### Scheme of Teaching & Examination

**M.E. Mechanical Engg. (Production Engineering)**

**II Semester**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Board of Study</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Periods per Week</th>
<th>Scheme of Examination</th>
<th>Total Marks</th>
<th>Credit</th>
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<tbody>
<tr>
<td></td>
<td>Mech. Engg.</td>
<td>542211 (37)</td>
<td>Machine Tools Engineering</td>
<td>3 1 -</td>
<td>L+T+P/2</td>
<td>140</td>
<td>4</td>
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<td></td>
<td>Mech. Engg</td>
<td>542212 (37)</td>
<td>Robotics</td>
<td>3 1 -</td>
<td>L+T+P/2</td>
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<td>4</td>
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<tr>
<td></td>
<td>Mech. Engg</td>
<td>542213 (37)</td>
<td>Quality Control &amp; Reliability Engineering</td>
<td>3 1 -</td>
<td>L+T+P/2</td>
<td>140</td>
<td>4</td>
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<tr>
<td></td>
<td>Mech. Engg</td>
<td>542214 (37)</td>
<td>Measurement system Analysis</td>
<td>3 1 -</td>
<td>L+T+P/2</td>
<td>140</td>
<td>4</td>
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<td>Refer Table –I</td>
<td></td>
<td>Elective-II</td>
<td>3 1 -</td>
<td>L+T+P/2</td>
<td>140</td>
<td>4</td>
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<tr>
<td></td>
<td>Mech. Engg</td>
<td>542221 (37)</td>
<td>Machine Tools Engineering Lab</td>
<td>- - 3</td>
<td>75</td>
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<td>Mech. Engg</td>
<td>542222 (37)</td>
<td>Robotics Lab</td>
<td>- - 3</td>
<td>75</td>
<td>150</td>
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</table>

- L- Lecture
- T- Tutorial
- P- Practical ,
- ESE- End Semester Exam
- CT- Class Test
- TA- Teacher's Assessment

### Table-I

**ELECTIVE I**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Board of Study</th>
<th>Subject Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mech. Engg.</td>
<td>542231 (37)</td>
<td>Mechatronics</td>
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<tr>
<td>2</td>
<td>Mech. Engg</td>
<td>542232 (37)</td>
<td>Productivity Management</td>
</tr>
<tr>
<td>3</td>
<td>Mech. Engg</td>
<td>542233 (37)</td>
<td>Advances in Material Processing</td>
</tr>
<tr>
<td>4</td>
<td>Mech. Engg</td>
<td>542234 (37)</td>
<td>Management of Organizational Behaviour</td>
</tr>
</tbody>
</table>

**Note (1)** - 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a particular academic session.

**Note (2)** - Choice of elective course once made for an examination cannot be changed in future examinations.
UNIT – I
Cutting Tool Design
Design of Single Point Tool, Tool angle specification systems and their interrelationship, Design of form Tool, Design of indexable insert and it specification system, Design of Chip Braker.
Design of Twist drill, milling cutter, broach, reamer and taps.
Cutting Tool Material
Characteristics of tool material, advances in cutting tool material, role of coating.

UNIT – II
Mechanics of Machining Processes
Chip formation, Orthogonal cutting, Oblique cutting, mechanics of turning, milling and drilling process, machinery with controlled contact tools.

Machinability and Economics of Machining
Machinability, evaluation of Machinability, mechanism of tool failure, tool wear mechanism, tool life and tool life equation, factors affecting Machinability surface finish and surface integrity.
Economics of machining, cost of turning operation, optimum cutting speed for minimum cost and maximum rate of production.

UNIT – III
Design of Machine Tool Structure
Function and requirement, design criteria, material, static and dynamic stiffness, profile of machine tool structure, design procedure.
Design of – Beds, columns, housing, bases and tables, cross rails, arms, saddles, carriage and Rams.
Model Technique in design of Machine Tool structure.

Design of Guide ways
Function, Design criterion and calculations for slideways, guide way operating under liquid friction condition.

