

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

Scheme of Teaching & Examination

M. E. in CAD

II Semester

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total	Credit L+(T+P)/2
				L	T	P	Theory / Practical				
							ESE	CT	TA		
1	Mech. Engg	563211(37)	Modeling and Analysis	3	1	-	100	20	20	140	4
2	Mech. Engg	558212(37)	Optimization Techniques	3	1	-	100	20	20	140	4
3	Mech. Engg	563213(37)	Computer Added design of Machine Elements	3	1	-	100	20	20	140	4
4	Mech. Engg	558214(37)	Finite element Analysis	3	1	-	100	20	20	140	4
5	Refer Table - II		Elective – II	3	1	-	100	20	20	140	4
6	Mech. Engg	563221(37)	FEM Lab.	-	-	3	75	-	75	150	2
7	Mech. Engg	563222(37)	CAD of Machine Elements Lab	-	-	3	75	-	75	150	2
Total				15	5	6	650	100	250	1000	24

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

Table-II

ELECTIVE II			
S.No.	Board of Study	Subject Code	Subject
1	Mech. Engg	558231 (37)	Mechatronics
2	Mech. Engg	563233 (37)	Industrial Automation
3	Mech. Engg	558232 (37)	Computer aided Process Planning

Note (1) – 1/4th of total strength of students subject 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.

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

Semester: **M. E. II**

Subject: **Modeling and Analysis**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **563211 (37)**

Total Tutorial Periods: **12**

UNIT-I

CAD Overview: Introduction to use of computer in Product Life Cycle. Software for mechanical engineering CAD/CAM/CAE.

UNIT-II

Geometric Modeling: Parametric sketching, constrained model dimensioning, material addition and removal for extruded, revolved, swept and blended features. References and construction features of points, axis, curves, planes, surfaces and customized analysis features. Feature and sequence of feature editing. Cosmetic features, chamfers, rounds, standard holes. File formats for data transfer. Feature patterns, duplication, grouping, suppression.

UNIT-III

Assembly modeling: Assembly analysis tools. Top-down vs. bottom-up design. Parametric relations and design optimization parameters creation. Mass property analysis. Automatic production drawing creation and detailing.

UNIT-IV

Software automation and customization tools: Colors and rendering. Advanced features for non parallel blend, helical sweep, swept blend, variable section sweep, draft, ribs, sketched holes. Mechanism design and assembly. Customized design & CAD automation using user defined features UDF.

UNIT-V

Mechanical Design Analysis and Optimization: Design analysis for mass properties, stress, thermal stress, fatigue, fluid flow, etc using CAD/CAE packages. Optimum design of machine components using multivariable non linear optimization techniques using iterative CAD/CAE software tools.

TEXT BOOKS

1. Mathematical Elements for computer graphics – Roger D.F.& Adams A.
2. Geometric modeling – Mortenson M.E.
3. Surface modeling for CAD –CAM –Choi B.K.

REFERENCE BOOKS

1. Principles of interactive computer graphics – Newman
2. Computational geometry for design & manufacture –Faux & Pratt

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

Semester: **M. E. II**

Subject: **Optimization Techniques**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **558212(37)**

Total Tutorial Periods: **12**

UNIT 1

Integer and parametric programming: cutting plane method, Branch & Bound method, Sensitivity analysis –Changes in b_i , changes in c_j , changes in a_{ij} . Parametric Programming – Parametric variation in c_j , b_i & a_{ij} , simultaneous parametric variations. Goal Programming.

UNIT 2

Non- linear Programming: langragian function, saddle point, Kuhn- tucker conditions, primal & dual problem, Quadratic programming, separable programming. Geometric programming– Generalization high Kuhn- Tucker theory.

UNIT 3

Dynamic Programming: Serial multistage model, backward & forward recursion, system with more than one constraints, Application of Dynamic Programming in continuous system. Direct search & Gradient methods- one dimensional & n- dimensional search.

UNIT 4

Taguchi Technique: Introduction to DOE, ANOVA, F-Test, Response surface Methodology. Markov chain.

UNIT 5

Introduction to modern Optimization Techniques: ANN, Fuzzy logic, Genetic Algorithms. Memetic Algorithms, Antz colony Algorithm, Tabu Search.

TEXT BOOKS

1. Optimization methods in Operation Research & System Analysis- K.V. Mithal & C. Mohan.- New Age International Publishers.
2. Neural Networks & Fuzzy System- Bart Kosko- PHI publications.
3. Quality Engineering using Robust Design- M.S. Phadke, PHI publication.
4. Introduction to Operation Research by Frederick S. Hillier · Gerald J. Lieberman

REFERENCE BOOKS

1. Operation Research Principles and Practice- Ravindran, Phillips, solbers Wiley Publication.
2. Established Quality Control- Engene L.Grant, Richard. S. Leaven Worth- TMH
3. Neural Engineering – Computation, Representation and Dynamics in Neurobiological systems.- Chris Eliasmith and Charles H. Anderson.- EEE
4. Quantitative Technique in Management – N.D. Vohra, - TMH Publication.
5. Neural Network in Computer intelligence – Li Min Fu - TMH.

