B. Tech with

MINOR

in

INDUSTRIAL ENGINEERING

Academic Regulations, Course Structure and Syllabus

Effective from 2023-24 admitted batches

Offered by

Department of Mechanical Engineering

KSRM College of Engineering (A) – Kadapa

(Approved by AICTE, Accredited by NAAC with A+ Grade and NBA and Affiliated to JNTUA, Anantapuramu)

ELIGIBILITY / REGISTRATION / AWARD OF MINOR

The primary objective of a minor degree is to provide students with a secondary area of study to broaden their knowledge, enhance their skill set, and potentially improve their career prospects. It allows students to explore interests beyond their major, potentially leading to a more well-rounded and competitive profile.

i) Minor degree is introduced by the respective departments offering B. Tech. programs and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) There is NO minimum CGPA requirement to register for Minor degree program. However, the student shouldn't have any course backlog **up to III Semester in the major degree.**

iii) A student shall earn **additional 18 credits for award of Minor degree** offered by the department other than parent department. This is in addition to 163 credits by a regular student and 123 Credits by a Lateral Entry student for the award of Major degree.

iv) A student is permitted to register for Minor in IV Semester after the results of III Semester are declared. Students shall register and pass in all the courses prescribed and being offered from V semester under the respective Minor degree.

v) Students have to attend classwork for courses under Minor degree beyond regular academic hours meant for major degree. Students can also undergo the courses under Minor through any proctored online platforms with the prior approval of the BoS Chairman and the HoD of the respective department offering Minor degree.

vi) The attendance for the registered courses under Minor and regular courses offered for Major degree in a Semester will be considered separately.

vii) A student shall have an aggregate of 75% attendance in all courses registered under Minor in that particular semester to become eligible for attending Semester-End examinations.

viii) The registration for the Minor will be cancelled, if the student is detained due to lack of attendance in Major.

ix) The registration for the Minor will be cancelled, if the student fails in any course of either Minor / Major in any semester from V to VIII Semester.

x) A student registered for Minor shall pass in all subjects that constitute the requirement for the Minor degree program. No class/division (i.e., second class, first class and distinction, etc.) will be awarded for Minor degree program.

xi) A separate grade sheet will be issued for the Minor degree courses semester-wise..

xii) If a student drops or is terminated from the Minor program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra.

xiii) The Minor will be mentioned in the degree certificate as Bachelor of Technology in Civil Engineering with Minor in Mechanical Engineering.

xiv) There shall be a minimum enrolment of 20% OR 20 enrollments from the list of

eligible students to offer Minor program.

xv) There is no fee for registration of courses for Minor program offered.

xvi) A student can register for either Minor / Honor but not both.

xvii) Student shall submit an application for either Minor / Honor at least one week before the commencement of the V Semester.

MINOR PROGRAMS OFFERED

Offering Department	Title	Who can Register
Civil Engineering	Civil Engineering	B.Tech. EEE / ME / ECE / CSE / AIML / CSE(AIML) / CSE(DS)
Mechanical Engineering	3D Printing	B.Tech. CE / EEE / ECE / CSE / AIML / CSE(AIML) / CSE(DS)
	Industrial Engineering	B.Tech. CE / EEE / ECE / CSE / AIML / CSE(AIML) / CSE(DS)
Electrical and Electronics Engineering	Energy Systems	B.Tech. CE / ME / ECE / CSE / AIML / CSE(AIML) / CSE(DS)
Electronics and Communication Engineering	Embedded Systems	B.Tech. CE / EEE / ME / CSE / AIML / CSE(AIML) / CSE(DS)
Computer Science and Engineering	Computer Science and Engineering	B.Tech. CE / EEE / ME / ECE
	Data Science	B.Tech. CE / EEE / ME / ECE
	Computer Science and Engineering – Artificial Intelligence and Machine Learning	B.Tech. CE / EEE / ME / ECE

