal rate of return, Benefit cost ratio, Payback period method
Unit 4.	Introduction and Scope of Accounting ,Financial Statements,Profit and Loss Account,Depreciation,Inventory Valuation
Unit 5.	Cash Flow Statement,Corporate Governance, Corporate Governance: Global Models,Accounting Standards and Principles ,Evolution of Accounting
Unit 6.	Recording of Financial Transactions,Interpretation and Analysis of Financial Statements,Ratio Analysis and Interpretation
List of Text Books:	
1.	Financial management for Managers Prof. Anil K.Sharma
2.	Financial Accounting Professor V. Bapat
List of Reference Books:	
1.	Financial management: Theory and practices by Prasanna Chandra : McGraw hills.
2.	Financial management: Text, Problem and cases M.Y Khan, P.K. Jain : McGraw hills.
URLs:	
1.	https://nptel.ac.in/courses/110106135
2.	https://nptel.ac.in/courses/110101131

3.	**https://nptel.ac.in/courses/110107144**

Lecture Plan

Lecture Number	Description of Topic
1.	Fundamentals of Financial Management
2.	Financial Planning and Forecasting
3.	Time Value of Money
4.	Capital Budgeting
5.	Estimation of Project Cash Flows
6.	Risk Analysis in Capital Budgeting
7.	Cost of Capital
8.	Capital Structure
9.	Dividend Decisions
10.	Revision FM
11.	Introduction and Scope of Accounting
12.	Financial Statements
13.	Balance Sheet
14.	Profit and Loss Account
15.	Depreciation
16.	Inventory Valuation
17.	Cash Flow Statement
18.	Corporate Governance
19.	Corporate Governance: Global Models
20.	Corporate Governance: Enron Case
21.	Accounting Standards and Principles
22.	Evolution of Accounting
23.	Recording of Financial Transactions
24.	Interpretation and Analysis of Financial Statements
25.	Ratio Analysis and Interpretation 1
26.	Financial Statement Analysis
27.	Revision of Accounting Course
28.	Introduction and Scope of Accounting
29.	Financial Statements
30.	Balance Sheet
31.	Profit and Loss Account
32.	Depreciation
33.	Inventory Valuation
34.	Cash Flow Statement
35.	Corporate Governance
36.	Corporate Governance: Global Models
37.	Cost of Capital
38.	Capital Structure
39.	Dividend Decisions
40.	Ratio Analysis and Interpretation

Evaluation Criteria:

Sl No.	Name of Examnation	Marks Alloted
1.	Mini Test	10
2.	Mid Semester Examination	20
3.	Attendence	10
4.	Assignments	10
5.	End Semester Examination	50

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Name of Program	M.Tech IEM	**Semester** I/II	**Year Ist**

Name of Course	Industrial safety and Environment Management System
Course Code	IEM24565
Core / Elective / Other	Elective
Prerequisite if any:	
	Nil
Course Outcomes:	
1.	The student will understand the fundamental concepts, theories and methods in Safety and Environment Management System
2.	The student will understand the safety management as practiced in industry and knows the concepts of Environment Impact Assessment.
Description of Contents in brief:	
Unit 1.	Safety Systems: Definition, Safety information system - Basic concepts. Definition of accidents, Analysis of causes of accident. Hazard analysis - General hazard analysis, Analysis of electrical, physical and chemical hazards. Cost effectiveness in hazard eliminations, Fault Tree Analysis and HAZOP studies.
Unit 2.	Managing for Safety: Safety inspection, procedure, periodicity, checklist, report forms. Planning for safety and productivity, Safety sampling, Safety audit, Safety survey, Accident prevention. Work permit and lock out system, Accident analysis, Safety education and communication, Safety performance analysis. Personal protective equipment testing and usage
Unit 4.	Fire Protection System: Automated fire fighting system, chemistry of fire, water sprinkler, fire hydrant, alarm and detection system. Suppression system, CO2 system, Foam system, DCP system, Halon system, Portable extinguisher.
Unit 5.	Safety in Process: Design for safety, safety in use of power press. Safety in foundry, forging, welding, hot working and cold working, electroplating and boiler operation. Safety Legislation: Provisions in factory act for safety, explosive act, workmen compensation act, compensation calculation. Boiler act and pollution control act, electrical safety, electricity act and rules. Environment Impact Assessment (EIA): Introduction, EIA capability and limitations, Legal provisions on EIA, Methods of EIA – checklists, matrices, Networks. Cost benefit analysis, Analysis of alternatives. Case studies. Adverse impact on environment. ISO14001:2004 EMS standards
List of Text Books:	
1.	Ridley, J., and Channing, J. (2008). Safety at Work. Butterworth-Heinemann UK.
2.	Deshmukh, L.M. (2005). Industrial Safety Management. Tata McGraw-Hill..
List of Reference Books:	
1.	Nicholas, P.C. (2000). Practical Guide to Industrial Safety: Methods for Process Safety Professionals. Marcel Dekker..
2.	National Safety Council. (2000). Accident Prevention Manual: Engineering & Technology, 12th edition. National Safety Council.

