ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

Abbreviation used:

AC	Audit course	LC	Lab Course	PA	Practical Assessment
PC	Professional Core	PR	Project/ Practical/ Internship	L	Lecture
PE	Professional Elective	SE	Seminar/ Expert Lecture/ Etc.	T	Tutorial
OE	Open Elective	IA*	Internal Assessment	P	Practical
MC	Mandatory/ Common Course	EA	End-Semester Assessment		

Subject Code Format:

A1	A2	B3	C4	C5	C6
School/ Dept. (Offering)		**Level**	**0:** AC	**Serial Number (01 to 99)**	
BH: Basic Sciences and Humanities		**1:** UG/ Int. Msc. (1st Year)	**1:** PC	01/ 03/…/ 19: Odd Sem. (IEM)	
CS: Computer Sciences		**2:** UG/ Int. Msc. (2nd Year)	**2:** PE	21/ 23/…/ 39: Odd Sem. (MML)	
EE: Electrical Sciences		**3:** UG/ Int. Msc. (3rd Year)	**3:** OE	41/ 43/…/ 59: Odd Sem. (MSD)	
EI: Electronic Sciences		**4:** UG/ Int. Msc. (4th Year)	**4:** MC	61/ 63/…/ 79: Odd Sem. (THE)	
IP: Infrastructure and Planning		**5:** UG/ Int. Msc. (5th Year)	**5:** LC	81/ 83/…/ 99: Odd Sem. (MBA)	
MS: Mechanical Sciences		**6:** PG (1st Year)	**6:** PR		
BT: Biotechnology		**7:** PG (2nd Year)	**7:** SE	02/ 04/…/ 20: Even Sem. (IEM)	
TE: Textile Engineering		**8:** Ph.D.	**8:**	22/ 24/…/ 40: Even Sem. (MML)	
			9:	42/ 44/…/ 60: Even Sem. (MSD)	
				62/ 64/…/ 80: Even Sem. (THE)	
				82/ 84/…/ 98: Even Sem. (MBA)	

1st Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC 1	MS6101	Decision Modelling	3	0	0	3	40	60	-	100
2	PC 2	MS6103	Production Planning and Inventory Control	3	0	0	3	40	60	-	100
3	PE 1	MS6201	Financial Management and Accounting	3	0	0	3	40	60	-	100
		MS6203	Business Ethics and Leadership								
		MS6205	Marketing Management								
		MS6207	Quality Engineering and Management								
4	MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3	40	60	-	100
5	MC 2	MS6403	Research Methodology and IPR	2	0	0	2	40	60	-	100
6	LC 1	MS6501	Operations Research Laboratory	0	0	4	2	-	-	100	100
7	LC 2	MS6503	Industrial Engineering Laboratory	0	0	4	2	-	-	100	100
8	AC 1	Any One from the List of AC 1 (Appendix-I)		2	0	0	0	40	60	-	100
			Total	**16**	**0**	**8**	**18**	**240**	**360**	**200**	**800**

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2nd Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PC 3	MS6102	Work Design and Ergonomics	3	0	0	3	40	60	-	100
2	PC 4	MS6104	Logistics and Supply Chain Management	3	0	0	3	40	60	-	100
3	PE 2	MS6202	Statistics for Management	3	0	0	3	40	60	-	100
		MS6204	Industry 4.0								
		MS6206	New Product Development								
		MS6208	Facility Layout and Design								
4	PE 3	MS6210	Human Resource Management	3	0	0	3	40	60	-	100
		MS6212	Business Analytics								
		MS6214	Project Management								
		MS6216	Maintenance, Safety and Reliability								
5	OE 1	Any One from the List of OE 1 (Appendix-I)		3	0	0	3	40	60	-	100
6	PR 1	MS6602	Project (Specialization Related)	0	0	4	2	-	-	100	100
7	LC 3	MS6502	Work System Design Laboratory	0	0	4	2	-	-	100	100
8	AC 2	Any One from the List of AC 2 (Appendix-I)		2	0	0	0	40	60	-	100
			Total	**17**	**0**	**8**	**19**	**240**	**360**	**200**	**800**

3rd Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PE 4*	MS7201	Lean Production Management	3	0	0	3	40	60	-	100
		MS7203	Management Information System								
		MS7205	Enterprise Resource Planning								
		MS7207	Sustainable Management								
2	PR 2	MS7601	Dissertation (Phase-I)	0	0	24	12	-	-	100	100
			Total	**3**	**0**	**24**	**15**	**40**	**60**	**100**	**200**

