# Scheme of Teaching and Examination

## B.E. IV 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>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>L   T  P ESE CT TA</td>
<td>Theory/Practical</td>
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<tr>
<td>5.</td>
<td>Electronics and Telecom</td>
<td>328413 (28)</td>
<td>Analog Electronic Circuits</td>
<td>4   1  -     80 20 20</td>
<td>120</td>
<td>5</td>
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<td>6.</td>
<td>Applied Mathematics</td>
<td>328411 (14 )</td>
<td>Mathematics - IV</td>
<td>3   1  -     80 20 20</td>
<td>120</td>
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<td>8.</td>
<td>Mech. Engg.</td>
<td>337424 (37)</td>
<td>Mechanical Measurements and Metrology Lab</td>
<td>-   -  2     40 - 20</td>
<td>60</td>
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<td>9.</td>
<td>Electronics and Telecom</td>
<td>328421 (28)</td>
<td>Analog Electronic Circuits Lab</td>
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<td>10.</td>
<td>Mech. Engg.</td>
<td>337423 (37)</td>
<td>Kinematics of Machines Lab</td>
<td>-   -  2     40 - 20</td>
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<td>11.</td>
<td>Humanities</td>
<td>300425 (46)</td>
<td>Health, Hygiene and Yoga</td>
<td>-   -  2     -   -  40</td>
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<td>Total</td>
<td>23 6 11 640 120 240 1000</td>
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L – Lecture, T – Tutorial, P – Practical, ESE - End Semester Exam, CT - Class Test, TA – Teacher’s Assessment

Note (1): Duration of all theory papers will be of **Three Hours**.

Note (2): Industrial Training of four weeks is mandatory for B.E. student. It is to be completed in two parts. The first part will be in summer after IV sem. after which students have to submit a training report which will be evaluated by the College teachers during B.E. V Sem.
UNIT - I
Introduction,
Application Areas. Input and Output Devices:- Keyboard, Mouse, Z mouse Trackball, Joysticks, Data Glove, Digitizers, Light pen, Touch Panels, Image scanners, Printers and Plotters. Video Display Devices: Refresh CRT; Raster & Random scan display; Color CRT monitor; Flat panel display; Co-ordinate representation.

UNIT – II
Basic Raster Graphics Algorithm for drawing 2-D primitives

UNIT - III
2-D Geometric Transformation
Window and View port: Window and View port relationship; World co-ordinates; Normalized device co-ordinates and Homogenous co-ordinates. Basic Transformations: Translation; Rotation and Scaling. Other Transformation: Reflection and Shear. Composite Transformation.

UNIT - IV
2-D Viewing and Clipping
Viewing world coordinates system, normalized coordinate system, device, image coordinate system, window definition, view port definitions, viewing transformation. Clipping: Point clipping; Line: Cohen-Sutherland algorithm, Mid-point Polygon.

UNIT - V
3-D Concepts and curves
3-D Display Methods: Parallel and Perspective projections; 3-D Transformation: Basic Transformations: translation, rotation and scaling
Curves
Spline Representation, Bezier Curves single and multiple segments , Cubic-spline and their parametric forms

TEXT BOOKS

REFERENCE BOOKS
5. Cad Cam Theory and Practice by Ibrahim Zeid - TMH publications
UNIT - I
Generalized Measurement System
Introduction - Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors sensors and Transducers – Types of sensors, type of transducers and their characteristics.

UNIT - II
Measurement
Measurement of Strain
Type of strain gauges and their working, strain gauge circuits, Mcleod guague, Pirani guage, temperature compensation. Strain rosettes. Measurement of force and torque. Measurement of temperature by thermometers, bimetallic, thermocouples, thermistors and pyrometers-total radiation and optical pyrometry.

UNIT - III
Measurement of flow
Obstruction meters, variable head meters, hot wire and magnetic meters, ultrasonic flow meters. Vibration and noise measurement : Seismic instruments, vibration pick ups and decibel meters.
Data acquisition system
Introduction to data acquisition systems, single and multi channel systems, microprocessors and PC based data acquisition systems. Input – output devices signal transmission and Processing. Devices and systems.

UNIT - IV
Metrology
Standards of measurement. Linear and angular measurement devices and systems limit gauges, gauge blocks. Measurement of geometric forms like straightness, flatness, roundness and circularity, principles and application of optical projectors, tool makers, microscope, autocollimators etc.

