Chhattisgarh Swami Vivekanand Technical University, Bhilai
PROPOSED SCHEME OF TEACHING AND EXAMINATION
B.E. VII SEMESTER MECHATRONICS ENGINEERING

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			TOTAL MARKS	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mechatronics	367731(67)	Autotronics	3	1	-	80	20	20	120	4
2.	Mechatronics	367732(67)	Automated Manufacturing I	4	1	-	80	20	20	120	5
3.	Mechatronics	367733(67)	Robotics and Machine Vision	4	1	-	80	20	20	120	5
4.	Mechatronics	367734(67)	Industrial Engineering	4	1	-	80	20	20	120	5
5.	Refer Table 2		Professional Elective 2	4	1	-	80	20	20	120	5
6.	Mechatronics	367761(67)	Robotics and Machine Vision Lab	-	-	3	40	-	20	60	2
7.	Mechatronics	367762(67)	Computer Numerical Control Lab	-	-	3	40	-	20	60	2
8.	Mechatronics	367763(67)	Autotronics Lab	-	-	3	40	-	20	60	2
9.	Mechatronics	367764(67)	Minor Project	-	-	3	100	-	40	140	2
10.	Management	367765(67)	Innovative and Entrepreneurial Skills	-	-	2	-	-	40	60	1
11.	Mechatronics	367766(67)	**Practical Training Evaluation/Library	-	-	1	-	-	40	60	1
			Total	19	5	15	620	100	280	1000	34

L – Lecture, T – Tutorial, CT- Class Test,
P – Practical, ESE- End Semester Exam, TA – Teacher's Assessment
**To be completed after VI Sem. and before the commencement of VII Sem.
Note (1): Duration of all theory papers will be of **Three Hours.**

Table – II
Professional Elective- II

S.No.	Board of Studies	Code	Name of Subject
1	Mech. Engg.	367741(37)	Reliability Engineering
2	Mechatronics	367742(67)	Operation Research & its Applications
3	Mech. Engg.	367743(37)	Maintenance Engineering
4	Mech. Engg.	337744(37)	Product Design and Development
5	Mechatronics	367745(67)	Electronic Instrumentation and Automation
6	Mechatronics	367746(67)	Artificial Intelligence and Expert Systems
7	Mechanical	337747(37)	Cyber Security/Information Security
8	Mech. Engg.	337748(37)	Quality Control & Total Quality Management

Note : 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 : Choice of elective course once made for an examination cannot be changed for future

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Autotronics**	Code:	**367731(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course Objectives:

- To understand the concepts of different parts of an automobile
- To receive knowledge of working of an automobile
- To gain knowledge about the electronic components in the automobile

UNIT-I

Chassis & Frame - Layout of chassis & its main components, types of frames, conventional frames & unitized chassis.
Suspension system & Springs -Principles of suspension, system, types, rigid axle suspension & Independent suspension for front & rear ends, simple & double arm parallel & perpendicular type of suspension system. Gas filled suspension system.
Springs - Purpose, types viz. leaf, coiled, rubber, air, suspension system, torsion bar, stabilizer, telescopic damper.

UNIT – II

Clutches
Characteristics, functions, principles of operation of clutch, friction clutch, single plate, multi plate, centrifugal clutch, positive clutch, friction plate, clutch lining materials. Torque transmitted and related problems.
Fluid flywheel -Construction, principles of working & characteristics.

UNIT – III

Gear Box: Object of Gear Box, Air, rolling & gradient resistance, tractive effort variation with speed, performance curve.
Types of Gear Boxes: - Sliding mesh, constant mesh, synchromesh device, Electronic automatic gear box, Sequential gear box, automatic transmission, overdrive, lubrication of gear box.
Torque converter: Principles of working, characteristics, Torque converter with direct drive.
Universal Joint-: Types, propeller shaft, slip joint.
Differential – Functions, single & double reduction differential, limited slip differential.
Front Axle: Live & dead axle, stub axle. Back Axle: Hotch kiss drive, torque tube drive.

UNIT – IV

Tyres: Types , specification
Brakes & Braking system: Purpose, principles, layout of braking system. Classification, mechanical, hydraulic, master cylinder, Tandem master cylinder ,wheel cylinder, self energizing & self adjusting brakes, disc brakes, antiskid brakes, power operated brakes
Steering system: - Gear & links, types of steering gears, reversibility of steering, center point steering, steering geometry viz. castor, camber, king pin inclination toe in, toe out, cornering power, under-over steer; power steering, effect of shimmy, condition of true rolling, calculation of turning radius. Correct steering equation and related problems.
Battery

UNIT – V

Electronics in automobiles ,Engine management system , Control system components , Sensors – Sensors types , Electronic Control unit – Actuators – Control system – Electronically controlled carburetor – Gasoline injection system – Solid state ignition , Electronic ignition system – Digital ignition – Combined ignition and injection system, Electronic diesel control – pilot injection – Unit injector – Common rail fuel injection system – Electronic stability program – Electronic wheel and two way protection ,Air conditioning – Electronic heater control – Central locking system – Power windows – power sun roof – Navigation system– Safety systems – Seat belts – Air bags

TEXT BOOKS

1. Automobile Engineering – Kripal Singh – Standard Publications
2. Automobile Engineering – K.K.Ramalingam- Scitech Publications(India) Pvt. Ltd.