* Virtual/Online Course either offered by OUTR or available in MOOCs platform (No physical class)

4th Semester

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	PR 3	MS7602	Dissertation (Phase-II)	0	0	32	16	-	-	100	100
			Total	**0**	**0**	**32**	**16**	**-**	**-**	**100**	**100**

Credits and Maximum Marks

Sl. No.	Semester	Credits	Maximum Marks
1	1st	18	800
2	2nd	19	800
3	3rd	15	200
4	4th	16	100
	Total	68	1900

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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1st Semester

PC 1	MS6101	Decision Modelling	3	0	0	3

Module I:
Use of quantitative techniques in decision making, Elements of linear algebra, Linear programming and Simplex method, Artificial variable, Duality in LP, Dual Simplex Method, Sensitivity analysis

Module II:
Transportation problem, Degeneracy, Assignment problem, Transhipment Model
Integer Programming: Integer programming problem formulation, Branch and Bound method

Module III:
Queuing Theory: Waiting line analysis, Basic elements of queuing model, Queue characteristics, Single server queuing system, Multiple server system, Single server system with constant service time, Single server system with general service time, Multiple server system with finite population
Introduction to Markov chain, Markov Process - Description of state, Transition probability matrix

References:

1. Operation Research: An Introduction, Taha H A, PHI
2. Operation Research, Phillips, Rabindran and Solberg, "John Wiley & Sons
3. Introduction to Operation Research, Hiller F S and Lieberman G J

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PC 2	MS6103	Production Planning and Inventory Control	3	0	0	3

Module - I

Generalised model of a production system, Different kinds of production systems, mass, batchjob and cellular production

Layout: Optimisation in Product and Process layout

Module - II

Demand forecasting: Moving Average and Exponential Smoothing methods, Multiple regression method, Error in forecasting

Overview of production systems; Product Decisions: Decisions in the life cycle of a production system, Evaluation of investments in new product and services, Process Decisions: Process selection, Process analysis, Capacity planning, Line balancing

Scheduling, Comparison of dispatch rules, Johnson rule

Module - III

Inventory control: EOQ and EBQ, Backordering, Determination of safety stock, P and Q System, Joint cycle for multiple products

Material Requirements Planning and Lot Sizing. Just-In-Time Production

Books:

1. Manufacturing Planning and Control, Vollman, Berry, Whybark & Jacobs, TMH
2. Production Planning and Inventory Control, Narasimhan S L, Mcleavey D W, Billington P J, PHI
3. D.D. Bedworth and J.E.Bailey (1983), Integrated Production Control System Management, Analysis and Design, John Wiley
4. E.G. Coffman (1976), Computer and Jobshop Scheduling Theory, Wiley

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 1	MS6201	Financial Management and Accounting	3	0	0	3

Module - I

Introduction: Nature and scope, Finance functions, financial objectives, roles and responsibilities of the finance manager, introduction to Indian financial system, Sources of finance: Equity capital, debenture, preference capital and term loans, Cost of capital, Principles of Valuation: Opportunity Cost of Capital; Money-Time relationships and applications; Present Value; Discount Rates; Comparables

Module - II

Project and Firm Valuation: Evaluating Projects; Net Present Value; Measuring Cash flows, Internal Rate of Return; Firm Valuation; Growth and Free Cash flows; Valuation Models, Accounting vs. Economic Returns

Risk and Return: Introduction to Risk and Return; Historical Evidence; Measuring the Risk of a Portfolio; Statistics Review; Portfolio Theory; Risk in a Portfolio Context, Trade-off between Risk and Return; Measuring the Risk of a Stock; Discount Rates in Practice.

Module - III

Accounting: Cost accounting and its objectives, allocation of overhead cost; Cost and Performance based Systems; Concept of Activity Based Costing (ABC) Systems; System of Book Keeping; References of Accounts; Journalizing; Trial Balance.

Books:

1. Prasanna Chandra, Financial Management: Theory and Practice, TMH, New Delhi.
2. Eugene F Brigham & Michael C Ehrhardt, Financial Management: Theory and Practice, Thomson, Bangalore.
3. I M Pandey, Financial Management, Vikas, New Delhi.
4. Brealey, R., and S. Myers. Principles of Corporate Finance. Irwin/ McGraw Hill.
5. Robin Cooper& Robert S Kaplan, The Design of Cost Management Systems, Prentice Hall

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 1	MS6203	Business Ethics and Leadership	3	0	0	3

Module - I

Basic Theory: Some basic Principles-Meaning, Types of evil and consequences, Proportionality, Minor evils or Physical evils, Problems, Positive obligations, Rights, Cooperation in Evil, Location of responsibility, The gray areas, Economical and Political Considerations, Relationship between firm and employee, customers, competitors, intermediaries, and unions.

