St. Joseph's

COLLEGE OF ENGINEERING AND TECHNOLOGY, -PALAI-

AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India

CURRICULUM & SYLLABUS
(2024 SCHEME)

Minor *in*

OPERATIONS MANAGEMENT (INDUSTRIAL ENGINEERING)

OFFERED BY   :   Department of Mechanical Engineering (ME)
ELIGIBLE DEPARTMENTS   :   AD, CA, CC, CE, CS, EC, ER, EE, ME

www.sjcetpalai.ac.in

Minor

OPERATIONS MANAGEMENT

INDUSTRIAL ENGINEERING

COURSES

CURRICULUM

				COURSES									
Sl. No:	Semester	Course Code	Course Title (Course Name)	Credit Structure				SS	Total Marks		Credits	Hrs./ Week
				L	T	P	R		CIE	ESE		
1	3	24SJMNIET309	Work Study and Ergonomics*/MOOC#	3	1	0	0	5	40	60	4	4
2	4	24SJMNIET409	Production and Operations Management*/MOOC#	3	1	0	0	5	40	60	4	4
3	5	24SJMNIET509	Decision Sciences/MOOC	3	1	0	0	5	40	60	4	4
4	6	24SJMNIET609	Inspection and Quality control/MOOC	3	0	0	0	5	40	60	3	3
			Total					**20**			**15**	**15**

* Students must register for theory courses in the 3rd and 4th semesters of the Minor curriculum.

\# Students who fail a theory course listed in the Minor curriculum are permitted to register for an alternate MOOC course specified in the Minor curriculum.

SEMESTER 3

WORK STUDY AND ERGONOMICS

Course Code	24SJMNIET309	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Pre-requisites (if any)	Nil	**Course Type**	Theory

Course Objectives:
- To provide students with an in-depth understanding of work study techniques and the principles of a productive working environment.
- To develop the ability to analyze and apply work study methods in real-world industrial applications.
- To build a solid foundation for implementing ergonomic and work environment improvements in various workplace settings.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand productivity concepts in organizations and identify the importance of work study.	**K2**
CO2	Apply method study concepts and identify its procedures and tools.	**K3**
CO3	Apply work measurement concepts and identify techniques such as stopwatch time study, MTM, work sampling, and the work factor system.	**K3**
CO4	Determine the role and applications of principles of motion, workplace design, and ergonomics in industrial settings.	**K2**

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	3	-	-	-	-	-	-
CO3	3	-	3	-	3	-	-	-	-	-	-
CO4	3	-	3	-	3	-	-	-	-	-	-

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Concepts, definition and importance of productivity, holistic approach to productivity, productivity and living standards, measuring productivity, fractional and multifactor productivity, work study and productivity, techniques for productivity improvement, importance of work study for productivity improvement.	11	1
2	Definition and objectives of method study, procedure of method study, selection of work, recording the work and activities, classification of activities, representation of activities, use of different charts and diagrams, examining the work, developing methods, evaluation and implementation of method study.	11	2
3	Definition and objectives of work measurement, basic procedure of stop watch time study, determination of sample size, performance rating systems, calculation of allowances and estimation of standard time. Work sampling, conducting work sampling study, calculation procedures, use of MTM, MOST and work factor systems in work measurement.	11	3
4	Classification of movements, micro motion study, therbligs, film analysis sheet and SIMO chart, principles of motion economy pertaining to work place, tools and worker, applications of these principles in design, workplace layout and workplace design concepts. Definition and objectives of ergonomics, application of anthropometry in workspace design and seating, arrangement of components within a physical space, effects of environmental factors such as lighting, noise, vibration and temperature in workplace, concepts of occupational safety and hazards.	11	4

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 2 marks **(8x3 = 24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which one question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

	Text Books			
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Work Study	Indian Adaptation, International Labour Office, Geneva	Oxford and IBH Publishing Company Private Limited	Third Edition, 2015
2	Work study and Ergonomics	S.K. Sharma, Savita Sharma	S.K. Kataria & Sons	First Edition, 2016
3	Motion and Time Study	Marvin E. Mundel, David L. Danner	Prentice Hall	Seventh Edition, 1998

	Reference Books			
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	An Introduction to Methods, Time Study and Wage Payment	Benjamin Niebel, BW, Lohmann, MR & Mee, JF	Literary Licensing, LLC	2012
2	Motion and Time: Study Design and Measurement of Works	Ralph M Barnes	Wiley India Private Limited., New Delhi	2009

Module No.	Topic	Link ID
1 to 4	Work Study	https://nptel.ac.in/courses/112107142

SEMESTER 4

PRODUCTION AND OPERATIONS MANAGEMENT

Course Code	24SJMNIET409	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Pre-requisites (if any)	Basic understanding of probability, normal distribution, and statistical tables.	**Course Type**	Theory