COURSE STRUCTURE

for

MINOR

in

INDUSTRIAL ENGINEERING

S. No	COURSE CODE	COURSE TITLE	Semester Offered	L	T	P	IM	EM	CR
1	2303571M	Production Planning and Control	V	3	0	0	30	70	3
2	2303572M	Ergonomics and Human factors in Engineering	V	3	0	0	30	70	3
3	2303573M	Industrial Engineering Lab	V	0	0	3	30	70	1.5
4	2303671M	Marketing Management	VI	3	0	0	30	70	3
5	2303672M	Strategic Management for Competitive Advantage	VI	3	0	0	30	70	3
6	2303771M	Six sigma and Lean Manufacturing	VII	3	0	0	30	70	3
7	2303772M	Metrology and Instrumentation Lab	VII	0	0	3	30	70	1.5
Total				**15**	**0**	**6**	**210**	**490**	**18**

2303571M	**MINOR IN INDUSTRIAL ENGINEERING** PRODUCTION PLANNING AND CONTROL (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Understand the role, objectives, and components of Production Planning and Control in various manufacturing systems.
CO2. Apply forecasting techniques and aggregate planning strategies to estimate future demand and balance production capacity.
CO3. Develop capacity plans and use Material Requirement Planning (MRP) to manage production resources efficiently.
CO4. Analyse different scheduling and sequencing techniques to optimize production Work flows.
CO5. Design and implement efficient production planning and control systems using modern tools and technique

SYLLABUS:

UNIT - I: INTRODUCTION TO PRODUCTION PLANNING AND CONTROL (08 Periods)

Definition, objectives, and functions of PPC, Components and phases of PPC, Types of production systems: job, batch, mass, and continuous, Relationship with other departments (purchase, marketing, inventory, etc.), Role of PPC in operations strategy.

UNIT - II: FORECASTING AND AGGREGATE PLANNING (08 Periods)

Need for forecasting in PPC, Qualitative and quantitative forecasting methods, Moving Average, Exponential Smoothing, Trend Projection, Forecast accuracy: MAD, MSE, MAPE, Aggregate planning: objectives, strategies (chase, level, hybrid),Aggregate Planning Techniques: graphical and mathematical approaches.

UNIT - III: CAPACITY AND MATERIAL PLANNING (10 Periods)

Capacity Planning: short-term and long-term, Capacity requirement planning (CRP), Bill of Materials (BOM), Master Production Schedule (MPS), Material Requirements Planning (MRP) Introduction to ERP systems.

UNIT-IV: SCHEDULING AND SEQUENCING (08 Periods)

Scheduling objectives and types: forward vs. backward scheduling, Gantt charts, Job shop and flow shop scheduling, Sequencing rules: FCFS, SPT, LPT, EDD, CR, etc. Johnson's Rule for two and three machines, loading techniques.

UNIT-V: INVENTORY CONTROL AND MODERN MANUFACTURING METHODS **(11 Periods)**

Inventory types and functions, Inventory control techniques: EOQ, Reorder Point, Safety Stock ABC, VED, and FSN analysis, Introduction to JIT, Kanban, and Lean Manufacturing, Recent trends in PPC: Industry 4.0, AI in manufacturing, Smart factories

Total Periods: 45

TEXT BOOKS:

T1. Production Planning and Control, K.C. Jain and L.N. Agarwal, Khanna Publishers, 2020, Tenth Edition.
T2. Production and Operations Management, Chary S.N McGraw Hill Education, 2019, Fifth Edition.

REFERENCE BOOKS:

R1. Production and Operations Management, Pannerselvam R, PHI Learning Pvt. Ltd., New Delhi, 2012, Third Edition.
R2. Production Systems: Planning, Analysis and Control, James L. Riggs, Wave Land Press, 1992, Fourth Edition.
R3. Manufacturing Planning and Control for Supply Chain Management, F. Robert Jacobs, William L. Berry, D. Clay Whybark, Thomas E. Vollmann, McGraw-Hill Education, 2017, Seventh Edition.

WEB RESOURCES:

1. https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf
2. https://lecturenotes.in/subject/100/production-and-operation-management
3. https://www.studocu.com/in/document/guru-gobind-singh-indraprastha-university/production-operations-management/full-unit-1-lecture-notes-6/3528988
4. https://mrcet.com/downloads/digital_notes/ME/III%20year/POM%20NOTES.pdf

2303572M	**MINOR IN INDUSTRIAL ENGINEERING** ERGONOMICS AND HUMAN FACTORS IN ENGINEERING (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Understand how ergonomics helps in designing safe and efficient systems and workplaces.
CO2. Understand body systems, biomechanics, and anthropometry for designing ergonomic tools and workstations.
CO3. Apply ergonomic principles to design workplaces, interfaces, and environments for improved human performance.
CO4. Analyse human cognitive processes and evaluate design strategies to minimize human errors and enhance system performance.
CO5. Evaluate ergonomic interventions using tools and case studies to improve system design in diverse sectors.