Module - II

Historical perspective, culture and ethics in India, Economics and the environment- green business, ethics and competition, The ethical code, social audit, A framework for analysis and action, The sphere of personal ethics-consequences, rights and duties, virtue and character, Ethical Responsibilities of Economic Agents: role obligations, obligation to shareholder, rights and obligations to customer, obligation to pay taxes, Environmental protection, Corporate accountability, Ethical conflicts, Ethics, Government policies and laws.

Module - III

Ethical responsibilities of Organizational Leader: power, leadership, obstacles to ethical conduct, pressures for conformity, Evaluation and rewards, Job pressures and issues, organizational change, Ethics in use of Information Technology, Intellectual Property Rights, Ethics in Marketing, Ethics of advertising and sponsorship, Acquisition and merger, Multinational decision making-Reconciling International norms.

Books:

1. Badaracco Jr J.L., Business Ethics: Roles and Responsibilities, Irwin, Chicago, 1995.
2. Drummond J., and Bain B.(Ed.), Managing Business Ethics, Butterworth Heinemann, Oxford, 1994.
3. Garrett M.Thomas, Business Ethics, The Times of India Press, Bombay, 1970
4. Mathias T.A.(Ed.), Corporate Ethics, Allied Publishers Ltd., New Delhi, 1994
5. Hendry J., and Sorell T., Business Ethics, Butterworth Heinemann, Oxford, 1994.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 1	MS6205	Marketing Management	3	0	0	3

Module - I

Overview of marketing: Importance and scope of marketing, Marketing management and planning and environments of marketing strategy. Markets and segmentation, Consumer buying behaviour & Organizational buying behaviour
Research for marketing decisions: Problem formulation, Obtaining and organizing data, analyzing associative data, and selected activities in marketing research.

Module –II

Product and pricing strategies: product and service concepts, Product development strategy, Pricing concepts and practices.
Placement and promotion strategy: Marketing channels, Distributing goods. Advertising sales promotion and publicity, Personal selling and sales management

Module - III

Industrial marketing: Managing industrial sales, Industrial marketing communication, and industrial distribution strategy and control.

Books:

1. Marketing Management, Kotler Philip, PHI
2. Fundamentals of Marketing, Stanton William J, TMH
3. Marketing Management, Saxena Rajan, TMH

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 1	MS6207	Quality Engineering and Management	3	0	0	3

Module - I

Attributes of quality, Evolution of philosophy of Quality Management, Economics of quality and measurement of cost of quality, Data presentation techniques for quality analysis,

Statistical process control, Use of control charts and process engineering techniques for implementing quality plan,Cusum chart, Machine and process capability analysis, statistical tolerance analysis, Acceptance sampling: Single, double and multiple sampling plans, Acceptance sampling for variables, O. C. Curve

Module - II

Reliability analysis and predictions, Bath-Tub Curve, Exponential and Weibull distribution in modelling reliability, Reliability in system network

Experimental designs and factorial experiments: 2k factorial experiments, Taguchi philosophy; Loss function; Signal to noise ratio, Orthogonal arrays for parameter and tolerance design.

Module - III

Fundamentals of TQM: Customer orientation, Continuous improvement, Six sigma, Just in Time, Kanban, Total participation; Some important philosophies and their impact on quality (Deming, Juran,Crossby), QC Tools, Components of Total Quality System (TQS), Quality audit,Introduction to ISO 9000 and 14000 standards.

Books:

1. Fundamental of Quality Control and Improvement, Mitra A, PHI
2. Quality Planning and Analysis, Juran J M and Gryna F M, Tata McGraw Hill”

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Effective from 2023-24)

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MC 1	BH6401	Mathematical Methods in Engineering	3	0	0	3

Refer Appendix-I for detailed Syllabus.