REFERENCE BOOKS

1. Automobile Engineering - Dr. N. K. Giri – Khanna Publishers
2. Automobile Engineering – K. R. Govindan – Anuradha Agencies
3. Automotive Mechanics – Heitner
4. Motor Vehicle – Newton & Steeds – Life & Sons Limited.

Course Outcomes:-

- The students will get the knowledge of different parts of the automobile
- The students will know about chassis & frame ,clutches ,gear box, tyres, brakes and the steering system
- The students will know about the electronic components in automobiles
- The students will be able to understand the functioning together of mechanical and electronic systems

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Automated Manufacturing I**	Code:	**367732(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To understand the concepts of automation
- To receive knowledge of motion control and machine elements
- To gain knowledge about part programming
- To get knowledge about rapid prototyping

UNIT I

INTRODUCTION:

Automation and types, Brief history of NC, CNC and DNC machines, Explanation of execution system, Basic configuration of machine, Capabilities and Limitations, Intelligent Manufacturing, Recent Trends.

UNIT II

MOTION CONTROL AND MACHINE ELEMENTS:

Ball screws, Linear Motion Guide ways, Hardened and ground guide ways, Turcite – B coating, Spindle Bearings, Air Bearings, Hydrostatic and Hydrodynamic Bearings, Tool Clamping systems, Servo motors and their applications, Feedback systems, Tachos, Encoders, Linear Glass Scales.

UNIT III

ACCESSORIES AND OTHER ESSENTIAL PERIPHERALS:

Automatic Tool Changer (ATC), Automatic Pallet Changer (APC), Coolant system, chip conveyor system, Auto part loading devices, In process measuring systems, Touch probes and non contact type measurements.

UNIT IV

BASIC PART PROGRAMMING:

Axes identification , movements and interpolation with other axis, Application of rotary axis, Manual programming – offline, Programming formats, Fundamentals of manual part programming , types of format, word address format manual part Programming for drilling , lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines., Tool offsets , Type of compensations and cutting parameters.

UNIT V

RAPID PROTOTYPING:

Product development cycle & importance of prototyping. Types of prototypes, principles and advantages and different types of generative manufacturing processes, viz. stereolithography, Fused Deposition Modeling,, Selective Laser Sintering.

Text Books:

1. Automation Production systems and Computer Integrated Manufacturing, 2nd Edition Groover M.P. Prentice Hall of India
2. CNC Fundamentals and Programming P. M. Agrawal &V. J. Patel Charotar Publishing House Pvt. Ltd.

Reference Books:

1. Numerical Control & Computer Aided Manufacturing Kundra T.K. Rao P.N. Tewari N.K. Tata McGraw Hill
2. Mechatronics HMT Tata McGraw Hill

Course Outcomes:-

- The Students will get the knowledge of NC,CNC and DNC machines
- The students will know about motion control tool ,mechanisms and machine elements
- The students will be able to understand basic part programming
- The students will be able to understand rapid prototyping

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Robotics and Machine Vision**	Code:	**367733(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To understand the concepts of robotics
- To receive knowledge about robotic sensors and visions
- To gain knowledge about robotic application

UNIT – I

Introduction to Robotics

Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.

UNIT – II

Coordinate Frames, Mapping and Transforms

Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices

UNIT – III

Symbolic Modeling of Robots – Direct Kinematic Model

Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transormation Matrix.
Introduction to Inverse Kinematic model

UNIT – IV

Robotic Sensors and Vision

The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision,Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Description of Other components of Vision System, Image Representation, Image Processing.

UNIT – V

Robot Applications

Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications, Robotic application for sustainable Development.