SYLLABUS:

UNIT - I: INTRODUCTION TO ERGONOMICS AND HUMAN FACTORS **(09 Periods)**

Definition and scope of ergonomics, Objectives and applications of human factors engineering, Historical development and interdisciplinary nature, Types of ergonomics – physical, cognitive, organizational, Human-system interaction, Importance of ergonomics in engineering and design, Role of ergonomics in occupational health and safety.

UNIT-II: HUMAN ANATOMY, PHYSIOLOGY, AND BIOMECHANICS **(09 Periods)**

Human body systems relevant to ergonomics, Musculoskeletal system and body mechanics, Biomechanics of motion and exertion, Anthropometry – types and application in design, Posture analysis and assessment, Manual material handling – lifting, pushing, pulling, Design of tools, equipment and workstations based on biomechanical principles, Physical limitations and capabilities of human body

UNIT-III: WORKPLACE DESIGN AND ENVIRONMENTAL ERGONOMICS **(09 Periods)**

Workstation design principles, Layout of workplace for efficiency and safety, Design of seating and standing workplaces, Human-machine interface design, Visual and auditory display design, Environmental factors – lighting, noise, vibration, thermal comfort, Impact of environmental conditions on performance and safety, Ergonomic standards and guidelines for workplace design

UNIT-IV: COGNITIVE ERGONOMICS AND HUMAN ERROR (09 Periods)

Cognitive processes – perception, memory, attention, decision-making, Mental workload and information processing, Design of user-friendly displays and controls, Alarms and warnings – design principles, Human error – types, causes and classification, Error identification and reduction techniques, Cognitive task analysis, Role of automation in reducing errors.

UNIT-V: APPLICATIONS OF ERGONOMICS IN ENGINEERING (09 Periods)

Ergonomic interventions in manufacturing systems, Product and equipment design considerations, Ergonomics in transportation systems, Construction and healthcare ergonomics, Participatory ergonomics approach, Ergonomic evaluation methods – checklists, RULA, REBA, Usability testing techniques, Case studies on ergonomic improvements in industrial and service sectors.

Total Periods: 45

TEXT BOOKS:

T1. Human Factors in Engineering and Design Sanders, M.S. and McCormick, E.J., McGraw-Hill Education, 2013, Seventh Edition.
T2. Introduction to Human Factors and Ergonomics, Bridger, R.S., CRC Press, 2017, Fourth Edition.
T3. An Introduction to Human Factors Engineering, Wickens, C.D., Lee, J.D., Liu, Y., and Gordon-Becker, S.E. Pearson Education, 2004, Second Edition.

REFERENCE BOOKS:

R1. Human Factors in Systems Engineering, Chapanis, *A.* Wiley-Interscience, 1996, First Edition,
R2. Ergonomics for Beginners: A Quick Reference Guide, Dul, J. and Weerdmeester, B. CRC Press, 2008, Third Edition.
R3. Fitting the Task to the Human: A Textbook of Occupational Ergonomics, Kroemer, K.H.E. and Grandjean, E., CRC Press, 2001, Fifth Edition.
R4. Handbook of Human Factors and Ergonomics, Salvendy, G. (Ed.), Wiley, 2012, Fourth Edition.

WEB RESOURCES:

1. https://archive.nptel.ac.in/courses/107/103/107103004/
2. https://archive.nptel.ac.in/courses/110/105/110105162/
3. http://elearn.psgcas.ac.in/nptel/courses/video/110105162/110105162.html

2303573M	**MINOR IN INDUSTRIAL ENGINEERING** INDUSTRIAL ENGINEERING LAB (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Apply time and motion study techniques to analyse and improve work performance and operational efficiency.
CO2. Evaluate and design ergonomic workstations based on anthropometric data and ergonomic assessment tools.
CO3. Develop simulation models of industrial systems using tools such as Excel, ARENA, to analyse system performance and identify bottlenecks.
CO4. Apply appropriate Tools and Techniques to analyse the problems following professional ethics with focus on societal and environmental aspects.
CO5. Work as a team and communicate results in an effective way.
CO6. Make decisions as an individual or as team member to manage tasks and also engage in independent and life-long learning with ability to adapt to new and technological changes.