MC 2	MS6403	Research Methodology and IPR	2	0	0	2

Refer Appendix-I for detailed Syllabus.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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LC 1	MS6501	Operations Research Laboratory	0	0	4	2

Sessions	List of Experiments
1	To solve linear programming problems using a graphical technique and using the Solver on Excel
2	To solve linear programming problems using LINGO.
3	To solve transportation problem using TORA software and obtain optimal solution.
4	To solve an assignment problem using the Hungarian Method. Apply Operations Research techniques to problems and understand the formulation and meaning of the solution.
5	Apply statistical analysis techniques to data sets using Excel To observe, measure and study simulated queueing systems.
6	To compare mathematical model results of queuing systems in order to simulate single server queueing systems with different distributions for service.
7	To demonstrate the implementation of Integer Programming Problem algorithms using MATLAB.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Effective from 2023-24)

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LC 2	MS6503	Industrial Engineering Laboratory	0	0	4	2

Sessions	LIST OF EXPERIMENTS
1	To introduce process and method improvement.
2	To apply stopwatch time study, conduct performance rating of workers and computation of time standards.
3	To apply Human Factors Principles to work and interpret the Human Interface with work. Illustrate auditory vs. visual interface applications.
4	To practice Facility layout and design on a realistic problem in groups.
5	To apply method study approach and analyze the motions involved in machining operation of the given job.
6	To apply work measurement technique and analyze the time components involved machining operation of given job using stop watch
7	Draw and interpret the Shewhart control charts for given Industry data using Excel Solver.
8	Draw and interpret the CUSUM control chart for given Industry data using Excel Solver.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

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Syllabus (Effective from 2023-24)

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AC 1	Any One from the List of AC 1 (Appendix-I)	2	0	0	0

Refer Appendix-I for detailed Syllabus.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
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2nd Semester

PC 3	MS6102	Work Design and Ergonomics	3	0	0	3

Module I:

Work Study Fundamentals: Productivity and Work Study, Definitions and Scope of Work Study, Analysis of Work Content.

Method Study: Process Analysis, Process and Activity Charts, Operation Analysis, Basic procedure, Micro Motion Study, Principles of Motion Economy.

Module II:

Work Measurement: Purposes and uses, Basic procedure &Techniques – Work Sampling, Time Study, Rating and Allowances, Setting Standard Times for Jobs, Standard Data, and Predetermined Time Standards. Analytical Estimation. Measuring work by physiological methods – heart rate measurement – measuring oxygen consumption– establishing time standards by physiology methods.

Module III:

Motion economy- Ergonomics practices – human body measurement – layout of equipment – seat design - design of controls and compatibility – environmental control – vision and design of displays. Design of work space, chair table.

REFERENCES

1. Barnes, Raeph.m., “Motion and Time Study – Design and Measurement of Work “, John Wiley &sons, New York, 1990.
2. Mc.Cormick, E.J., “Human Factors in Engineering and Design”, Mc.Graw Hill.
3. ILO, “Introduction to Work study “, Geneva, 1974.
4. Motion and Time Study, Mundel M, Printice Hall India

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
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PC 4	MS6104	Logistics and Supply Chain Management	3	0	0	3

Module I

Nature and scope of logistics, Logistics environment, Logistic decisions: facility location, transportation, storage and material handling, Logistics information systems, Logistics audit and control. Introduction and overview of supply chain management; Supply chain performance: Strategic fit and scope; Supply chain drivers and obstacle

Module II

Designing distribution network, Network design in uncertain environment
Demand forecasting in supply chain, Bullwhip effect in logistics, Aggregate planning in supply chain

Module III

Transportation and servicing, Pricing and revenue management in supply chain
Supply chain information system, E-business and supply chain

Books

Business Logistics/Supply Chain Management, Ronald Ballou, Pearson Education.
The Management of Business Logistics A Supply Chain Perspective, Coyle, Bardi, and Langley, Thomson Asia.
Designing and Managing the Supply Chain, David Simchi Levi, Philip Kaminsky, Edith Simchi Levi, Tata McGraw Hill.
Logistics: An Introduction to Supply Chain Management, Walters, Palgrave Macmillan.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 2	MS6202	Statistics for Management	3	0	0	3

Module I:
Descriptive Statistics: Measures of Statistics, Numerical description of data, Exploratory data analysis. Probability distributions: Introduction to probability and random variables – Discrete Distributions, Continuous Distributions; Sampling–sampling techniques, Central limit theorem; Sampling distributions- Mean and Proportion, Introduce statistical packages – working with statistical packages.

Module II:
Statistical hypothesis testing: Statistical Inference: Confidence interval estimation for the mean and proportion, Hypothesis Testing for Single populations – about a population mean, variance and proportion. Two Populations – about difference in two means of independent and dependent samples, two population proportions, two variances. Chi-Square goodness of fit test, Chi-Square test of independence.