TEXT BOOKS

1. Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications
2. Robotics for Engineers - Yoram Korean- McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications - M.P.Groover, M.Weiss, R.N.Nagel,N.G.Odrey

REFERENCE BOOKS

1. Robotics Control Sensing, Vision and Intelligence - K.S.Fu, R.C.Gonzalex, C.S.G.Lee- McGrew Hill Book co.
2. Kinematics and Synthesis of Linkages - Hartenberg and Denavit - McGrew Hill Book Co
3. Kinematics and Linkage Design - A.S. Hall - Prentice Hall
4. Kinematics and Dynamics of Machinery - J.Hirchhorn - McGrew HillBook Company

Course Outcomes:-

- The Students will be able to understand the basics of robotics
- The students will know about the symbolic modeling of robots
- The students will be able to know about the robotic sensors and vision
- The students will know the applications of robots

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Industrial Engineering**	Code:	**367734(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To understand about the history and development of Industrial Engineering
- To receive knowledge of tools of Industrial Engineering
- To gain knowledge about Work Study
- To get knowledge about Business Process Re-Engineering and Value Engineering

UNIT – I

Introduction

History & development, system approach, relationship with other departments. Objective of Industrial Engineering, Place of Industrial engineering in an organization, related discipline, management, OR, statistics, ergonomics, manufacturing engineering.

Plant Location

Need for a suitable location, urban, suburban, systems approach, factors affecting location, quantitative method for evaluation of plant location.

Plant Layout

Objective & Principles, factors affecting layout, types of layout.

UNIT – II

Work Study

Purpose, objectives and applications of work study, Productivity and work study.

Method Study

Introduction, procedure, charts, man-machine, flow process charts, motion economy principles, micro motion study - Therbligs, cyclegraph.

Work Measurement

Definition, types, selection & timing the job, rating, allowances, Normal and standard time determination, work sampling

UNIT -III

Job Evaluation & Merit Rating

Definition, objectives, methods, job rotation, job enlargement, job enrichment.

Wages & Incentives

Terminology, characteristics, factors, types of incentives, wage incentive plan, Rowan plan, Taylor's differential piece rate system, Emerson's efficiency plan, Halsey's 50-50 plan, Bedaux plan, Group task & Bonus system.

UNIT – IV

Information systems in organizations

Role id IS in Industry, increasing value of Information Technology, Internet worked enterprise, Internet, Intranet and Extranet, Globalization and IT, competitive advantage with IT.

Business Process Re-Engineering

Definition, need & characteristics, Industrial Engineering & Re-engineering, advantages of re-engineering.

UNIT V

Maintenance Management

Objectives and need for maintenance, types of maintenance, breakdown, predictive and preventive maintenance

Equipment replacement policy

Reasons for replacement, deterioration, obsolescence, depreciation, method for depreciation calculation

Value Engineering & Value Analysis

Objectives & scope, application & techniques.

TEXT BOOKS

1. Industrial Engineering & Management – O.P. Khanna – Dhanpat Rai & Sons
2. Operations Management- By William J. Stevenson- TMH, 10th edition
3. Industrial Engineering and Production Management – Martand Telsang – S. Chand & Company
4. Introduction of work study, ILO, Geneva. Universal Publishing Corporation, Bombay

REFERENCE BOOKS

1. Industrial Engineering & Management –A New Perspective, Philip E Hicks, McGraw Hill
2. Motion & Time Study – Mundel – PHI

3. Motion and Time Study – Ralph M. Bannes – John Wiley & Sons
4. Handbook of Industrial Engineering – Grant & Grant – PHI
5. Techniques of Value Engineering – L.D. Miles – Mc GrawHill
6. Work Study and Ergonomics – H.S. Shan – Dhanpat Rai & Sons
7. Industrial Engineering & Management – S. Dalela & Mansoor Ali – Standard Publishers & Distributors

Course Outcomes:-

- The Students will be able to understand the significance of Industrial Engineering
- The students will know about the different types of plant layouts
- The students will know about method study and time study
- The students will know about Business Process Re-engineering, Equipment replacement policy and Value Engineering

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program: **Bachelor of Engineering**
Branch: **Mechatronics Engineering** Semester: **VII**
Subject: **Quality Control and Total Quality Management** Code: **337748(37)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
Class Tests : **Two(Minimum)** Assignments : **Two (Minimum)**
ESE Duration : **Three Hours** Maximum Marks: **80** Minimum Marks: **28**

Course Objectives

- Define and understand various terms associated with quality control
- Enhance the students understanding of the complexity of statistical analysis and interpretation.
- Provide an introduction to the fundamental concept of SPC, total quality management, six sigma, quality function deployment and applications of these concepts.
- Understanding the philosophies of TQM in order to better evaluate the TQM implementation proposals.
- Assess exactly where an organization stands on quality management with respect to ISO 9000 quality management.

UNIT-I

Basic Concept of Quality

Quality and quality control, concept of quality, quality characteristics, Quality of design and quality of conformance ,History of quality control, Quality policy and objectives, Economics of quality.

Statistical Concept of Variation

Concept of variation frequency distribution, continuous and discrete, probability distributions viz. Normal, Exponential and Weibull distribution, pattern of variation, significance tests, Analysis of variance, statistical aids in limits and tolerances.

UNIT-II

Quality Assurance

Concept, advantages, field complaints, quality rating, quality audit, inspection planning, quality mindness, quality budget, vendor quality rating (VQR), vendor rating (VR), manufacturing planning for quality, Quality function deployment (QFD).