UNIT - V
Metrology

TEXT BOOKS
1. Mechanical Measurements and Control – D.S. Kumar – S.K. Kataria & Sons

REFERENCES BOOKS
2. Engineering Metrology – K.J. Hume - MacDonald and Company
Unit-I
Vapour and Vapour Power Cycle
(a) Vapour: Properties and processes in ideal vapour, use of steam tables and Mollier’s diagram in determination of steam properties, energy and entropy calculations.
(b) Vapour Power Cycle: Carnot and Rankine cycle as applied to steam power plants, Reheat cycle, ideal regenerative cycle, practical regenerative cycle, characteristics of ideal working fluids, binary vapour cycle.

Unit-II
Steam Turbines
Steam turbine – Principal of operation of steam turbine, types, impulse turbine compounding of steam turbine, pressure compounded, velocity compounded and pressure – velocity compounded impulse turbine. Velocity diagram for impulse turbine, force on the blade and work done.

Unit-III Internal Combustion (I.C.) Engines

Unit-IV Gas Turbine cycles
Classification of gas turbine. Simple open cycle gas turbine Ideal and actual cycle (Brayton Cycle) for gas turbine Optimum pressure ratio for maximum specific output in actual gas turbine Regeneration, reheat and inter cooling and effect of these modification on efficiency and output, closed cycle gas turbine.

Unit-V Solar Energy Conversion
Classical sources of energy crisis and search for alternative sources of energy. Solar energy, earth sun angles, resolution, solar measurement, collection of solar energy, flat plate and focusing collector analysis, calculations and same design parameters. Applications of solar energy.
Introduction to Photovoltaic cell energy conversion techniques.

Text Books
1. Steam and Gas turbine – By R. Yadav - Central Publishing House, Allahabad

Reference Books
1. Turbine compressors and Fans – S.M. Yahya - TMH
2. Gas Turbine – V. Ganeshan – TMH
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Sub : Kinematics of Machines Code : 337414 (37)
Total Theory Periods : 40 Total Tutorial Periods : 10

Total Marks in End Semester Exam : 80
Minimum number of class tests to be conducted : 02

UNIT - I
Relative Velocity
Elements, pairs, mechanisms, four bar chain and its inversions, velocity diagrams, Relative velocity method, instantaneous center method.

UNIT- II
Relative Acceleration
Synthesis of Mechanism, pantograph, lower pair mechanisms, relative acceleration diagram, Klien’s construction, Coroilis Component of acceleration.

UNIT - III
Cams:
Classification of cams and followers, nomenclature of a radial cam, description of follower movement, displacement diagrams, uniform and modified uniform motion, simple harmonic motion, uniform acceleration motion and its modifications, cycloidal motion, synthesis of cam profile by graphical approach, considerations of pressure angle, cams with specified contours: circular arc cam & tangent cam.

UNIT- IV
Gear and gear trains
Gear terminology, law of gearing, gear tooth forms, standard involute and cycloid tooth profile, interference and undercutting of involute teeth, minimum number of teeth on pinion to avoid interference, types of gears

Gear trains
Simple, compound, reverted, and epicyclical gear trains, tabular/analytical/graphical/vector method for computation of velocity ratio in gear trains

UNIT-V
Friction
Friction in turning pairs, application of friction circles in slider crank and four bar mechanisms; pivot and collar friction, thrust bearings.

Brakes and Dynamometers
Simple block and shoe brake, band brake, band and block brake, and internal expanding shoe brake; absorption dynamometers, transmission dynamometers.

TEXT BOOKS
1. Theory of Machine- S.S.Rattan - TMH.

REFERENCE BOOKS
2. The Theory of Machines - Thomas Bevan, - CBS Publishers
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester : B.E. IV Sem. Branch: Electronics & Telecommunication, Mechatronics
Subject: Analog Electronic Circuits Code: 328413 (28)
Total Theory Periods: 40 Total Tutorial Periods: 10
Total Marks in End Semester Examination: 80 Minimum number of Class tests to be conducted: Two

UNIT-I
LOW FREQUENCY TRANSISTOR AMPLIFIER: Graphical Analysis of CE amplifier; h-parameter Models for CB, CE, CC configurations and their Interrelationship; Analysis and Comparison of the three Configurations; Linear analysis of Transistor Circuits: Miller's Theorem: Cascading: Simplified Models and Calculation of CE and CC Amplifiers; Effect of emitter Resistance in CE amplifiers; Cascode amplifiers: Darlington Pair, analysis of Single stage FET amplifier-CS and CD Configuration, FET as VVR.

UNIT-II
HIGH FREQUENCY TRANSISTOR AMPLIFIERS: CE hybrid-π model: Validity and parameter Variation: Current Gain with Resistive load: frequency response of a single stage CE Amplifier: Gain-Bandwidth product: CC stage High frequencies: Multistage Amplifiers: sources of Noise in Transistor Circuits; Noise Figure.

UNIT-III

UNIT-IV

UNIT-V

TEXT BOOKS:
1. Integrated Electronics – Millman  & Halkias, TMH.
2. Microelectronics – Millman and Grabel, TMH.