UNIT – IV
Design of spindle and spindle supports
Function of spindle unit and requirement, material, effect of machine tool compliance on machining accuracy, Design calculations of spindles, antifriction bearing and sliding bearing.

Kinematics of Machine Tool
Aim of speed and feed rate regulation, stepped regulation of speed, classification of speed and feed boxes, design of speed box & feed box, stepless regulation of speed and feed rates.

UNIT – V
Jig & Fixtures

TEXT BOOKS
1. Tool Design – Cyril Donaldson, George H. Lecain, VC Goold – TMH, New Delhi
3. Jig & Fixture – P.H. Joshi – TMH, New Delhi

REFERENCE BOOKS
5. Production Engineering & Science – Dr. P.C. Pandey, Dr. C.K. Singh – Standard Publishers, Delhi
Semester: M. E. II Branch: Mechanical Engineering
Subject: Robotics Code: 542212 (37)
Total Theory Periods: 40 Total Tutorial Periods: 12
Total Marks in End Semester Exam.: 100
Minimum number of class test to be conducted: 02

UNIT – I
Robotics
Concepts in Robotics - Advances and applications of robotics in Robots, Resolution, Accuracy and Repeatability, Point, Continuous part system control loops, types of manipulators, wrist & Grippers.

UNIT – II
Kinematics Analysis of Robotics
Geometry based direct kinematics, Co-ordinate and vector transformation using matrix, Denant – Hartenberg Convention, application of DH notation, Inverse Kinematics.

UNIT – III
Dynamics

UNIT – IV
Control & Trajectory Planning
Drives, Control of Trajectory: Hydraulic system stepper motor, Direct current servomotors, A-C servomotors, adaptive control, interpolators, trajectory planning, resolved motion rate control method.

UNIT – V
Robotic Sensors
Vision system, Range, proximity, touch, force and torque sensors, Assembly-Aid devices, Robot programming, Artificial intelligence.
Applications of Robot
Handling, loading, unloading, welding, painting, assembly, Machining, Manufacturing, Work-cell, Installation of Robots.

TEXT BOOKS

REFERENCE BOOKS
2. Shimon Y. Nof (Editor), hand book of industrial robotics, John Wiley and Sons
4. Anthony C, Mc Donald, Robot Technology, theory, design and applications, Prentice Hall, New Jersey
5. Yoren Koren, Robotes for Engineers.
6. K.S. Fu, R.C. Gonzaler C.S.G. Lee, Robothes (Control, sensing vision & intelligence)
UNIT – I
Introduction to Quality Control and Total Quality System

UNIT – II
Fundamentals of Statistical concepts and Techniques in Quality Control and Improvement
Descriptive statistics describing product or process characteristics – Data collection, measurement scales, measure of central tendencies, measure of dispersion, measure of skewness and Kurtosis. Probability distribution – discrete distributions (Hyper geometric, Binomial, Poisson), continuous distributions (Normal, exponential, Weibull). Approximate to some probability distribution. Inferential statistics drawing conclusion on product and process quality – sampling distribution, Hypothesis testing, Analysis of Variance. Graphical methods of data presentation and quality improvement – Frequency distributions and histogram, Run chart, Pareto diagram, Cause - Effect diagram, Box plot etc.
Tolerances of Assemblies and component – Tolerance limits on interacting components, tolerance limits on matting parts.

UNIT – III
Statistical Process Control using control charts

UNIT – IV
Acceptance Sampling
Sampling plans for attributes - Advantages and Disadvantages of sampling, evaluation of sampling plans, various sampling plans. Sampling plan for variables- Advantages, disadvantages, variable sampling plans.

UNIT – V
Reliability Engineering
Reliability, life cycle curve, probability distribution in modelling reliability, system reliability, Redundancy, Reliability allocation, Reliability and life testing plans. Experimental design, Taguchi method, quality control in service sector.