Module III:
Analysis of Variance and Design of Experiments: Introduction to Design of Experiments, Fundamental assumptions of analysis of variance, Classification of ANOVA – One-way and Two-way classification, Fixed/random effects model – Multiple comparison test – Tukey's Honestly Significant Difference Test.

Books

1. K. Black, Business Statistics. 7th Edn., Wiley Publication2012.
2. R.I. Levin, and D.S. Rubin, Statistics for Management. 7th Edn., Prentice-Hall Inc.Publication2012.
3. D.C. Montgomery, and G. C.Runger, Applied Statistics and Probability for Engineers. 6thEdn.,Wiley Asia Publication 2016.
4. D. M. Levine, D. F.Stephan, K.A. Szabat, Statistics for Managers – Using Microsoft Excel. 8thEdn., Pearson Publication 2017.
5. W.L. Winston, Microsoft Excel 2016 Data Analysis and Business Modeling, 1st Edn.Prentice-HallInc. Publication 2017.
6. R.E.Walpole, R.H.Myers, S.L. Myers and K. Ye, Probability & Statistics for Engineers and Scientists. 9th Edn.Pearson Education Publication 2014.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 2	MS6204	Industry 4.0	3	0	0	3

Module I:
Introduction to Industry 4.0: Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances

Module II:
Industry 4.0 and Cyber Physical System: Introduction to Cyber Physical Systems (CPS), Architecture of CPS-Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in Industry domain.

Module III:
Resource-based view of a firm, Data as a new resource for organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0, Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, infrastructure for data transfer and governance, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security, Classification of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendment.

Books
1. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics by Christoph Jan Bartodziej, Springer Gabler
2. Industry 4.0: Entrepreneurship and Structural Change in the New Digital Landscape,by TessalenoDevezas, João Leitão, Askar Sarygulov, Springer
3. Rapid Manufacturing: An Industrial Revolution for a Digital Age by Hopkinson, N, Haque, R., and Dickens, P., Wiley.
4. Cybersecurity Management:A governance risk and compliance framework by Peter Trim, Yang-Im Lee, Routledge.

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PE 2	MS6206	New Product Development	3	0	0	3

Module - I

Introduction: Challenges of product development; Successful product development; Quality aspect of product design; Market Research; Survey. Identify customer needs and Product Planning Processes.

Module - II

Product specifications: Process of setting specifications. Concept generation, selection, testing. Product Architecture: Implication of architecture, establishing the architecture, related system level design issue. Industrial design: Overview

Module - III

Design for manufacturing and assembly - tolerancing, design of gauges; Design for environment; Robust design. Prototyping; Engineering Materials. Concurrent engineering. Product costing, value engineering, Aesthetic concepts; visual effects of form and colour, Product data management.
Innovation and Creativity in Product Design. Case Studies.

Books:

1. Product Design and Development: Karl T. Ulrich, Steven G. Eppinger; Irwin McGrawHill.
2. Product design and Manufacture: A.C.Chitale and R.C. Gupta; PHI
3. New Product Development: Tim Jones, Butterworth, Heinmann, Oxford, 1997.
4. Product Design : Otto and Wood; Pearson education.
5. Industrial Design for Engineers: Mayall W.H, London, Hiffee References Ltd, 1988

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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PE 2	MS6208	Facility Layout and Design	3	0	0	3

Module - I

Introduction: Nature, Significance and Scope of Facility layout and design. Facility Location: Location analysis, Single-facility and multi-facility location problems, Location allocation problems.

Module - II

Facility Layout: Significance, Objectives, Steps in layout planning, Quantitative techniques. Material Handling: Definition, Principles of Material Handling, Material Handling System Design, Equipment selection.

Module - III

Storage and Warehousing: Functions, Objectives and Principles. Facility Services. Design of Assembly and Production Lines.

Books:

1. Product Design and Development: Karl T. Ulrich, Steven G. Eppinger; Irwin McGrawHill.
2. Product design and Manufacture: A.C.Chitale and R.C. Gupta; PHI
3. New Product Development: Tim Jones, Butterworth, Heinmann, Oxford, 1997.
4. Product Design: Otto and Wood; Pearson education.
5. Industrial Design for Engineers: Mayall W.H, London, Hiffee References Ltd, 1988

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 3	MS6210	Human Resource Management	3	0	0	3

Module I:
Introduction: Concept, Nature and Scope of HRM. Growth and Development of HRM in India. Emerging Trends of HRM in a globalised economy, Contemporary Issues in HRM: Outsourcing, BPO and Call Centres, Globalization, Mergers and Acquisitions. Organisational objectives, functions, relationships, Organisational structure of formal and Organisations.