3	Macdonald, D. (2004). Practical Industrial Safety, Risk Assessment and Shutdown Systems, 1 stedition.Newnes (Elsevier).
4	Ridley, J., and Channing, J. (2008). Safety at Work. Butterworth-Heinemann UK

Lecture Plan (about 40-50 Lectures):

***Lecture No.**	**Topic**	**Remarks**
1.	Safety Systems: Definition	
2.	Safety information system - Basic concepts. Definition of accidents, Analysis of causes of accident.	
3.	Hazard analysis - General hazard analysis, Analysis of electrical, physical and chemical hazards.	
4.	Cost effectiveness in hazard eliminations,	
5.	Fault Tree Analysis and HAZOP studies	
6.	Managing for Safety: Safety inspection	
7.	Managing for Safety procedure, periodicity, checklist, report forms.	
8.	Planning for safety and productivity,	
9.	Safety sampling, Safety audit	
10.	Safety survey Accident prevention. Work permit and lock out system, Accident analysis	
11.	Safety education and communication,	
12.	Safety performance analysis.	
13.	Personal protective equipment testing and usage	
14.	Fire Protection System: Automated fire fighting system	
15.	Chemistry of fire, water sprinkler, fire hydrant, alarm and detection system.	
16.	Suppression system, CO2 system, Foam system, DCP system, Halon system, Portable extinguisher	
17.	Safety in Process: Design for safety,	
18.	Safety in use of power press. Safety in foundry	
19.	Safety in use forging, welding,	
20.	Safety in use hot working and cold working processes	
21.	Safety in use Electroplating and boiler operation.	
22.	Safety Legislation: Provisions in factory act for safety	
23.	Safety Legislation: Explosive act, workmen compensation act, compensation calculation..	
24	Boiler act and pollution control act, electrical safety, electricity act and rules	
25.	Environment Impact Assessment (EIA): Introduction	

26.	EIA capability and limitations,	
27.	Legal provisions on EIA,	
28.	Methods of EIA – checklists, matrices, Networks.	
29.	Cost benefit analysis, Analysis of alternatives.	
30.	Case studies. Adverse impact on environment.	
31.	ISO14001:2004 EMS standards	
32	Tutorial	
33.	Tutorial	
33.	Tutorial	
34.	Tutorial	
35.	Tutorial	
36.	Tutorial	
37.	Tutorial	
38.	Tutorial	

Evaluation Criteria:

Sl.No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Assignment if any	10	
4	Tutorial if any	10	
5	Quiz if any		
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
8	Any other		