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

Semester: **M. E. II**

Subject: **CAD of Machine Elements**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **563213 (37)**

Total Tutorial Periods: **12**

UNIT 1

INTRODUCTION: The design process and roll of CAD – types and application of design models- Computer representation of drawing, three dimensional modeling schemes, wire frames and surface representation schemes, solid modeling

UNIT 2

INTRODUCTION TO CAD SOFTWARES: Writing interactive programs to solve design problems and production of drawing/ solid model using language like auto LISP/ C++, system customization and design automation, features of various solid modeling packages

UNIT 3

COMPUTER ADDED DESIGN OF MACHINE ELEMENTS- Development of programs for design, drawing & plotting of Machine Elements shafts, gears, pulleys, flywheel, connecting rods etc., Interfacing with packages.

UNIT 4

ENTITY MANIPULATION AND DATA STORAGE : Manipulation of the model, Model storage, Data structures, Data base considerations, Objects oriented representations, organizing data for CIM applications, Design information system.

UNIT 5

EXPANDING THE CAPABILITY OF CAD: Parametric and variation modeling, Design by features, Assembly and Tolerance modeling, Tolerance representation, specification, analysis and synthesis, Rapid prototyping, AI in Design.

TEXT BOOK

1. Donald Hearn and M. Pauline Baker, “Computer Graphics”, Prentice Hall Inc., 1992.
2. Mikell, P. Grooves and Emory W.Zimmers Jr., “CAD/CAM Computer – Aided Design and Manufacturing”, Prentice Hall Inc., 1995.
3. William M Neumann and Robert F.Sproul, “Principles of Computer Graphics”, McGraw Hill Book Co., 1989.

REFERENCE

1. Ibrahim Zeid, “CAD/CAM – Theory and Practice”, McGraw Hill, International Edition, 1998.
2. Sandor G.N. and Erdman A.G., “Advanced Mechanism Design Analysis and Synthesis”, Prentice Hall, 1984.
3. Kenneth J, Waldron, Gary L. Kinzel, “Kinematics, Dynamics and Design of Machinery”, John Wiley-sons, 1999.

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

Semester: **M. E. II**

Subject: **Finite Element Analysis**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **558214 (37)**

Total Tutorial Periods: **12**

UNIT 1

Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods.

UNIT 2

Variational approach, Galerkin Methods. Co-ordinates, basic element shapes, interpolation function.

Virtual energy principle, Rayleigh - Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations

UNIT 3

1-D structural problems – axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses – Plane Truss and Space Truss elements.

UNIT 4

Analysis of beams – Hermite shape functions – stiffness matrix – Load Vector – Problems 2-D problems –Constant Strain Triangles, force terms, Stiffness matrix and load vector, boundary conditions.

UNIT 5

Application of FEM to elasticity, structural, fluid flow and lubrication problems.

Scalar field problems - 1-D Heat conduction – 1-D fin element – 2-D heat conduction problems – Introduction to Torsional problems.

Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen Vector, natural frequencies – mode shapes – modal analysis.

TEXT BOOKS

1. The Finite Element Method -- O C Zienkiewicz, R L Taylor
2. An Introduction to the Finite Element Method – J. N. Reddy, TMH Publication

REFERENCE BOOKS

1. Finite Element Analysis – P. Seshu, PHI Publication
2. Introduction to Finite Element Method – C.S. Desai and J. F. Abel
3. Introduction to Finite Elements in Engineering – T. R. Chandrupatla & A. D Belegundu, PHI Publication.
4. Applied Finite Element Analysis – L. J. Segerland , John Wiley Publications

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

Semester: **M. E. II**

Subject: **Mechatronics**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **558231 (37)**

Total Tutorial Periods: **12**

UNIT 1

Introduction: Mechatronics, Measurement Systems, Basic Electrical Elements, Kerchoeff's Law, Voltage And Current Sources and Meters, Thevenin and Norton Equivalent Circuits, Alternating Current Circuit Analysis, Power in Electrical Circuits, Transformer, Impedence Matching, Grounding and Electrical Interference.

UNIT 2

Semiconductor Electronics: Introduction, Semiconductor Physics as the Basis for Understanding Electronic Devices, Junction Diode, Bipolar Junction Transistor, and Field Effect Transistors

UNIT 3

Microcontroller Programming and Interfacing: Microprocessor and Microcomputers, Microcontrollers, The PIC16F84 Microcontroller, Programming a PIC, Pic Basic Pro, Using Interrupts, Interfacing Common PIC Peripherals, Interfacing to the PIC.