Module II:
Manpower planning: Man power forecasting process and techniques, job analysis and job design. Selection: Developing sources, methods of recruitment, alternative selection policies, application blanks and qualification card, interviews, psychological testing. Training: The nature of training, objectives in training, types of training, requirements of effective training conventional training techniques, management development, evaluating training effectiveness. Performance appraisal: Traditional performance appraisal systems, appraisal programs.

Module III:
Compensation: Managing Basic Remuneration and Incentives, Factors affecting compensation policy- equity and compensation -comparable value, job evaluation, job evaluating systems Employee Benefits, Empowering Employees, Promotions- Basis of Promotions. Transfers, Separations and Rightsizing. Employee Welfare: A Safe and Healthy Environment, Motivating Employees. Career Management and Growth. Industrial Relations- Trade Unions, Resolving Disputes, Evaluating HRM Effectiveness, International HRM.

Books:
1. K. Aswathappa, Human Resource Management, Tata McGraw Hill, 2008.
2. J. Ivanicevic, Human Resource Management, Tata McGraw Hill, 2004.
3. Noe, Hollenbeck, Gerhart, and Wright, Fundamentals of Human Resource, McGraw-Hill, 2006.
4. S. C. Fisher, Human Resource Management, Wiley / Biztantra, 1999,
5. G. Dessler, Human Resource Management, 12thed. Person Education, 2011

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 3	MS6212	Business Analytics	3	0	0	3

Module - I

Business Analytics: Definition, Evolution, Architecture, Benefits, Future; Business Analytics as Solution for Business Challenges, Effective Predictive Analytics, Integrating Analytics in Business Processes, Unstructured Data Analytics, Balanced Scorecard, Quality, Master Data Management, Data Profiling, Emerging Areas of Analytics: Facial Analytics, Retail Analytics, Social Media Analytics

Module - II

Data Modelling Concepts, Data Modelling Types and Techniques, Multidimensional modelling: measures, dimensions, attributes and hierarchies, Schemas, Data Marts,

Module - III

Data Integration: Extraction, Transformation and Load Processes, Data Warehouse: Definition, Architecture, Development and Implementation issues, OLTP and OLAP, Data Mining: Definition, Concepts, Applications and Methods

Books:

1. Business Analytics by Sahil Raj, Cengage Publication, 2015
2. Fundaments of Business Analytics by RN Prasad and Seema Acharya, Wiley India Publication
3. Win With Advanced Business Analytics by Jean Paul Isson and Jesse S. Harroitt, Wiley Publication, 2013
4. Successful Business Intelligence: Secrets to Making BI a Killer App by Cindi Howson, Tata McGraw Hill Edition 2012
5. Business Intelligence: A Managerial Approach by Efraim Turban, Ramesh Sharda, Dursun Delen and Daid King, Pearson Publication, 2012

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

PE 3	MS6214	Project Management	3	0	0	3

Module –I

Introduction to Project Management, Project Lifecycle, Project Selection and Portfolio Management, MRD, PRD, QFD

Project Planning, Project Scope Document, Work Breakdown Structure

Module - II

Project Scheduling, Network scheduling (precedence diagramming), PERT, CPM, Resource allocation, Project Crashing, Theory of Constraints (ToC), Critical Chain Project Management, Project Cost Management, Cost Estimating techniques, Project Budgeting, Project Quality Management, Quality Planning, Quality Assurance, Quality Control

Module – III

Project Risk Management, Risk breakdown Structure and Risk Management Plan, Risk Register, Qualitative and Quantitative Risk Analysis

Project Control and Monitoring, Earned Value Management

Books:

6. Business Analytics By Sahil Raj, Cengage Publication, 2015
7. Fundaments of Business Analytics by RN Prasad and Seema Acharya, Wiley India Publication
8. Win With Advanced Business Analytics by Jean Paul Isson and Jesse S. Harroitt, Wiley Publication, 2013
9. Successful Business Intelligence: Secrets to Making BI a Killer App by Cindi Howson, Tata McGraw Hill Edition 2012
10. Business Intelligence: A Managerial Approach by Efraim Turban, Ramesh Sharda, Dursun Delen and Daid King, Pearson Publication, 2012

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 3	MS6216	Maintenance, Safety and Reliability	3	0	0	3