Statistical Quality Control

Objectives, Growth and applications of S.Q.C., S.O.C, Techniques in manufacturing planning. Process capability analysis, Control charts for variables and attributes and their analysis, process capability, concept of six sigma.

UNIT III

ACCEPTANCE SAMPLING

Fundamental concept in acceptance sampling, operating characteristics curve. Acceptance plans, single, double and introduction of multiple plans.

UNIT -I V

Total Quality Management

Total Quality Control (TQC), Concept of Total Quality Management (TQM), TQM philosophies, Deming approach to TQM, Juran ten steps to Quality Management, Taguchi Philosophy, Crosby fourteen steps, TQM models, Tools and techniques of TQM,

UNIT V

Quality system

Quality system, need for quality system, ISO 9000 Quality Management Standards, ISO 9000:2000 requirement, Quality Auditing, ISO 14000, Benefits of ISO 14000.

TEXT BOOKS

1. Quality Planning and Analysis - Juran & Gryana – McGraw Hill, New York
2. Statistical Quality Control – R.C. Gupta – Khanna Publishers, Delhi

REFERENCE BOOKS

1. Statistical quality control – Grant and Leavenworth – McGraw Hill, New York
2. Engineering Statistics and Quality Control – I. W. Burr- McGraw Hill, New York
3. Managing for Total Quality - Logothetis – PHI Delhi
4. Statistical Quality Control – M. Mahajan – Dhanpat Rai – New Delhi
5. Total Quality Management – Suganthi & Samuel - PHI, Delhi
6. Total Quality Management - Charantimath, Poornima – Pearson, Delhi
7. Total Quality Management – K.C. Arora - S.K. Kataria- New Delhi

Course Outcomes

- Explain the importance of quality & role of statistical quality control
- Apply methods and techniques of statistical quality control, to studies and interpret the results in business.
- Demonstrate motivation and responsibility to advocate for quality in business
- Develop an understanding on quality management philosophies and frameworks
- Develop in-depth knowledge on various tools and techniques of quality management

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Reliability Engineering**	Code:	**367741(37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To understand the concepts of probability theory
- To know about system reliability
- To gain knowledge about probabilistic design methodology
- To get knowledge about reliability testing and data analysis

UNIT - I
Basic concepts in probability theory:
Probability of events and random variables; discrete distributions: Poisson and Binomial, continuous distributions: Exponential, Weibull, Normal and Lognormal distributions

UNIT - II
System reliability:
Series, parallel, standby redundant and 'out-of' systems; static and dynamic reliability models

UNIT - III
Probabilistic models:
Load (stress) and capacity (strength) variables, load-capacity analysis (Stress-Strength Interference Theory)
Probabilistic design methodology:
Interference theory, calculation of reliability of with stress and strength having exponential, normal, lognormal, Gamma and Weibull distributions

UNIT - IV
Reliability and rates of failure:
Reliability characterization and failure rates, bath tub curves, constant failure rate models, conditional probability of survival of a device, increasing failures rate models

UNIT- V
Reliability testing and data analysis:
Non-parametric methods; grouped and ungrouped data, ungrouped and grouped censored data
Reliability data analysis; parametric methods, parameters estimation using linear regression of transformed data, accelerated life testing

TEXT BOOKS
1. Introduction to Reliability Engineering, 2nd Edition - Elmer E. Lewis - John Wiley & Sons, Inc.
2. Mechanical Engineering Design, 5th Edition- J. E. Shigley and C. R. Mischke - McGraw-Hill

REFERENCE BOOKS
1. Optimisation for Engineering Design - Kalyanmoi Deb- Prentice Hall India
2. Optimisation Concepts and Applications in Engineering - Ashok Belegundu, T Chandrupatla –Pearson Education
3. Optimisation Theory and Applications – S.S. Rao - Wiley Eastern Ltd
4. Reliability in Design - Kapoor K.C.

Course Outcomes:-

- The Students will be able to understand the significance of Reliability Engineering
- The students will know about the static and dynamic reliability models
- The students will know about Probabilistic design methodology
- The students will know about Reliability testing and data analysis

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program: **Bachelor of Engineering**
Branch: **Mechatronics Engineering** Semester: **VII**
Subject: **Operations Research and Its Applications** Code: **367742(67)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
Class Tests : **Two(Minimum)** Assignments : **Two (Minimum)**
ESE Duration : **Three Hours** Maximum Marks: **80** Minimum Marks: **28**

Course objectives:

- To understand the concepts of General Linear Programming
- To receive knowledge of transportation models and assignment model
- To gain knowledge about waiting line theory and network analysis
- To get knowledge about game theory and simulation

UNIT I

Introduction

Various stages of O.R., Fields of application, optimization and its classification.