LIST OF EXPERIMENTS:

1. Determine the standard time for a specific operation using stopwatch timing.
2. Analyse worker motions using process charts and suggest improvements.
3. Optimize a linear objective function subject to constraints using Excel solver.
4. Simulate a queue system and analyse performance metrics using TORA.
5. Determine optimal order quantity using EOQ formula using Excel solver.
6. Balance tasks across a production line to minimize idle time.
7. Monitor and control process quality using control charts ($\bar{X}$-R, P, C charts).
8. Develop and evaluate single or double sampling plans.
9. Measure anthropometric data to design comfortable workspaces
10. Measure reaction time under varying conditions (light, sound).
11. Use discrete event simulation to model manufacturing or service systems.
12. Develop efficient facility layouts using layout planning techniques using CRAFT/ALDEP algorithms.

REFERENCE BOOKS & MANUALS

R1. Motion and Time Study, Design and Measurement of Work, Ralph M. Barnes, Wiley, 1980, Seventh Edition.

R2. Work Study and Ergonomics, S. Dalela, Sourabh, Standard Publishers Distributors, Standard Publishers Distributors, First Edition.

R3. Facilities Planning, James A. Tompkins, John A. White, Yavuz A. Bozer, J. M. A.Tan Choco, Wiley, 2010, Fourth edition.

R4. Facilities Planning and Design, S.C. Sharma, J.P. Agrawal, Kataria & Sons, 2015,Fifth Edition.

R5.Plant Layout and Material Handling, James A. Apple, Krieger Publishing Company, 1991, Third Edition.

Web Resources:

1.https://ielab.info/about-us

2303671M	**MINOR IN INDUSTRIAL ENGINEERING** MARKETING MANAGEMENT (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Gain knowledge of fundamental marketing principles including the marketing mix, segmentation, targeting, positioning, and consumer behaviour.
CO2. Formulate effective marketing strategies based on market analysis and organizational objectives.
CO3. Analyse market trends, study consumer needs, and apply this knowledge to product and service development.
CO4. Equipped to design, conduct, and interpret marketing research to support decision- making.
CO5. Evaluate the role of various media channels in advertising and measure advertisement effectiveness.

SYLLABUS:

UNIT - I: INTRODUCTION TO MARKETING (13 Periods)

Introduction to Marketing and Marketing Management, Marketing Concepts - Marketing Process Marketing mix - Marketing environment. - Consumer Markets and buying behaviour Market segmentation and targeting and positioning.

UNIT - II: PRODUCT DECISIONS AND LIFE CYCLE (10 Periods)

Product Decisions - concept of a Product - Product mix decisions - Brand Decision - New Product Development – Sources of New Product idea - Steps in Product Development - Product Life Cycle strategies- Stages in Product Life Cycle.

UNIT - III: PRICING POLICES (07 Periods)

Price Decisions - Pricing objectives - Pricing policies and constraints - Different pricing method - New product pricing, Product Mix pricing strategies and Price adjustment strategy.

UNIT - IV: NATURE OF MARKETING CHANNELS (08 Periods)

Channel Decision - Nature of Marketing Channels –. Types of Channel flows - Channel functions - Functions of Distribution Channel – Structure and Design of Marketing Channels-Channel co-operation, conflict and competition – Retailers and wholesalers.

UNIT - V: PROMOTION DECISION **(07 Periods)**

Promotion Decision - Promotion mix - Advertising Decision, Advertising objectives - Advertising and Sales Promotion – Developing Advertising Program – Role of Media in Advertising - Advertisement effectiveness - - Sales force Decision.

Total Periods: 45

TEXT BOOKS:

T1. Marketing Management Text and Cases, K.S. Chandrasekar, Tata McGraw-Hill Publication, New Delhi, 2012, Second Edition.

T2. Marketing Management Concepts, Cases, Challenges and Trends, Govindarajan, Prentice Hall of India, New Delhi, 2007 ,Second Edition.

REFERENCES BOOKS:

R1. Marketing Management- Analysis Planning and Control, Philip Kotler, Pearson Education , New Delhi, 1996, Ninth Edition.