Module - I

Maintained systems and various definitions associated with them, Type of Maintenance. Maintainability analysis, Maintainability design considerations, Availability and MTTF computations, Renewal Theory Approach, Life Cycle Costs

Optimum Inventory Assessment. Optimal inspection, overhaul, replacement or repair strategies

Module - II

Causes and types of failures, Reliability expressions for constant, increasing and decreasing hazard rates. Data Analysis, Probability plots for various distributions (exponential, Weibull, Normal and Gamma) Maintainability test, demonstration and warranties, Case Studies

Maintenance strategies, Managing change, Selection of maintenance tactics, Planning and scheduling resources, Measurement and benchmarking of performance

Module - III

Safety in Maintenance: Reasons for Safety; Problems in Maintenance Safety and Maintenance Tasks; Guidelines for Equipment Designers to Improve Safety in Maintenance; Maintenance Safety-Related Issues for Equipment Manufacturers; Maintenance Personnel Safety

Books

1. Maintenance Engineering: A Modern Approach, B S Dhillon, CRC Press
2. Total Productive Maintenance, Borris& Steve, McGraw Hill
3. Maintenance Engineering and Management, D G Mahto & Anjani Kumar, Axis Books Pvt. Ltd., New Delhi
4. Reliability and Maintenance Engineering, R C Mishra, New Age International,

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

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Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

OE 1	Any One from the List of OE 1 (Appendix-I)	3	0	0	3

Refer Appendix-I for detailed Syllabus.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

PR 1	MS6602	Project (Specialization Related)	0	0	4	2

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

LC 3	MS6502	Work System Design Laboratory	0	0	4	2

Sessions	LIST OF EXPERIMENTS
1	Graphic tools for method study
2	Peg board experiment
3	Stop watch time study
4	Performance rating exercise
5	Walking rating
6	Card dealing
7	Work sampling
8	Methods Time Measurement

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

AC 2	Any One from the List of AC 2 (Appendix-I)	2	0	0	0

Refer Appendix-I for detailed Syllabus.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

3rd Semester

PE 4	MS7201	Lean Production Management	3	0	0	3

Module I:
Small-Lot Production: Lot-size Basics; Lot sizing; Lot-size Reduction; Facilitating Small Lot Size. Setup-Time reduction: Setup Reduction Methodology; Techniques for Setup-Reduction; Setup Reduction Projects.

Module II:
Pull Production Systems: Pull Systems and Push Systems, Conditions for Pull Production Systems, How to achieve Pull Production; Mechanisms for Signal and Control: Two-card pull production system, Signal Kanban, CONWIP. Workcells and Cellular Manufacturing: Cell layout and Capacity Measures, Design of Workcells, Worker Assignment, Implementation Issues.

Module III:
Scheduling for Smooth Flow: Production Leveling, Levelling the master production schedule, Level Scheduling in Pull Production: Mixed model production (Heijunka); Production planning and scheduling in environment like make-to-stock, assemble-to-order, make-to-order. Synchronising and Balancing Process: Synchronisation; Bottleneck Scheduling; Balancing; Adapting to Schedule changes. Planning and Control in Pull Production: Centralised Planning and Control System; Decentralised planning and Control system; Adapting MRP-Based Production Planning and Control System to Pull production

Books

1. J. Nicholas, Lean Production for Competitive Advantage: A comprehensive Guide to Lean Methodologies and Management Practices, CRC Press – Taylor & Francis Group – A Productivity Press Book, 2010
2. J. Nicholas, Competitive Manufacturing Management – Continuous Improvement, Lean Production, and Customer-Focused Qualities. Tata McGraw-Hill Edition, 2001.
3. R. G. Askin and J. B. Goldberg, Design and Analysis of Lean Production Systems. Wiley Student Edition, 2007.
4. M. G. Korgaonker, Just in Time Manufacturing, Macmillan Publishers India Limited, 2000.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 4	MS7203	Management Information System	3	0	0	3

Module - I

Concepts of MIS: Global factors responsible of growth of information systems, Types of Information Systems Evolution of information theory, Characteristics of management information System, Richard Nolan MIS Stages theory, Information Resource Management, Management information system organization functions MIS Long range planning Meaning and role of MIS in an organization.

Module - II

Analysis and design of information systems; Conceptual modeling of data and process in organizations.
System development life cycle model, Methods of collection of data, Tools for modeling and analysis of data: Concept of Data Base Data base management systems and its functions Data flow diagram, Data dictionary, Data banks.