General Linear Programming Problems- Introduction, maximization and minimization of function with or without constraints, formulation of a linear programming problem, graphical method and simplex method, Big M method degeneracy, application of L.P.P. in Mechanical Engineering.

UNIT – II

The Transportation Problems

Mathematical formulation computational procedures, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of Degeneracy.

The Assignment Problems

Mathematical formulation of assignment problems, solution of assignment problems, traveling salesman problems, Air crew Assignment problems.

UNIT - III

Waiting Line Theory

Basic queuing process, basic structure of queuing models, some commonly known queuing situations Kendall's service time, solution to M/M/1: ∞ /FCFS models.

Network Analysis

CPM/PERT, Network Representation, Techniques for drawing network. Resource smoothing and leveling, project cost, Optimum project duration, project crashing, updating, Time estimation in PERT.

UNIT – IV

Game Theory

Introduction, two person zero sum game, methods for solving two person zero sum game: when saddle point exists, when no saddle point exists, solution of 2xn and mx2 game.

Simulation

Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

Note: Four questions to be set, one from each unit.

TEXT BOOKS

1. Operation Research– Hira & Gupta – S. Chand & Co
2. Operation Research – N. D. Vohra – TMH
3. Operation Research , Sasien Yaspan

REFERENCES

1. Operation Research – H. Gillette – TMH, New Delhi
2. Operations Research – M. Taha – TMH, New Delhi
3. Fundamentals of Operation Research – Ackof Sasieni – Dhanpat Rai & Sons
4. Quantitative Approach to Management – Lovin and Krit Patrick – TMH
5. Operation Research– S.D. Sharma – S. Chand & Com. New Delhi

Course Outcomes:-

- The Students will be able to solve the General Linear Programming problems
- The students will be able to formulate and solve transportation problems and assignment problems
- The students will be able to understand and solve problems on Waiting Line Theory, Network Analysis, Simulation, Game Theory

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of the Program: **Bachelor of Engineering**
Branch: **Mechatronics Engineering** Semester: **VII**
Subject: **Product Design and Development** Code: **337744(37)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
Class Tests : **Two(Minimum)** Assignments : **Two (Minimum)**
ESE Duration : **Three Hours** Maximum Marks: **80** Minimum Marks: **28**

COURSE OBJECTIVES

- To introduce design concepts and techniques to develop design ability in a product design.
- To provide knowledge about estimating and evaluating the feasible manufacturing design.
- To make aware of legal issue pertaining to product design.
- To provide knowledge of management of product development projects

UNIT-I

Product Development Process

Background for design, design theory, design materials, human factors in design applied ergonomics, product development processes and organization, identifying customer needs, establishing product specifications, concept generation and selecting product architecture.

UNIT-II

Product Design Methods

Generating concepts, selection of a concept, Testing of concept, product architecture, Creative and rational clarifying objectives- the objective trees methods, establishing functions – the function analysis methods, setting requirement-requirements specification methods determining characteristics – the QFD method, generating alternatives-the morphological chart method, evaluating alternatives-the weighted objectives methods, improving details-the value engineering method and design strategies.

UNIT –III

Design for Manufacture

Estimating manufacturing costs, reducing component, assembly and support cost design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping – principle and planning.

UNIT –IV

Industrial Design

Its need - Ergonomic needs, Aesthetic needs, impact, accessing the quality, steps involved in Industrial design process, Management of Technology & user driven products.

UNIT – V

Patents, Product Development & Project Management

Legal issues in product design, trademarks, trade-secret, copy rights, patents – types, steps for disclosure, design resources, economics – quantitative & qualitative analysis, management of product development projects, Design Structure Matrix, Gantt Chart, Project schedule, budget, risk plan, accelerating project, execution, assessing and correction, Intellectual property rights.

TEXT BOOKS

1. Product Design & Development - Karl. T. Ulrich and Steven D. Eppinger – TMH,Delhi.
2. Product Design – Kevin Otto and Kristin Wood - Pearson Education.

REFERENCE BOOKS

1. Product Development - Chitale & Gupta - Tata McGraw Hill.
2. Product Design and Manufacturing – Chitale & Gupta – PHI, Delhi.
3. Product Design: Creativity, Concepts and Usability – Kumar – PHI, Delhi .
4. Concurrent Engineering in Product Design and Development- Imad Moustapha – New Age.
5. Operations Management- Monks, J.G - McGraw Hill.
6. Product Design and Development - Ulrich & Eppinger – TMH Delhi.
7. Facility Layout and Location - Francis, R. L., and White, J. A. - Prentice Hall of India