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Name of Program	**M.Tech IEM**	**Semester: I / II**	**Year: Ist**
Name of Course	**RESEARCH METHODOLOGY**		
Course Code	**ME24524**		
Core / Elective / Other	**Elective**		
Prerequisite if any:			
1.	Graduation in a sciences		
2.	Graduation in a Technologies		
Course Outcomes:			
1.	Student will be able to apply knowledge Research Methodology different field and research		
2.	Student will be able to design always the research problem with different quantities and qualitative method of data collection tool and techniques		
3.	Student will be able to apply knowledge and Research Methodology to write research paper.		
4	Student will be able to identified the tools , software and techniques for data analysis and data validation.		
Description of Contents in Brief:			
Unit 1.	Research Meaning, Objectives, Motivation, Types of Research, Research Approach, Research and Scientific Methods, Identification of Problem, Significance of Defining Research Problem, Research Design, Research Ethics		
Unit 2.	Data Collection Methods, Primary Data, Secondary Data, Questionnaire Preparation, Case Study Method, Measurement Scales, Levels of measurement – Nominal, Ordinal, Interval, Ratio Measures of Central Tendency (Mean, medium, Mode), Measures of Dispersion (range, mean deviation, standard deviation), Graphical Representation of Data, Tabular Presentation of Data, Oral Presentation, Posters Presentation		
Unit 3.	Sampling Design, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample, Research Question, Normal Probability Curve, Standard Error, Confidence Intervals		
Unit 4.	Significance of correlation, Pearson‟s Product Moments Correlation. Regression and Multiple Regression equations, Hypothesis Formation, Hypothesis Testing, Testing the Significance of difference between means(z and „t‟ test), Analysis of Variance (ANOVA) -concept and applications, Chi Square Test steps, Type I and Type II errors,		
Unit 5.	Writing Research Report:, Interpretation, Significance of Report Writing, Steps In Writing Report, Types of Report, Technical Report Writing, Review of Related Literature, Structure of The Research Report, Precaution In Writing Report, Layout of Research Paper, Format and Style, Impact Factor of Journals, Suitability of Journal for Publication, Plagiarism, Citation, Reference Writing, IPR, Copyright, Patents,		
Unit 6	Introduction of Softwares used for Research like Matlab,SPSS, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism, Google Scholar, Research Gate,		

List of Text Books:

1.	Research Methodology: Methods and Techniques, Kothari, C.R, New Age International Publishers, 2010 , 2010
2.	Fundamentals of Mathematical Statistics, Gupta, S. C. and Kapoor, V. K, Sultan Chand and Sons, New Delhi. , 2010
3.	Theory and Application of Statistics, Bruce E. Wampold and Difford J. Drew, McGraw-Hill International Editions. , 2010

List of Reference Books:

1.	Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2.	Business Research Methods – Alan Bryman& Emma Bell, Oxford University Press
3.	Business Research Methods, Naval Bajpai, Pearson

URLs:

2.	https://swayam.gov.in/nd1_noc19_ge21/preview
3.	https://www.youtube.com/watch?v=Yzfl3rtF0SM

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic	Remarks
1-2	Research Meaning,Objectives	
3-4	Motivation	
5-6	Types of Research, Research Approach,Research and Scientific Methods	
7-8	Identification of Problem, Significance of Defining Research Problem,	
9-10	Research Design, Research Ethics	
11-12	Data Collection Methods, Primary Data, Secondary Data,	
13	Questionnaire Preparation, Case Study Method,	
14-15	Measurement Scales, Levels of measurement – Nominal, Ordinal, Interval,	
16-17	Ratio Measures of Central Tendency (Mean, medium, Mode), Measures of Dispersion (range, mean deviation, standard deviation),	
18	Graphical Representation of Data, Tabular Presentation of Data,	
19-20	Oral Presentation, Posters Presentation	
21	Sampling Design, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling.	
22	Determining size of the sample, Research Question, Normal Probability Curve, Standard Error, Confidence Intervals	
23	Significance of correlation, Pearson‟s Product Moments Correlation.	
24	Regression and Multiple Regression equations,	

25-26	Hypothesis Formation, Hypothesis Testing, Testing the Significance of difference between means(z and „t‟ test),	
27-28	Analysis of Variance (ANOVA) -concept and applications, Chi Square Test steps, Type I and Type II errors,	
29-30	Writing Research Report:, Interpretation, Significance of Report Writing, Steps In Writing Report, Types of Report,	
31	Technical Report Writing, Review of Related Literature, Structure of The Research Report, Precaution In Writing Report,	
32-33	Layout of Research Paper, Format and Style, Impact Factor of Journals, Suitability of Journal for Publication, Plagiarism, Citation, Reference Writing, IPR, Copyright, Patents,	
34	Introduction of Softwares used for Research like Matlab, SPSS,	
35	Reference Management Software like Zotero/Mendeley,	
36	Software for paper formatting like LaTeX/MS Office,	
37	Software for detection of Plagiarism, Google Scholar, Research Gate, ,	

Evaluation Criteria:

Sl. No.	Name of Examination	Marks Allotted	Remarks
1	Mini Test	10	
2	Mid Semester Test	20	
3	Attendance/Assignment if any	10	
4	Tutorial if any		
5	Quiz if any	10	
6	Seminar, Viva voce if ay		
7	End Semester Examination	50	
8	Experiments if any (for practical courses)		
9	Any other		