R2. Marketing Management-Planning Implementation and Control, Ramaswamy. V S & Nama kumari**. S**, Macmillan Business Books, New Delhi, 2002, First Edition.

WEB RESOURSES:

1. https://nptel.ac.in/courses/110/104/110104070/
2. https://academy.hubspot.com/courses/marketing
3. https://www.investopedia.com/terms/m/marketing.asp
4. https://www.coursera.org/learn/wharton-marketing

2303672M	**MINOR IN INDUSTRIAL ENGINEERING** STRATEGIC MANAGEMENT FOR COMPETITIVE ADVANTAGE (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Explain the key concepts and process of strategic management and articulate a strategic vision and mission.
CO2. Apply various analytical tools and models to assess the internal and external business environment.
CO3. Formulate appropriate strategies at different organizational levels considering stability, growth, or retrenchment.
CO4. Demonstrate the ability to implement strategies effectively, aligning them with
leadership roles and organizational contexts.
CO5. Evaluate and control strategic decisions using strategic audits, benchmarking, and feedback systems in Indian and international scenarios.

SYLLABUS:

UNIT - I: INTRODUCTION CONCEPTS IN STRATEGIC MANAGEMENT (11 Periods)

Strategic Management as a process –Developing a strategic vision, Mission, Objectives, Policies – Factors that shape a company's strategy – Environmental Scanning -Concepts of Core Competence, Crafting a strategy for competitive advantage.

UNIT-II: **STRATEGIC ANALYSIS AND CHOICE: TOOLS AND TECHNIQUES** (**08 Periods**)

Porter's Five Force Model, BCG Matrix, GE Model, SWOT Analysis and TOWS Matrix, Market Life Cycle Model - and Organisational Learning, and the Experience Curve.

UNIT - III: STRATEGY FORMULATION (10 Periods)

Formulation of strategy at corporate, business and functional levels. Strategy Alternatives- Stability Strategy, Growth Strategy, Retrenchment Strategy, and Combination Strategy,

UNIT - IV: STRATEGY IMPLEMENTATION (08 Periods)

Types of Strategies: Offensive strategy, Defensive strategy, vertical integration, horizontal strategy; Tailoring strategy to fit specific industry and company situations, Strategy and Leadership, Resource Allocation as a vital part of strategy – Planning systems for implementation.

UNIT-V :STRATEGY EVALUATION AND CONTROL (08 Periods)

Establishing strategic controls - Role of the strategist - benchmarking to evaluate performance - strategic information systems – Guidelines for proper control- Strategic surveillance -strategic audit - Strategy and Corporate Evaluation and feedback in the Indian and international context

Total Periods: 45

TEXT BOOKS:

T1. Strategic Management, J.S.Chandan& Nitish sen Gupta , Vikas Publishing House, Noida, 2013, First Edition

REFERENCE BOOKS:

R1. Strategic Management Concepts and Cases, Fred R.David,PHI Learning Pvt Ltd, New Delhi,2018, Sixteenth Edition.
R2. Strategic Management, Hill, Ireand, manikutty, Cengage Learning,2009, Ninth Edition
R3. Concepts in Strategic Management and Business Policy, Wheelen & Hunger, Pearson Education,New Delhi, 2018, Fourteenth Edition,
R4. Strategic Management – Text and Cases, V.S.P. Rao, Excel Books, New Delhi, 2013, Second Edition

WEB RESOURCES:

1. https://strategicmanagementinsight.com
2. https://www.mindtools.com/pages/main/newMN_STR.htm
3. https://hbr.org/topic/strategy
4. http://www.quickmba.com/strategy
5. https://www.coursera.org/courses?query=strategic%20management

2303771M	**MINOR IN INDUSTRIAL ENGINEERING** SIX SIGMA AND LEAN MANUFACTURING (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-Requisites: Engineering Mathematics

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Summarize various techniques that are related to the six-sigma and lean manufacturing
CO2. Outline the concepts of cellular manufacturing, JIT and TPM
CO3. Illustrate the principles and implementation of 5S techniques
CO4. Discuss procedure and principles of value stream mapping
CO5. Determine the reliability function using six-sigma.