Course Objectives:
- To introduce the basics of industrial systems, impart ability to analyse the manufacturing operations of a firm and to understand the importance of various factors of production.
- To introduce the methods and techniques to effectively manage the inventory of an organisation, and the basics of scheduling and sequencing of activities to improve organizational effectiveness.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basics of operations management and apply different forecasting techniques to predict demand accurately.	**K3**
CO2	Analyze and apply aggregate planning strategies, plant layout methods, and capacity planning techniques in production systems..	**K3**
CO3	Develop and manage master production schedules and apply inventory models to optimize stock control and service levels.	**K3**
CO4	Apply scheduling techniques and understand modern production systems like ERP, JIT, and lean manufacturing concepts.	**K3**

K1-   Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	3	-	-	-	-	-	2
CO2	3	3	2	-	3	-	-	-	-	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-
CO4	3	2	2	-	3	2	-	-	-	2	3

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction to operations management, its functions and scope. Demand forecasting: methods-causal and time series models, moving average, exponential smoothing methods. Trend, cycle and seasonality components, Winter's model. Analysis of forecast error, comparison of forecasting methods based on errors.	11	1
2	Aggregate planning: definition, value of decision rules, aggregate planning strategies, methods. Location Selection factors - Factor rating and centre of gravity methods. Plant layout: Types of layouts, Comparison of layouts, Systematic Layout Planning (SLP), Design procedures and methods, Software packages for SLP. Models for assembly line balancing. Capacity planning and control, controlling continuous production, batch processing technique.	11	2
3	Master production schedule - bill of material, structuring BOM, disaggregation techniques, managing and maintenance of MPS. Basic inventory models: assumptions and performance measures. Inventory systems under risk, service levels, safety stock, joint determination of Q and R, time varying demands – Selective Inventory Control.	11	3
4	Flow shop and Job shop scheduling techniques-Johnson's algorithm and Palmer's heuristic. Advances in production systems: Introduction to Business Process Re-engineering, Enterprise Resource Planning, ERP II, Toyota Production System, World Class Manufacturing Concepts, Kanban - Push Vs. Pull systems, Just-in time systems (basics only).	11	4

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 2 marks **(8x3 = 24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which one question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Modern Production /Operations Management	Buffa S.	John Wiley & Sons	1987

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Operations Management	Mahadevan B.,	Pearson Education	2010
2	Operations Management: Strategy and Analysis	Krajewski L. J. and L. P. Ritzman	Pearson Education	2002

Video Links (NPTEL, SWAYAM…)		
Module No.	**Topic**	**Link ID**
1 to 4	Production and Operations Management	https://onlinecourses.nptel.ac.in/noc20_mg06/preview/

SEMESTER 5

DECISION SCIENCES

Course Code	24SJMNIET509	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Pre-requisites (if any)	Nil	Course Type	Theory

Course Objectives:
- To introduce students to mathematical, data exploration, and analysis techniques essential for effective decision-making.
- To provide foundational knowledge of machine learning methods and decision tools used in analytical problem-solving.

Course Outcomes (COs)
At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand and apply basic concepts of linear algebra, probability, and data collection methods in statistical analysis.	K3
CO2	Analyze and interpret data using summarization, visualization, regression models, and ANOVA with appropriate software tools..	K3
CO3	Explain and apply multivariate statistical techniques and operations research models using suitable analytical tools.	K3
CO4	Understand the fundamentals of data analytics, data science, and machine learning concepts for solving real-world problems.	K2

K1-   Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	2	-	-	-	-	-	2
CO2	3	3	2	-	3	-	-	-	-	-	2
CO3	3	3	2	-	3	2	-	-	-	2	2
CO4	3	2	2	-	3	2	-	-	-	2	3

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Linear Algebra, Vectors, Matrices. (Simple problems) Probability - Dependence and Independence, Conditional Probability, Bayes' Theorem, Random Variables, Continuous Distributions, Normal Distribution. (Simple problems). Method of data collection, primary and secondary data, observation method, interview method, questionnaire method. (Concept only)	11	1
2	Exploring your data - Data summarization, Data visualization, Cleaning and Munging, Rescaling, Data reduction. (Simple problems) Software tools for data exploration and visualization. Correlation, Simple Linear Regression, Multiple Regression, Logistic Regression, ANOVA, Fitting the Model, Interpreting the Model, Goodness of Fit. (Simple problems)	11	2
3	Factor Analysis, Multi-Dimensional Scaling, Cluster Analysis, Discriminant Analysis and Conjoint Analysis (Concept only) Software tools for statistical analysis. Operations research Applications; Models for solving Operations Research Models – Linear Programming models, Transportation Problems, Assignment Problems, Queuing theory, Decision Trees, (Concepts only, Mathematical formulations expected). Software tools for Operations Research.	11	3
4	Data analysis, Types of data analysis - Descriptive, predictive, diagnostic and prescriptive; Introduction to data science, data mining and big data analytics. (Concepts only) Machine learning concepts - Neural Networks, Perceptrons, Feed-Forward Neural Networks, Back propagation, Supervised and Unsupervised Learning methods, Clustering; Deep learning. (Concepts only) Software tools for data analytics.	11	4