Course Outcomes

- The course enhance students understanding of new product development processes as well as useful tools, techniques and organizational structures that support new product development practice.
- Understands the legal issue pertaining to patent of product design.
- Understand professional, ethical and social responsibilities resulting in a commitment to quality, timeliness, and continuous improvement.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Maintenance Engineering**	Code:	**367743(37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I
PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING
Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems –Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II
MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III
CONDITION MONITORING
Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV
REPAIR METHODS FOR BASIC MACHINE ELEMENTS
Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V
REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT
Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

TEXT BOOKS:
1. “Industrial Maintenance Management”, Srivastava S.K - S. Chand and Co., 1981
2. “Installation, Servicing and Maintenance”- Bhattacharya S.N, S. Chand and Co.1995

REFERENCES:
1 “Maintenance Planning”, White E.N., I Documentation, Gower Press, 1979.
2. “Industrial Maintenance”, Garg M.R., S. Chand & Co., 1986.
3. “Maintenance Engineering Hand book”, Higgins L.R., McGraw Hill, 5th Edition, 1988.
4. “Condition Monitoring”, Armstrong, BSIRSA, 1988.
5. “Handbook of Condition Monitoring”, Davies,Chapman &Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE,1996.

Course Outcomes:-

- The Students will be able to understand the Principles of maintenance planning
- The students will be able to understand Condition Monitoring
- The students will be able to understand the repair methods for basic machine elements and material handling equipment

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Electronic Instrumentation and Automation**	Code:	**367745(67)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives:

- To study various types of errors occurring in instrumentation
- To understand various display devices used in analysis of data and automation
- to study various methods of voltage and current measurements
- To study various methods of frequency and Power measurements

UNIT: I

Instrument Errors & Error Reduction : Errors and their statistical behavior, Types of errors, Statistical analysis of data, Probability of errors. Limiting errors, Error reduction using intelligent instruments.

Recorders: Single and Multivariable recorders, Servo recorders, Potentiometric Recorders, X-Y recorders, Paper-less recorders, Magnetic Tape recorders, Digital recorders and recording process.

UNIT: II

Instrument Displays: Special Oscilloscopes: Oscilloscope controls, Sampling oscilloscope. Analog & Digital Storage oscilloscope. Dual channel and dual trace oscilloscope. Displays: Digital displays: LED and LCD and displays based on them, Plasma displays, TFT Displays

UNIT: III

Voltage and Current Measurements: Digital Voltmeters: Non-Integrating type, Integrating Type, Using counting circuits, Principles of AC voltage measurement: Average and Peak responding detectors, Peak to Peak detector, Root mean square detectors, DC and AC probes, Basic Hand-held Multimeter, Bench type Digital Multimeters, Comparison of Analog and Digital Multimeters, Digital LCR meters.

UNIT: IV

Frequency & Power Measurement: Bolometer method. Calorimeter method.

Frequency Measurement: Basic Frequency Meter, Spectral analysis, Swept superheterodyne frequency analyzer, Harmonic Mixing, Multifilter Real Time Spectrum Analyzer, Digital Spectrum Analyzer, Audio Analyzer, Modulation Analyzer.

UNIT: V

Advanced Topics in Instrumentation: Telemetry: Various types of Telemetry, Principles of Telemetry, Telemetry Equipment, Basics of - Data Loggers, Data Acquisition Systems, Distributed Control Systems, Programmable Logic Controllers.

TEXT BOOKS

1. Electronic and Electrical Measurement and Instrument: Sawhney: Dhanpat Rai & sons.
2. Modern Electronic Instrumentation and Measurement Techniques: Cooper & Helfrick, Pearson Education.

REFERENCE BOOKS

1.Industrial Control & Instrumentation, W. Bolton, University Press.
2. Electronic Measurements and Instrumentation: Oliver and Cage: TMH.
3. Electronic Instrumentation, H.S. Kalsi, 2nd Ed., TMH.

Course Outcomes:

- The students will get knowledge about modern concepts in advanced instrumentation
- They will receive the basic knowledge measurements of various electrical quantities.
- The basic knowledge of various display devices associated with electrical and electronics systems are obtained

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program: **Bachelor of Engineering**
Branch: **Mechatronics Engineering** Semester: **VII**
Subject: **Artificial Intelligence and Expert System** Code: **367746(67)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
Class Tests : **Two(Minimum)** Assignments : **Two (Minimum)**
ESE Duration : **Three Hours** Maximum Marks: **80** Minimum Marks: **28**

Course objectives:

- To understand the concepts of AI and other knowledge based systems.
- To receive knowledge of various search algorithms of AI
- To get knowledge of various knowledge representation techniques.
- To understand the basics of expert systems

UNIT – I

Overview of AI : What is AI? The importance of AI, Early works in AI, AI and Related fields. Knowledge:Importance of Knowledge, knowledge-based system representation, organization, manipulation, acquisition.

UNIT – II

Search Techniques: Problem Solving, State space search, Blind search: Depth first search, Breadth first search, informed search: Heuristic search, Hill climbing search, Best first search, A*, AO*, Constraint satisfaction. Game Playing: Minimax search, Alpha – beta pruning.

