### Scheme of Teaching and Examination

**B.E. VII Semester Mechatronics Engineering**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Board Of Study</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>Periods Per Week</th>
<th>Scheme Of Exam</th>
<th>Total Marks</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
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<td>L</td>
<td>T</td>
<td>P</td>
<td>ESE</td>
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<tr>
<td>1.</td>
<td>Mech. Engg.</td>
<td>337713 (37)</td>
<td>CAD/CAM</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>80</td>
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<tr>
<td>3.</td>
<td>Electronics and Telecom</td>
<td>367711 (28)</td>
<td>Digital Design with HDL</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>80</td>
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<td>5.</td>
<td>Refer Table 2</td>
<td>Professional Elective 2</td>
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<td>4</td>
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<td>-</td>
<td>80</td>
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<td>6.</td>
<td>Electronics and Telecom</td>
<td>367721 (28)</td>
<td>Digital Design with HDL Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>40</td>
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<td>7.</td>
<td>Mech. Engg.</td>
<td>337723 (37)</td>
<td>CAD/CAM Lab</td>
<td>-</td>
<td>-</td>
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<td>40</td>
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<tr>
<td>10.</td>
<td>Management</td>
<td>300725 (36)</td>
<td>Innovative and Entrepreneurial Skills</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
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<td>11.</td>
<td>Mech. Engg.</td>
<td>367723 (37)</td>
<td><strong>Practical Training Evaluation/Library</strong></td>
<td>-</td>
<td>-</td>
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<td>20</td>
<td>5</td>
<td>15</td>
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</table>

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

**Note:** To be completed after VI Sem. and before the commencement of VII Sem.

**Table – II**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Board of Studies</th>
<th>Code</th>
<th>Name of Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical</td>
<td>337751(37)</td>
<td>Quality Control &amp; Total Quality Management</td>
</tr>
<tr>
<td>2</td>
<td>Mechanical</td>
<td>337752(37)</td>
<td>Reliability Based Design</td>
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<tr>
<td>3</td>
<td>Mechanical</td>
<td>337714(37)</td>
<td>Operations Research</td>
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<tr>
<td>4</td>
<td>Electronics and Telecom</td>
<td>328751(28)</td>
<td>Electronic Instrumentation and Automation</td>
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<td>5</td>
<td>Electronics and Telecom</td>
<td>328753(28)</td>
<td>Consumer Electronics</td>
</tr>
<tr>
<td>6</td>
<td>Electronics and Telecom</td>
<td>328757(28)</td>
<td>Artificial Intelligence and Expert Systems</td>
</tr>
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</table>

**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.
UNIT – I
Introduction CAD/CAM
The influence of computers on manufacturing environment, Introduction of CAD/CAM, the product cycle & CAD/CAM, automation and CAD/CAM, the common database as linkage to various computerized applications. Product engineering, Benefits of CAD/CAM, Concurrent engineering.

UNIT – II
Geometric Modeling
Data base: Design database concept, objectives, data structures, creation of data files in application programs and relational database management system. Requirement of Geometric Modeling, Geometric models, Geometric construction Methods, other modeling methods, curve representation, desirable modeling facilities & rapid prototyping. 3D representation of surfaces and solids; Plane surface, surfaces of revolution, Bezier surfaces, spline surfaces, Solid entities, basic set theory.

UNIT – III
Numerical Control
Introduction to Numerical Control, Basic components of an NC system, the NC procedure, NC coordinate systems, NC motion control systems, applications of Numerical Control, Introduction to Computer Control in NC, problems with conventional NC, Computer Numerical Control, Direct Numerical Control, Combined DNC/CNC system, Adaptive control machining system.

NC Part Programming
Introduction to NC Part Programming, Manual part programming, Computer assisted part programming, the APT (Automatically Programming Tool) language, MACRO statement in APT, Advantages of CAD/CAM in NC programming.

UNIT – IV
Group Technology
Introduction to group technology, part families, parts classification & coding, three parts classification & coding system, group technology machine cells, benefits of group technology

Computer integrated manufacturing (CIM) system
Introduction of CAPP, Flexible manufacturing system, benefits.

UNIT V
Finite Element method
Introduction, types of analysis, general procedure of finite element analysis- stiffness matrix, solution procedure, one dimensional problem.

TEXT BOOKS
1. CAD/CAM Principles & Applications – P.N. Rao – TMH Publication
2. CAD/CAM Computer Aided Design & Manufacturing – Mikell P. Groover, Emory W. Zimmer - Pearson Education
3. Concept and application of Finite element analysis, R D Cook, John Wiley

REFERENCES BOOKS
1. CAD/CAM Theory & Practice – Ibrahim Zied – TMH Publication
2. CAD/CAM – Surendra Kumar & A.K. Jha – Dhanpat Rai & Company
3. Finite element analysis
Subject: Numerical Control of Machine Tools Code: 337755 (37)
Total Theory Periods: 50 Total Tutorial Period: 12
Total Marks in End Semester Exam: 80 Minimum number of class tests to be conducted: 2

UNIT - I
Introduction
Fundamentals of numerical control, advantages limitations of N.C systems -classification of N.C systems.

Computer Numerical Control

UNIT - II
Features of N.C. Machine tools
Design consideration of N.C machine tools - increasing productivity with N.C machines, tooling for CNC machine.

System Device
Feedback system-counting devices digital analog converters

Interpolations
DDA integrators, simple and symmetrical DD reference word CNC interpolators.

UNIT - III
Part Programming
Process planning and flow chart for part programming. systems, nomenclature and tool geometries. Tool presetting & Modular Tooling. Selection of tools based on machining capacity, accuracy and surface finish. Elements of programming for turning and milling. part programming. Preparatory codes G, Miscellaneous functions M. Interpolation, Tool compensations, cycles for simplifying programming. Typical part programming

Control Loops for N C Systems
Introduction-control loops for point and counting systems.