TEXT BOOKS:

REFERENCE BOOKS
3. Managing for total quality from Deming to Tagachi and SPC – N. Lugotheis Prentice – Hall of India.
Semester: M. E. II Branch: Mechanical Engineering
Subject: Measurement System Analysis Code: 542214 (37)
Total Theory Periods: 40 Total Tutorial Periods: 12
Total Marks in End Semester Exam.: 100
Minimum number of class test to be conducted: 02

UNIT – I
Analysis of Measurement System
Classification of measurement, analysis of experimental data, types of measurement errors, uncertainty, uncertainty analysis, proposition of uncertainty, curve fitting.

UNIT – II
Static Characteristics
Static Performance Characteristics, linearity, static sensitivity, repeatability, hysteresis effect, resolution, readability, span, Thevinin Theorem, Theory of validation, multiple regression analysis, measurement with linear equality and inequality.

UNIT – III
Dynamic Characteristic
Zero order Instrument, first order instrument, ramp response, frequency response equation, second order Instrument with over damping, critical damping and under damping.

UNIT - IV
Data Analysis
Data acquisition and processing, types and configuration of DAS signal conditions, analog to digital conversion, digital to analog conversion, mechanical transmission, electric transmission, pneumatic transmission system.

UNIT – V
Theory of Calibration

TEXT BOOKS
2. Experimental Methods for Engineering – Holman. J.P. – TMH, Delhi

REFERENCE BOOKS
1. Mechanical Measurement – Backwith, Buck and Narangani – Narosa Publications, Delhi
2. Engineering Experimentation – Doeblin
UNIT – I
Introduction

UNIT– II
Sensors and Transducers
Performance Technology, Displacement, Position and Proximity, Velocity and Motion, Fluid Pressure, Temperature Sensors, Light Sensors, Selection of Sensors, Signal processing, Servo systems.

UNIT – III
Microprocessors in Mechatronics

UNIT– IV
Programmable Logic Controllers
Basic structure, Input/Output processing, Programming, Mnemonics Timers, Internal relays and counters, Data handling, Analog input / output – Selection of PLC.

UNIT – V
Design and Mechatronics
Designing – Possible design solutions – Case studies of Mechatronic systems.

TEXT BOOKS

REFERENCE BOOKS
UNIT – I
Productivity
Output, different inputs and productivity measures, partial and indirect measures, multi-factor productivity, efficiency and effectiveness, quantity orientation, productivity and quality, measures to increase productivity.

UNIT – II
Modern Tools and Techniques for Productivity Improvement

UNIT – III
Operation Strategy
Operations Decision, priorities, components of production strategy, framework for manufacturing, types, developing and implementing, focussed operations, strategic management process, interfaces between operations and marketing function, Porter's five forces Models, Meaningful differentiation, flexibility, comparison, Traditional Vs New approach, cost leadership, operation strategies.

UNIT – IV
Performance Measurement
Principles, Indicators, key success factors, performance measurement system issues, Design and Implementation of performance measurement system.

UNIT – V
Technology Management
Technical issues and Implications, Technology Development and Acquisition, Technology Absorption and Diffusion, Technology Environment, Technology Support System.

TEXT BOOKS
1. Production & Operation Management – S.N. Chary – TMH, Delhi
2. Productivity Engineering & Management – Sumanth David J. – TMH, Delhi

REFERENCE BOOKS
2. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Co., Delhi
UNIT – I
Introduction to Advance Material
Composites, Ceramic, Polymer, Super alloy, Refractory metal and alloy, Low melting alloy, precious metal, shape memory alloy, amorphous alloy.

UNIT – II
Solidification Principle
Heat transfer in solidification, Nucleation and growth, Plane front solidification of alloy, Lateral segregation, cellular and dendritic growth, segregation, solidification process and cast structure, single crystal growth, grain refinement and eutectic modification.

UNIT – III
New Solidification Process
Rapid solidification process: conduction process and convection process, chill block melt spinning process, free flight melt spinning process, free jet melt spinning process, planer flow casting process, crucible melt extraction process, spray deposition process, plasm spray deposition process, ultrasonic gas atomization process.
Solidification of metal matrix Composite
Infiltration Casting process, dispersion process, spray casting process, reactive processing, Squeeze casting, semi mold metal forming process, Cosworth process, Improved low pressure casting process (LIP), Directional solidification processing.