Module - III

Tools for modelling and analysis of processes: Flow charts, Decision tables, Decision trees.Transform analysis, Transaction analysis. Information systems audit. Impact of MIS on organizations. Usefulness of various industrial engineering techniques in the design of MIS.

Books:

1. Management Information Systems, Lauden and Lauden, PHI(1999)
2. Management Information Systems by Jerome Kanter
3. Management Information Systems by Davis Gordon.

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 4	MS7205	Enterprise Resource Planning	3	0	0	3

Module I:

Introduction to ERP: Overview of ERP - Introduction and Evaluation of ERP, Reasons for the growth of the ERP-Market, Advantages and Disadvantages of ERP, Overview of Enterprise - Integrated Management Systems, Business Modeling, Integrated Data Model.

ERP-and Related Technologies: Business Process Re-engineering (BPR) – Best Practices in ERP, Business Intelligence Systems-Data Mining, Data Warehousing, On-Line Analytical Processing (OLAP).

ERP System Options and Selection Methods: Optimal Means of Developing an ERP, Measurement of Project Impact, IT Selection and Project Approval, ERP proposal Evaluation, Project Evaluation Techniques, Testing.

Module II:

ERP Implementation and Maintenance: Implementation Strategy Options, Features of Successful ERP Implementation, and Strategies to Attain Success, User Training, ERP Maintenance.

ERP - The Business Modules: Introduction: - Finance, Manufacturing (Production), Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution.

Module III:

Future Directions in ERP: Introduction - New Markets, New Technologies, Faster Implementation Methodologies, New Business Segments, Trends in Security.

Books:

1. Alexis Leon, Enterprise Resource Planning, 10/E, TMH, 2004.
2. ERP: A Managerial Perspective, Sadagopan, S., Tata Mcgraw-Hill

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM), Duration: 2 years (Four Semesters)

PE 4	MS7207	Sustainable Management	3	0	0	3

Module 1: Management of sustainability: rationale and political trends - An introduction to sustainability management - International and Indian policies on sustainable development - The theoretical pillars in sustainability management studies - Corporate sustainability and responsibility - The corporate sustainability perimeter - The corporate sustainability institutional framework - The integration of sustainability into strategic planning and regular business practices - The fundamentals of stakeholder engagement.

Module 2: Sustainability management: strategies and approaches: Corporate sustainability management and competitiveness- Sustainability-oriented corporate strategies, markets and competitiveness - Green Management between theory and practice - Sustainable Consumption and Green Marketing strategies. Environmental regulation and strategic postures: Green Management approaches and tools – Ecodesign and product development according to life-cycle thinking - Environmental Management Systems and Audit techniques according to EMAS and ISO 14001. Green engineering: Clean technologies and innovation processes - Sustainable Supply Chain Management and Procurement - Inter-organizational alliances and public-private partnerships - Case studies on sustainability practices.

Module 3: Product certification and labels: Environmental claims - Communication and environmental footprint - Performance indicators and reporting. Sustainability and innovation: Socio-technical transitions and sustainability - Sustainable entrepreneurship - Sustainable pioneers in green market niches - Smart communities and smart specializations. Sustainable management of resources, commodities and commons - Energy management - Water management - Waste management.

Books:

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall. 2011.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering Applications in Sustainable Design and Development, Cengage learning , 2016.
3. Cetinkaya, B.,Cuthbertson, R.,Ewer, G., Klaas-Wissing, T., Piotrowicz, W.,Tyssen, C.,Sustainable Supply Chain Management: Practical Ideas for Moving Towards Best Practice, Springer-Verlag Berlin Heidelberg 2011.
4. Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management Approaches and Operational Tools, Routledge, 2015.
5. Gerwig, K., Greening Health Care, Oxford University Press, 2015.
6. Morana, J., Sustainable Supply Chain Management, John Wiley & Sons, Inc. 2013

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

Syllabus (Effective from 2023-24)

School/ Department: School of Mechanical Sciences
Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
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PR 2	MS7601	Dissertation (Phase-I)	0	0	24	12

ODISHA UNIVERSITY OF TECHNOLOGY AND RESEARCH

Techno Campus, Mahalaxmi Vihar, Ghatikia, Bhubaneswar-751029.

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Course: M. Tech. (SSP), Programme: Industrial Engineering and Management (IEM),
Duration: 2 years (Four Semesters)

4th Semester

PR 3	MS7602	Dissertation (Phase-II)	0	0	32	16