REFERENCE BOOKS:
1. Electronic Devices & Circuits – David A. Bell, PHI
**UNIT - 1 SERIES SOLUTION OF DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS**

Series solution of differential equations, The method of Frobenius, Bessel's differential equation, Bessel’s function of the First Kind - recurrence relations, generating function, orthogonality, Legendre's differential equation, Legendre’s polynomial - Rodrigue's formula, generating function, recurrence relations, orthogonality.

**UNIT - 2 PARTIAL DIFFERENTIAL EQUATIONS:**

Formation, Solution of Lagrange’s linear differential equation, homogeneous linear differential equation with constant coefficients, non-homogeneous linear differential equations, Method of separation of variables.

**UNIT - 3 APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**

Initial & boundary value problems, Vibrations of a stretched string, D’Alembert's solution, One-dimensional heat flow, Transmission of signals along a cable - Telephone equation, Telegraph & radio equations, Vibrations of rectangular & circular membranes.

**UNIT - 4 Z-TRANSFORM**

Sequence, Basic operations on sequences, Definition of Z- Transform, Linearity, Change of scale & shifting properties, Z-transform of standard sequences, Inverse Z- Transform, Multiplication by n & division by n, Initial value & final value theorems, Convolution of sequences, Convolution theorem, Inverse Z- transform by partial fraction, power series and residue methods. Application to solution of difference equations.

**UNIT - 5 RANDOM VARIABLE & PROBABILITY DISTRIBUTIONS**

Random variable, Discrete & continuous probability distributions, Mathematical Expectation, Mean & variance, Moments & moment generating function, Probability distributions - Binomial, Poisson & Normal distributions.

**TEXT BOOKS:**


**REFERENCE BOOKS:**

3. Applied Mathematics for Engineers & Physicists by Louis A. Pipes- TMH.
Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

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<tbody>
<tr>
<td>Sub</td>
<td>Computer Graphics Lab</td>
<td>Practical Code</td>
<td>337421 (37)</td>
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<td>Total Practical Periods</td>
<td>20</td>
<td>Total Marks in End Semester Exam</td>
<td>40</td>
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**EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)**

1. To develop the concept of Computer Graphics in C
2. DDA Line drawing algorithm
3. Bresenham’s Line drawing algorithm
4. Bresenham’s Circle drawing algorithm
5. Mid point circle drawing algorithm
6. Bezier curve
7. Cohen Sutherland Clipping algorithm
8. Mid point clipping algorithm
9. Mid point Ellipse drawing algorithm
10. Matrix Multiplication
11. 2-D Transformation (Move, Rotate, Scale)
12. Cubic Spline

**LIST OF EQUIPMENTS/MACHINES REQUIRED**

1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14” Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required – C & C++
MEASUREMENT LAB TO BE PERFORMED (MINIMUM 7 NUMBERS)
1. To Measure Pressure Using Bourdon Pressure Gauge.
2. To Calibrate Pressure Gauge Using Dead Weight Pressure Gauge Tester.
3. To Measure Displacement Using LVDT
4. To Measure Temperature Using Thermister
5. To Measure Flow Rate Using Rotameter.
6. To Measure Angle Using Angular Sensor.
7. To Measure Torque Using Torque Transducer
8. To Measure Pressure Using Pressure Transducer.
9. To Measure Strain Using Strain Cantilever Beam.
10. To Measure Temperature Using RTD.
11. To Measure Temperature Using Thermo Couple.
12. To perform the following experiments using Data Acquisition System
   a) To measure Temperature by Thermocouple
   b) To measure Temperature by Thermistor
   c) To measure Temperature by RTD.
   d) To measure Strain.

METROLOGY LAB TO BE PERFORMED (MINIMUM 5 NUMBERS)
1. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier Height Gauge, Micrometers.
3. Determining the accuracy of Electrical and Optical Comparator.
4. Determine the Surface Flatness and Contour using Interferometer.
5. Determine the Effective Diameter of screw threads by using Two wire & Three wire methods.