Data Acquisition: Introduction, Quantizing Theory, Analog-to-Digital Conversion, Digital-to-Analog (D/A) Conversion,

UNIT 4

Sensors: Introduction, Position and Speed Measurement, Stress and Strain Measurement, Temperature Measurement Vibration and Acceleration Measurement, Pressure and Flow Measurement, Semiconductor sensors and Microelectromechanical Devices.

UNIT 5

Actuators: Introduction, Electromagnetic Principles, Solenoids and Relays, Electric Motors, Motors, Stepper Motors, Selecting a Motor, Hydraulics, Pneumatics,

TEXT BOOKS

1. Introduction to Mechatronics and Measurement Systems – David G. Alciatore, Michael B.Histand, TMH Publication.
2. Mechatronics – Principles, Concepts and Applications – Dan Neculescu, Published by Pearson Education (Singapore)

REFERENCE BOOKS

1. Mechanical Measurements– Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Pearson Education.
2. Mechatronics -Principles, Concepts and Applications – Nitaigour Premchand Mahalik, Tata McGraw-Hill Publication.

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

Semester: **M. E. I**

Subject: **Industrial Automation**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **563233 (37)**

Total Tutorial Periods: **12**

UNIT-1

Introduction to Factory Automation and Integration: Basic Concepts, types of automation, automation strategies.

Introduction to Hydraulics/Pneumatics controls and devices: Simple systems for obtaining motions in combination or in sequence by the use of hydraulic, pneumatic automation devices and controls.

UNIT-2

Fluid Power Control: Fluid Power Control elements and standard graphical symbols for them, Construction and performance of fluid power generators, Hydraulic & pneumatic cylinders - construction, design and mounting, Hydraulic & pneumatic valves for pressure, flow & direction control; Servo valves and simple servo systems with mechanical feedback, Simple hydraulic and pneumatic circuits.

UNIT-3

Pneumatic Logic Circuits: Boolean Algebra, Truth tables, Un-complementation algorithm and Karnaugh Maps, Design of pneumatic logic circuits for a given time displacement diagram or sequence of operation. Pneumatic safety and remote control circuits and their applications to clamping, traversing and releasing operations. Program logic controllers. Modern developments.

UNIT- 4

Automatic Transfer Systems: Introduction to automatic transfer, feeding and orientation devices. Automatic feeding using - vibratory and mechanical feeders, feed tracks, Escapements, Part-placement Mechanisms and Robots; Orienting devices, Designing Parts for feeding, manual and automatic assembly and Robotic Assembly.

UNIT-5

Automatic loading: types of loading facilities and their purpose, Magazines, bunker loading facilities, Work flow lines and automatic transfer machines; classification; design and applications. Analysis of automated flow-lines: Reliability and efficiencies of automatic transfer machines.

Assembly automation: Types of assembly systems, assembly line balancing, performance and economics of assembly systems.

TEXT BOOK

1. **Industrial Automation and Robotics by A.K. Gupta and S.K. Arora**

REFERENCE BOOKS

1. Handbook of industrial automation By Ernest L. Hall
2. Fluid Power Control by Shearer P. ,John Wiley
3. Robotics and Flexible Automation by SR Deb

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

Semester: **M. E. II**

Subject: **Computer Aided Process Planning**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class test to be conducted: **02**

Branch: **Mechanical Engineering**

Code: **558232 (37)**

Total Tutorial Periods: **12**

UNIT 1

Introduction to CAPP: Information requirement for process planning system, Role of process planning, advantages of conventional process planning over CAPP, Structure of Automated process planning system, feature recognition, methods.

UNIT 2

Generative CAPP system: Importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits.
Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.

UNIT 3

Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

UNIT 4

Determination of machining parameters: reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

UNIT 5

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

TEXT BOOKS

1. Automation , Production systems and Computer Integrated Manufacturing System –Mikell P.Groover, PHI Publication.
2. Computer Aided Engineering – David Bedworth, TMH Publishers

REFERENCE BOOKS

1. Computer Aided Design and Manufacturing – Dr.Sadhu Singh, Khanna Publisher

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

Semester: **M. E. II**

Subject: **FEM Lab**

Total Practical Periods: **40**

Total Marks in End Semester Exam. : **75**

Branch: **Mechanical Engineering**

Code: **563221 (37)**

Analysis of Mechanical Components – Use of FEA Packages, like ANSYS NASTRON etc.,
Excesses shall include FEA analysis of

- i) Machine elements under static loads
- ii) Heat transfer in mechanical systems
- iii) Determination of natural frequency
- iv) Axi-Symmetric
- v) Non-linear systems

Use of kinematics and dynamics simulation software like ADAMS software. Analysis of velocity and acceleration for mechanical linkages of different mechanisms.

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

Semester: **M. E. II**

Subject: **CAD of Machine Elements Lab**

Total Practical Periods: **40**

Total Marks in End Semester Exam. : **75**

Branch: **Mechanical Engineering**

Code: **563222 (37)**

Development of programs for design, drawing & plotting of Machine Elements using language like auto LISP/ C++.