UNIT – III

Knowledge Representation: Predicate Logic (well formed formulas, quantifiers, Prenex Normal Form, Skolemization , Unification, Modus pones, Resolution refutation – various strategies), Rule Based Systems ,Forward reasoning: Conflict resolution, Conflict resolution, backward reasoning: Use of No. Backtracking,
Structured Knowledge Representations ,Semantic Net: slots, inheritance, Frames: exceptions and defaults handling. Conceptual Dependency formalism, Object oriented representations.

UNIT – IV

Handling uncertainty: Probabilistic reasoning: Bayes Net, Dempster Shafer Theory, Use of certainty Factors, Fuzzy Logic, Non monotonic reasoning, Dependency directed backtracking, Truth maintenance systems, Learning : Concept of learning, Learning automation, The Genetic algorithm, Learning by induction, Neural Networks: Hopfield Networks, Perceptrons-Learning algorithm, Back propagation Network, Boltzman Machine, Recurrent Networks.

UNIT – V

Planning: Components of Planning System, Plan Generation Algorithms: Forward state propagation, Backward state propagation, Nonlinear planning using constraint posting, Natural Language Processing: Syntactic analysis, Top down and bottom up parsing, Augmented Transition Networks, Semantic analysis, case grammars.
Expert System: Need and Justification for expert systems- cognitive problems, Expert System Architectures (Rule based systems, Non production system, knowledge acquisition, Case studies: MYCIN , R1.

TEXT BOOKS

1. Artificial Intelligence By Elaine Rich and Kevin Knight , Tata McGraw Hill.
2. Introduction to AI and Expert Systems By Dan W.Patterson, PHI.

REFERENCE BOOKS

1. Principles of Artificial Intelligence By Nils J.Nilsson, Narosa Pub. house.
2. Foundation Artificial Intelligence & Expert Systems by VS Janakiraman K, Sarukesi P Gopalakrishnan
Macmillan series in computer science

Course Outcomes :

- Students will come to know about principles of artificial intelligence.
- The students will learn the basics of Expert Systems

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Name of the Program:	**Bachelor of Engineering**		
Branch:	**Mechatronics Engineering**	Semester:	**VII**
Subject:	**Cyber Security/Information Security**	Code:	**337747(37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
Class Tests :	**Two(Minimum)**	Assignments :	**Two (Minimum)**
ESE Duration :	**Three Hours**	Maximum Marks: **80**	Minimum Marks: **28**

Course objectives

Introduce students to cyber security concepts and techniques and foster their abilities in designing and implementing solutions for real-world problems, As in today's networked world, most of the organizations and enterprises depend on different kinds of Information Technology solutions, say e-commerce, e-governance, e-learning, e-banking etc. All communications must be secured and under control since the information stored and conveyed is ultimately an invaluable resource of the business.

UNIT-I

Security Policies and Management

Security Policy Design, Designing Security Procedures, Risk Assessment Techniques, Security standards. Security Models - Biba Model, Chinese Wall, Bell La Pedula Model, Physical and Environmental Security, Server Room Design, Firefighting equipment, Temperature/humidity Control etc

UNIT-II

Application Security

Databases, Email and Internet etc, Communications and Operations Management: Network Architecture, Network Operations Security Devices (Firewalls, IDS/IPS, Antivirus etc), Routers/Switches.

UNIT-III

Business Continuity Planning and Management - Business Impact Analysis, Business Continuity/Disaster Recovery Plans, Access Control - Logical and physical access Control

UNIT-IV

Software development, maintenance and support

Security in development methodology , Security testing, Segregation of duties

UNIT-V

Cyber Forensics

Introduction to forensic tools, Evaluation of crime scene and evidence collection, Usage of tools for disk imaging and recovery processes. Introduction to Information Security Standards - ISO 27001, PCI DSS .Compliance - IT Act, Copy Right Act, Patents etc

Bibliography:

1. Security Engineering: A Guide to Building Dependable Distributed Systems - Ross J. Anderson - John Wiley, New York, NY, 2001. ISBN: 0471389226.
2. Computer Security: Art and Science - Matt Bishop - Addison Wesley, Boston, MA,2003. ISBN: 0-201-44099-7.
3. Security for Ubiquitous Computing - Frank Stajano - John Wiley, 2002. ISBN: 0470844930.