UNIT - IV
Computerized Numerical Control
CNC concepts-advantage of CNC reference planes, sampled data techniques, microcomputers in CNC.

Adaptive Control Systems
Adaptive control with optimization, and constraints-variable gains AC systems.

UNIT - V
Modern CNC machines

TEXT BOOKS

REFERENCE BOOKS
1. HMT Mechatronics - Tata McGraw Hill
2. Numerical Control of Machine Tool by Urie and Koren
UNIT-I
Chassis & Frame - Layout of chassis & its main components, types of frames, conventional frames & unitized chassis.

Suspension system & Springs - Objects & 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, automatic transmission, overdrive, lubrication of gear box.

Torque converter: Principles of working, characteristics, Torque converter with direct drive.

Testing of automobiles.

UNIT – IV
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.

Tyres: Types specification, causes of tyre wear & rim.

Brakes & Braking system: Purpose, principles, layout of braking system. Classification, mechanical, hydraulic, master cylinder, Tandoma master cylinder wheel cylinder, self energizing & self adjusting brakes, disc brakes, antiskid brakes, power operated brakes:

UNIT – V
Steering system: Gear & links, types of steering gears, reversibility of steering, center point steering, steering geometry viz. 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.

Electrical System: Battery construction, maintenance, testing and charging, cut out, lighting circuit, horn, signals etc.

TEXT BOOKS

REFERENCE BOOKS
1. Automobile Engineering - Dr. N. K. Giri – Khanna Publishers
3. Automotive Mechanics – Heitner
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, LTPD, AOQL, AOQ.

UNIT IV
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

TEXT BOOKS

REFERENCE BOOKS
5. Managing for Total quality from Deming to Tguchi and SPC. - Logothetis – Prentice Hall of India
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

REFERENCE BOOKS
1. Optimisation for Engineering Design - Kalyanmoi Deb - Prentice Hall India
2. Optimisation Concepts and Applications in Engineering - Ashok Belegundi, T Chandrauptala -Pearson education
4. Reliability in Design - Kapoor K.C.
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 , Sasien Yaspan
2. Operation Research – N. D. Vohra – TMH

REFERENCES
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

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**

**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.
UNIT  I


UNIT  II


UNIT – III


UNIT – IV


UNIT – V


TEXT BOOKS
Consumer Electronics, Bali S.P., Pearson Education

REFERENCE BOOKS
K. Blair, Benson “Audio Engineering Hand book"
**Chhattisgarh Swami Vivekanand Technical University, Bhilai (C G)**

Semester: B.E. VII Sem.  
Branch: Mechanical Engg., Mechatronics Engg.  
Subject: Artificial Intelligence & Expert System  
Code: 328757 (28)  
Total Theory Periods: 40  
Total Tutorial Periods: 12  
Total Marks in End Semester Examination: 80  
Minimum number of Class tests to be conducted: Two

**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**

**UNIT – III**

**UNIT – IV**

**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**
2. Foundation Artificial Intelligence & Expert Systems by VS Janakiraman K, Sarukesi P Gopalakrishnan Macmillan series in computer science
EXPERIMENTS TO BE PERFORMED

**CAD (MINIMUM FIVE EXPERIMENTS)**
1. Introduction & different features of the CAD Software
2. 2-D Drafting
3. 3-D Modeling
4. 3-D Advanced Modeling
5. Assembly modeling
6. Feature Modification and Manipulation
7. Detailing
8. Sheet Metal Operations
9. Surface Modeling
10. One Dimensional problems of Finite Element Method.
   *(These exercises may be performed by any of the following Advanced CAD Software)*

**CAM (MINIMUM FIVE 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. Software – Pro-E, Solid-work, CATIA, ANSYS
4. CNC Controlled Milling Machine
5. CNC Controlled Drilling Machine
STUDIES TO BE CARRIED OUT (MINIMUM TEN EXPERIMENTS)

1. Study of Frame and Chassis.
2. Study of Clutches – Single Plate, Multi Plate and Centrifugal
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.
13. Study of Educational Car Model.

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
**Chhattisgarh Swami Vivekanand Technical University, Bhilai (C G)**

Semester: VII  
Subject: Innovative and Entrepreneurial Skills  
Total Theory Periods: 28  
Total Marks in End Semester Exam: 40  
Minimum no. of Class test to be conducted:--

**Unit I**
Innovation: innovation- an abstract concept; creativity, innovation and imagination; types of innovation - classified according to products, processes or business organizations.

**Unit II**
Entrepreneurship: who is an entrepreneur? Entrepreneurship- A state of Mind, Emergence of entrepreneur; Role of Entrepreneur; A Doer not a Dreamer- Characteristics of an entrepreneur; Factors affecting entrepreneurial growth – Social, cultural, personality factors, psychological and Social Factors.Impact of Entrepreneurship for sustainable development.

**Unit III**
Difference between entrepreneur and entrepreneurship, Difference between entrepreneur and intrapreneur,  
Common Entrepreneurial competencies/Traits; Entrepreneurship stimulants, Obstacles inhibiting Entrepreneurship; Types of entrepreneurs, Functions of an entrepreneur.

**Unit IV**

**UNIT-V**

**Text and Reference Books:**
1. Competing through Innovation-Bellon & Whittington, Prentice Hall of India
3. Entrepreneurship- Rober D Hisrich, Peters, Shepherd- TMH
4. Entrepreneurship in Action- Coulter, Prentice Hall of India
5. Entrepreneurship Management and Development – Ajith Kumar, HPH
6. Fundamentals of entrepreneurship- Mohanty, PHI