LIST OF EQUIPMENTS/MACHINES REQUIRED

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>METROLOGY</th>
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<tbody>
<tr>
<td>1. Data Acquisition System</td>
<td>1. Vernier Calipers</td>
</tr>
<tr>
<td>2. Software compatible with DAS</td>
<td>2. Vernier Height Gauge</td>
</tr>
<tr>
<td>3. Displacement Measurement Tutor Using (LVDT)</td>
<td>3. Depth Micrometers</td>
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<td>5. Strain Measurement Tutor Using Strain Cantilever Beam</td>
<td>5. Interferometer</td>
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<td>10. Angular Measurement Tutor Using Angular Sensor</td>
<td>10. Combination Set</td>
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<tr>
<td>11. Rotameter Trainer Module</td>
<td>11. Optical &amp; Electrical Comparator</td>
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<td>12. Dead Weight Pressure Gauge Tester</td>
<td>12. Optical Flats</td>
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<td>15. Snap and Ring Gauges (GO and NO-GO type)</td>
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Experiments to be performed: (minimum 10 experiments)

1. Static input characteristics curves of CE transistor.
2. Static output characteristic curve CE transistor.
3. Static input characteristic curve of CB transistor.
4. Static output characteristic curve of CB transistor.
5. To design and study the frequency response of single stage CE transistor amplifier.
6. To study the frequency response of RC coupled double stage CE transistor amplifier.
7. To study the frequency response of RC coupled double stage CE transistor amplifier with voltage feedback.
8. To study the frequency response of RC coupled double stage CE transistor amplifier with current feedback.
9. To plot the voltage gain vs. load characteristics of common collector (emitter follower) n-p-n transistor.
10. To study Wein Bridge Oscillator.
11. Experiment with emitter follower a voltage series feedback amplifier.
12. General study of pushpull audio power amplifier.
13. To study RC phase shift oscillator.
14. Study of various topologies of feedback amplifier.
15. Experiment with Darlington pair amplifier.

List of Equipments/Machine Required:
Circuit components, Power supply, CRO, Function generator, Multimeter, Breadboard.
**EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)**

1. To determine the jump phenomena of cam follower apparatus.
2. To draw displacement, velocity and acceleration curve of cam motion.
3. To find out the load carrying capacity of bearing.
4. To find out the Coefficient of friction of bearing.
5. To find out the frictional horse power of bearing.
6. To find out the Pressure around the bearing by journal bearing apparatus.
7. To measure co-efficient of friction, power transmitted with varied belt tension by slip & creep apparatus.
8. To find out the percentage slip at fixed belt tension by varying load with slip & creep apparatus.
9. To find out belt slip and creep by slip and creep measurement apparatus.
10. To verify the coriolli’s component of acceleration with theoretical and practical results.
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To find the speed and torque of different gear in a simple, compound and reverted gear train.
13. Study and analysis of Pantograph.
14. To study Four-bar mechanism and its inversions.
15. To study internal expanding and external contracting shoe brakes.
16. To study rope brake dynamometer and calculation of torque and power.

**LIST OF EQUIPMENTS/MACHINES REQUIRED**

1. Cam analysis apparatus
3. Coriolli’s component of acceleration apparatus
4. Slip & Creep Measurement Apparatus In Belt Drive
5. Simple, compound, reverted and epicyclic gear train apparatus.
6. Pantograph apparatus (with all accessories)
7. Internal / External shoe brake (complete set with accessories)
8. Four bar mechanism and its inversions.
9. Rope brake dynamometer apparatus (with all accessories)
10. Mechanoset.
UNIT- I

HEALTH & HYGIENE: Concept of health, Physical health and mental health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and under-eating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food v/s nutritious food; fruits, vegetables cereals and qualities of each of these.

UNIT- II

INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE: History, development, basic concepts, modes of operation of Allopathy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Accupressure, Accupuncture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.

UNIT- III

YOGASANS: Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasans, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Matsyasans, Shashankasan, Surya Namaskar, Halasan, Janushirasans, Utshap Mudra,

UNIT- IV

YOGASANS FOR COMMON DISEASES: From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

- Modern silent killers: High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomach disorders, such as, indigestion, acidity, dysentery, piles and fissures, artheritis, its causes, prevention and cure.
- Asans for relaxation: Shavasan, Makarasan, Masyakridasans, Shashankasan.
- Asans for eye sight: Tratak, Neti Kriya.
- Asans for increase memory and blood supply to brain: Shirsh padasan, Shashankasan.

UNIT V

CONCENTRATION: Concentration of mind and how to achieve it. Tratak $\frac{1}{4}=k\sqrt{d}\frac{1}{2}$ Concentration on breath, Japa $\frac{1}{4}+\frac{1}{2}$ Ajapajar $\frac{1}{4}+\frac{1}{2}$ internal silence $\frac{1}{4}+\sqrt{z}\frac{1}{2}$ visualisation in mental sky $\frac{1}{4}+\frac{1}{2}$ Concentration on point of light $\frac{1}{2}$;ksfr $\frac{1}{2}$ Concentration on feeling $\frac{1}{2}$hko $\frac{1}{2}$ Concentration on figure $\frac{1}{2}$ewUkZ $\frac{1}{2}$-ku$\frac{1}{2}$

REFERENCES

1. Yogic Materia Medica
2. Asan, Pranayam and Bandh