Internet Web Sites:

1. Online Textbook Materials www.securityplusolc.com

Course outcomes:

Acquire knowledge and hands-on competence in applying cyber security solutions to work professionally in the areas of information security.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of Program: Bachelor of Engineering
Branch: Mechatronics Engineering **Semester: VII**
Subject: Robotics and Machine Vision Laboratory **Code: 367761(67)**
Total Lab Periods: 24 **Batch Size: 30**
Maximum Marks: 40 **Minimum Marks: 20**

EXPERIMENTS TO BE PERFORMED (MINIMUM FIVE EXPERIMENTS)

1. Demonstration of Cartesian/ cylindrical/ spherical robot.
2. Demonstration of Articulated/ SCARA robot.
3. Virtual modeling for kinematics and dynamic verification any one robotic structure using suitable software.
4. Design, modeling and analysis of two different types of grippers.
5. Study of sensor integration.
6. Two program for linear and non-linear path.
7. Study of robotic system design.
8. Programming for forward kinematics problems.
9. Dynamic analysis of manipulators using software.
10. Study and demonstration of actuators and vision system.
11. Study of various robotic applications.
12. To detect the sensor scanning system to overcome limitation of fixed sensors on various robotic applications, ultrasonic sensor, laser range finders, infrared detectors and miniature.
13. To detect objects with infrared ray detector.
14. To determine 5 Axis Robotic Arm movement and its degree of rotation
15. To study various Robotic Arm Configurations.
16. To study Pick and Place Robot
17. Setting robot for any one industrial application after industrial visit.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. 5 Axis Robotic Arm System
2. Hex Crawler Robot. “The Mechatronics Robot”
3. Ultrasonic Range Finder
4. Servo Power Supply
5. Infrared Object/Distance Detector
6. A 7.2V Battery Charger
7. Blue Tooth Transducer
8. Blue Tooth Pc Adaptor
9. Various Wooden Models to study Robotic Arm Configuration
10. Working model of Pick and Place Robot

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of Program: Bachelor of Engineering
Branch: Mechatronics Engineering **Semester: VII**
Subject: Computer Numerical Control Laboratory **Code: 367762(67)**
Total Lab Periods: 24 **Batch Size: 30**
Maximum Marks: 40 **Minimum Marks: 20**

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN EXPERIMENTS)

1. To prepare part programming for plain turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program in inch mode for plain turning operation.
4. To prepare part program for taper turning operation.
5. To prepare part program for turning operations using turning cycle.
6. To prepare part program for threading operation.
7. To prepare part program for slot milling operation.
8. To prepare part program for gear cutting operation.
9. To prepare part program for gear cutting using mill cycle.
10. To prepare part program for drilling operation.
11. To prepare part program for multiple drilling operation in Z-axis.
12. To prepare part program for multiple drilling in X-axis.
13. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Computer Numerically Control Lathe Trainer
2. P-IV (IBM) 2.6 GHz, 80 GB HDD,256/512 SD RAM(As Compatible with CAD Software) 52 X CD RW, 1.44 MB FDD, 17" Colour Monitor, Laser Scroll Mouse
3. CNC Controlled Milling Machine
4. CNC Controlled Drilling Machine

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Name of Program: Bachelor of Engineering
Branch: Mechatronics Engineering **Semester: VII**
Subject: Autotronics Laboratory **Code: 367763(67)**
Total Lab Periods: 24 **Batch Size: 30**
Maximum Marks: 40 **Minimum Marks: 20**

STUDIES TO BE CARRIED OUT (MINIMUM TEN EXPERIMENTS)

1. Study of Frame and Chassis.
2. Study of Clutches – Single Plate, Multi Plate and Centrifugal
3. Study of Gear Boxes – Sliding mesh, Constant mesh, Synchro mesh.
4. Study of Differential, Universal joints, Axles and Slip Joints.
5. Study of Brakes – Mechanical, Hydraulic, Air Brake and Disc Brake.
6. Study of Steering System used with Rigid Axle suspension and independent suspension system, Power Steering
7. Study of different types of springs used in Automobiles.
8. Study of Rigid Axle suspension system.
9. Study of Front Independent Suspension System.
10. Study of Read Independent Suspension System.
11. Study of Battery, Staring and Generating System and Battery Charging System.
12. Study of Automotive Electrical System.
13. Study of Educational Car Model.
14. Study of MPFI and CRDI systems and their application.
15. Study of ABS system and draw a complete system diagram with costing for a passenger vehicle.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Working model of Single plate, Multi-plate & Centrifugal Clutch
2. Working model of Actual Differential System
3. Working model of Universal Joint, Axles & Slip Joints
4. Working model of Mechanical, Hydraulic and Air Brake
5. Working model of Steering System used with Rigid Axle suspension System
6. Working model of Steering System used with Independent Suspension System
7. Different types of Springs used in Automobiles
8. Working model of Rigid Axle Suspension System
9. Working model of Front Independent Suspension System
10. Working model of Rear Independent Suspension System
11. Working model of Battery, Staring and Generating System along with Charging unit
12. Working model of Electrical System
13. Cut section of Actual Master Cylinder of Hydraulic Brake System
14. Educational Car Model