UNIT – IV
Powder Metallurgy
Recent Advances in Powder Metallurgy: Hot Isostatic pressing, spark discharge sintering, gravity sintering, Induction sintering, sinter HIP process, ceracon process, Ospney process, Metal Inspection molding, Designing the powder Metallurgy parts for production.

UNIT – V
Special Processing Methods
Hot machining, Unit head, Plasting tooling, Electroforming, surface cleaning and surface treatment, surface coating, surface coating for tooling.
Modern techniques for Material Studies
Optical Microscope, Electron Microscope, Chemical Analysis using atomic absorption, spectrooscope, photoelectron spectrooscope, magnetic resonance.

TEXT BOOKS

REFERENCE BOOKS
1. Modern Ceramic Engineering – D. W. Richardson – Mareel Dekker Inc.
UNIT– I

Fundamentals of Organizational behavior
Dynamics of people & Organization – Goals, forces, characteristics of O.B. field, nature of people, nature of organization, supportive approach, contingency approach, system approach, causes of human behaviour.
Models of Organizational Behavior - Elements of the system – Autocratic model, custodian model, supportive model, collegial model.
Managing Communication – Importance of communication, process, problems, barriers & solutions to overcome barriers, types of communications.
Social System & Organization culture – Social equilibrium, effects of change, cultural diversity, role perception – conflict, ambiguity, characteristics of culture, measuring organization culture.

UNIT– II

Motivation & Reward System
Sources of motivation, Theories of motivation, Maslow’s, Megregor’s X & Y Theory, McClelland’s theory, Herzebeegs Theory, Models – Expectancy model, comparison model, Money as means of rewarding, performance appraisal, 360° feedback program, Economic incentive systems.

UNIT– III

Leadership & Empowerment
Nature of leadership, behavioral approaches to leadership styles, personality, perception, dimensions of personality, learning & behavior reinforcement, empowerment, participative process, impact on managerial power & prerequisites.

UNIT– IV

Individual & Group behaviour & Conflict Management
Individual & interpersonal behaviour, nature of employee attitude, effects of attitude, Job satisfaction, reasons for group formation, types of group, factors contributing to group conveniences, Differentiation of groups, conflicts – nature, types of situation, causes, negotiation, levels of conflict, team building – concept, ingredients of effective team, the process skills useful in T. Build.

UNIT – V

Emerging aspects of organizational behavior
Organizational behavior across culture, managing interpersonal behavior, barriers to cultural adoption, overcoming barriers, cultural contingencies.

TEXT BOOKS
1. Organizational Behaviour – Human Behavior at work – John W. Newstrom and K. Davis. – TMH, Delhi
2. Organizational Behaviour – Concept Controversies and Applications – S. P. Robbins – Prentice Hall of India

REFERENCE BOOKS
List of Experiments

1) Design and Specification of Single point cutting Tool
2) Design and specification of indexable inserts and tool holders
3) Design of Chip breakers and tool shank
4) Practical application of turning operation
5) Form Tools
6) Design of Twist Drill and Practical application of drilling
7) Design of Milling cutter and practical application of milling
8) Practical application of grinders
9) Design for Limits, Fits and Tolerances
10) Design of Gear Hob
Chhattisgarh Swami Vivekanand Technical University, Bhilai (CG)

Semester: M. E. II
Subject: Robotics -Lab
Total Practical Periods: 40
Total Marks in End Semester Exam.: 75

List of Experiments (In Basic Stamp V2 Software)
1) Write a program for the forward movement of the hex crawler.
2) Write a program for the backward movement of the hex crawler.
3) Write a program for right rotation of the hex crawler.
4) Write a program for left rotation of the hex crawler.
5) Write a program for sensing an obstacle by the hex crawler.
6) Write a program for pick and place of an object.
7) Write a program for the tuning of the legs of hex crawler.
8) Write a program for setting the home position of the hex crawler.