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 2 marks **(8x3 = 24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which one question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

| Text Books					
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability and Statistics for Engineering and the Sciences	Devore, J. L.	Khanna publishers	8th Edition, Cengage, 2012
2	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data	Dietrich, D.	John Wiley & Sons.	2015
3	Data Mining: Introductory and Advanced Topics,	Dunham, M. H.	earson Education India	2006
4	Operations Research	Hira, D. S. and Gupta, P. K.	S. Chand and Sons.	2015
5	Research Methodology	Kothari C. R. And Garg G.	New Age.	4th Edition, 2019
6	Statistics for Management	Levin, I. R., Siddiqui, M. H., Rubin, D. S. and Rastogi, S.	Pearson Education India	8th Edition, 2017
7	Quantitative Methods in Management	Vohra, N. D.	TMH.	2007

| Reference Books					
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Predictive Analytics: Microsoft Excel	Carlberg, C.	Que Publishing	1st Edition, 2012
2	Introduction to Operations Research	Hillier, F. S. and Lieberman, G. J.	Tata McGraw Hill.	2005
3	Data Mining and Business analytics with R,	Ledolter, J.	John Wiley & Sons.	1st Edition, 2013
4	Data Mining: Practical Machine Learning Tools and Techniques,	Witten, I. H., Frank, E., Hall, M. A.	Morgan Kaufmann.	Morgan Kaufmann, 2011
5	Data Science Essentials in Python	Zinoriev, D.	O'Reilly.	1st Edition, 2016

| Video Links (NPTEL, SWAYAM…)			
Module No.	**Topic**	**Link ID**
1 to 4	Decision Sciences	https://nptel.ac.in/courses/110104094

SEMESTER 6

INSPECTION AND QUALITY CONTROL

Course Code	24SJMNIET609	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Pre-requisites (if any)	Nil	Course Type	Theory

Course Objectives:
- To enable students to understand quality control processes, inspection practices, and the use of quality tools and techniques.
- To provide knowledge on Reliability Engineering and Total Quality Management (TQM) principles.

Course Outcomes (COs)
At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand concepts of statistical process control and process capability.	K2
CO2	Understand complexities of statistical analysis and the application of the knowledge in control chart interpretation.	K3
CO3	Apply knowledge on acceptance sampling plans and use them in sampling inspection.	K3
CO4	Apply the concepts of reliability improvement techniques, and understand the advanced quality tools to improve product and service quality.	K3

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-
CO3	3	3	3	-	2	-	-	2	-	2	-
CO4	3	3	3	-	3	-	-	2	-	2	-

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction to Statistical Quality Control, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost- process variability – process control – process capability – process capability studies.	9	1
2	Theory of control chart- uses of control chart – Control chart for variables – R charts- s chart. Control chart for attributes –control chart for fraction defectives – p chart. control chart for number of defectives - np chart. control chart for defects – c chart, u chart and D chart. state of control and process out of control identification in charts.	9	2
3	The concept of Acceptance sampling, Economics of inspections, Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – The Operating characteristic curve– producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD.	9	3
4	Introduction to Reliability Engineering, Failure data analysis - mean failure rate, mean time to failure, mean time between failure, hazard rate, System reliability - series, parallel and mixed configuration. Maintainability and Availability. Reliability improvements techniques - designing for reliability – redundancy unit and standby redundancy. Study of Quality Improvement Tools: Total quality management-philosophies-models-implementation. Quality circles - concepts-objectives - organisational structure. KAIZEN- meaning- management practices. Six sigma- introduction- definition - DMAIC method -roles and responsibilities.	9	4

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 2 marks **(8x3 = 24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which one question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

	Text Books			
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Statistical Quality Control	Gupta, R. C	Khanna Publishers	2003
2	Statistical Quality Control	Mahajan, M.	Dhanpat Rai & Sons	2001
3	Introduction to Statistical Quality Control	Montgomery.	John Wiley & Sons.	2019
4	Inspection Quality Control and Reliability	Sharma, S. C.	Khanna Publishers	2002
5	Reliability Engineering	Srinath, L. S.	Affiliated East West Press	2011

	Reference Books			
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Quality Control and Improvement	Mithra, A.	Pearson Education	1998
2	Statistical Quality Control,	Grant, E. L.	McGraw Hill.	2000

	Video Links (NPTEL, SWAYAM…)	
Module No.	**Topic**	**Link ID**
1 to 4	Inspection and Quality control	https://onlinecourses.nptel.ac.in/noc21_me16/preview