SYLLABUS:

UNIT - I: INTRODUCTION TO SIX-SIGMA (10 Periods)

Probabilistic Models-Six Sigma Measures-Yield-DPMO-Quality Level-Reliability function using Six Sigma- MTTF using Six Sigma-Maintenance free operating period- Availability using Six- Sigma Point availability-Achieved availability-Operational Availability-Examples.

UNIT- II: THE ELEMENTS OF SIX SIGMA AND THEIR DETERMINATION (10 Periods)

Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)Six sigma approach-Six sigma and the 1.5 a shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

UNIT-III: INTRODUCTION TO LEAN MANUFACTURING (08 Periods)

Conventional Manufacturing versus Lean Manufacturing — Principles of Lean Manufacturing —Basic elements of lean manufacturing — Introduction to LM Tools.

UNIT-IV: CELLULAR MANUFACTURING, JIT, TPM (09 Periods)

Cellular Manufacturing — Types of Layout, Principles of Cell layout, Implementation. JIT —Principles of JIT and Implementation of Kanban. TPM — Pillars of TPM, Principles and implementation of TPM.

UNIT-V: SET UP TIME REDUCTION, TQM, 5S, VSM 10 (08 Periods)

Set up time reduction — Definition, philosophies and reduction approaches. TQM Principles and implementation. 5S Principles and implementation - Value stream mapping procedure and principles.

Total Periods: 45

TEXT BOOKS:

T1. Reliability and Six Sigma, U Dinesh Kumar, Crocker, Chitra and Harithe Saranga, Springer Publishers, 2006, First Edition.
T2. Six Sigma for Quality and Productivity Promotion, Sung H. Park, Asian Productivity Organization, 2003, First Edition.

REFERENCE BOOKS:

R1. Six Sigma for Electronics Design and Manufacturing, Sammy G. Shina, McGraw-Hill,2002, First Edition.
R2. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003, First Edition.
R3. Automation, Production Systems and CIM, Mikell P. Groover, 2002,Third Edition.
R4. Six Sigma & Lean Manufacturing, Learning to See: Value Stream Mapping to Add Value and Eliminate Muda, Rother M. and Shook J, 1999, Lean Enterprise Institute, Brookline, MA, 1999, First Edition.

WEB RESOURCES:

1. https://nptel.ac.in/courses/110105123
2. https://nptel.ac.in/courses/110105039

2303772M	**MINOR IN INDUSTRIAL ENGINEERING** METROLOGY AND INSTRUMENTATION LAB (CE,EEE,ECE,CSE,CSE-DS,CSE-AIML,AIML)	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Pre-Requisites: Nil

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Use gear teeth, Vernier callipers for checking the tooth height of spur gear and use of tool maker's microscope and its application.

CO2. Measure angle and taper measurements by bevel protractor, sine bars and Measuring the effective diameter of screw thread by two wire / three wire method.

CO3. Calibrate measuring devices, analyse LVDT, capacitive transducers and flow measuring devices like rotameter.

CO4. Able to apply appropriate Tools and Techniques to understand and analyse the Problems following professional ethics with focus on societal and environmental aspects.

CO5. Work as a team and communicate results in an effective way.

CO6. Make decisions as an individual or as team member to manage tasks and also engage in independent and life-long learning with ability to adapt to new and technological changes.

List of Exercises/List of Experiments:

Minimum Ten experiments are to be conducted.

Metrology Lab

1. Use of gear teeth vernier callipers and checking the chordal addendum and chordal height of spur gear.
2. Alignment test on milling machine using dial indicators
3. Study of Tool makers microscope and its application
4. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
5. Thread measurement by Two wire/Three wire method.
6. Alignment test on the lathe using dial indicators
7. Use of straight edge and spirit level in finding the flatness of surface plate.

Instrumentation Lab

8. Calibration of Pressure Gauges.
9. Calibration of Rotameter for flow measurement.
10. Calibration of strain gauge for temperature measurement.
11. Study and Calibration of Photo and Magnetic speed pickups for the measurement of speed.
12. Calibration of thermocouple for temperature measurements.
13. Calibration of resistance temperature detector for temperature measurement.

REFERENCE BOOKS/LABORATORY MANUALS:

R1 Metrology and Instrumentation: Wiley.
R2 Engineering Metrology and Instrumentation: R.K. Rajput

WEB RESOURCES:

1. https://www.youtube.com/watch?v=A3KRgldudos