



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) Scheme in light of NEP-2020**  
**B. Tech in Mechatronics**  
**(2021-2025)**

| COURSE CODE | CATEG<br>ORY | COURSE NAME                   | TEACHING &EVALUATION SCHEME   |                  |                         |                               |                         |   |   |   |         |
|-------------|--------------|-------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |              |                               | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|             |              |                               | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMEMT709   | DCC          | DESIGN OF MACHINE<br>ELEMENTS | 60                            | 20               | 20                      | 30                            | 20                      | 3 | 1 | 2 | 5       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

This course will provide the following knowledge, skills and attitudes (1) To familiarize the various steps involved in the Design Process. (2) To understand the principles involved in evaluating the shape and dimensions of a components to satisfy functional and strength requirements. (3) To learn to use standard practices and standard data (4) To learn to use catalogues and standard machine components.

**Course Outcomes (COs):**

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Understand basic concepts of design.
2. Design temporary and permanent joints.
3. Design IC engine components and miscellaneous components- flywheels.
4. Design journal bearing and select antifriction bearing for state application.

*Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority).*

**Syllabus**

**Unit - I**

**Steady Stresses and Variable Stresses in Machine Members: (10 hr)**

Introduction to the design process, factors influencing machine design, selection of materials based on mechanical properties, preferred numbers, fits and tolerances. Direct, bending and torsional stress equations, Impact and shock loading; calculation of principle stresses for various load combinations, eccentric loading, curved beams, crane hook and 'C' frame. Factor of safety, theories of failure: design based on strength and stiffness; stress concentration. Design for variable loading.

**Unit - II**

**Shafts and Couplings: (9 hr)**

Design of solid and hollow shafts based on; strength, rigidity and critical speed; Keys, keyways and splines; Rigid and flexible couplings.

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of  
Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Joint Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) Scheme in light of NEP-2020**  
**B. Tech in Mechatronics**  
**(2021-2025)**

| COURSE CODE | CATEG<br>ORY | COURSE NAME                   | TEACHING &EVALUATION SCHEME   |                  |                         |                               |                         |   |   |   |         |
|-------------|--------------|-------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |              |                               | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|             |              |                               | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMEMT709   | DCC          | DESIGN OF MACHINE<br>ELEMENTS | 60                            | 20               | 20                      | 30                            | 20                      | 3 | 1 | 2 | 5       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

**\*Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### Unit - III

#### Temporary and Permanent Joints: (9 hr)

Threaded fasteners, bolted joints including eccentric loading, knuckle joints, cotter joints, welded joints, and riveted joints for structures; theory of bonded joints.

### Unit – IV

#### Energy Storing Elements and Engine Components: (9 hr)

Various types of springs, optimization of helical springs, rubber springs. Flywheels, considering stresses in rims and arms for engines and punching machines, connecting rods and crank shafts.

#### Unit-V Bearings: (8 hr)

Sliding contact and rolling contact bearings, Hydrodynamic journal bearings. Sommerfeld Number, Raimondi and Boyd graphs. Selection of Rolling Contact bearings.

#### Text Books:-

1. Bhandari .V, “Design of Machine Elements” 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

#### Reference Books:-

1. Sundararajamoorthy T.V. and Shanmugam .N, “Machine Design”, Anuradha Pub., Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, TMH, Schaum’s Outline), 2010.
4. Bernard H., Steven S. and Bo Jacobson, “Fundamentals of Machine Elements”, 2<sup>nd</sup> Ed. TMH, 2006.
5. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
6. Ansel Ugural, “Mechanical Design – An Integral Approach”, 1<sup>st</sup> Ed., Tata McGraw-Hill, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2003.

#### List of Experiments:

Designing and sketching of components as per the syllabus.

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of  
Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Joint Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

## BBAI501 HUMAN VALUES AND PROFESSIONAL ETHICS

| SUBJECT CODE | SUBJECT NAME                         | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |
|--------------|--------------------------------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|
|              |                                      | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P |
|              |                                      | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |
| BBAI501      | Human Values and Professional Ethics | 60                           | 20            | 20                   | -                       | -                    | 4 | - | - |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### Course Objectives

The objective of the course is to disseminate the theory and practice of moral code of conduct and familiarize the students with the concepts of "right" and "good" in individual, social and professional context

### Course Outcomes

1. Help the learners to determine what action or life is best to do or live.
2. Right conduct and good life.
3. To equip students with understanding of the ethical philosophies, principles, models that directly and indirectly affect business.

## COURSE CONTENT

### Unit I: Human Value

1. Definition, Essence, Features and Sources
2. Sources and Classification
3. Hierarchy of Values
4. Values Across Culture

### Unit II: Morality

1. Definition, Moral Behaviour and Systems
2. Characteristics of Moral Standards
3. Values Vs Ethics Vs Morality
4. Impression Formation and Management

  
Chairperson  
Board of Studies

Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore

  
Joint Registrar

Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore

### Unit III: Leadership in Indian Ethical Perspective.

1. Leadership, Characteristics
2. Leadership in Business (Styles), Types of Leadership (Scriptural, Political, Business and Charismatic)
3. Leadership Behaviour, Leadership Transformation in terms of Shastras (Upanihads, Smritis and Manu-smriti).

### Unit IV: Human Behavior – Indian Thoughts

1. Business Ethics its meaning and definition
2. Types, Objectives, Sources, Relevance in Business organisations.
3. Theories of Ethics. Codes of Ethics

### Unit V: Globalization and Ethics

1. Sources of Indian Ethos & its impact on human behavior
2. Corporate Citizenship and Social Responsibility – Concept (in Business),
3. Work Ethics and factors affecting work Ethics.

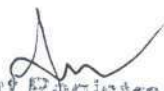
### Suggested Readings

1. Beteille, Andre (1991). *Society and Politics in India*. Athlone Press:New Jersey.
2. Chakraborty, S. K. (1999). *Values and Ethics for Organizations*. oxford university press
3. Fernando, A.C. (2009). *Business Ethics - An Indian Perspective*. India: Pearson Education: India
4. Fleddermann, Charles D. (2012). *Engineering Ethics*. New Jersey: Pearson Education / Prentice Hall.
5. Boatright, John R (2012). *Ethics and the Conduct of Business*. Pearson. Education: New Delhi.
6. Crane, Andrew and Matten, Dirk (2015). *Business Ethics*. Oxford University Press Inc:New York.
7. Murthy, C.S.V. (2016). *Business Ethics – Text and Cases*. Himalaya Publishing House Pvt. Ltd:Mumbai
8. Naagrajan, R.R (2016). *Professional Ethics and Human Values*. New Age International Publications:New Delhi.



**Chairperson**  
**Board of Studies**

Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore



**Joint Registrar**

Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE<br>CODE | CAT-<br>EGOR<br>Y | COURSE NAME     | TEACHING & EVALUATION SCHEME  |                  |                         |                               |                         |   |   |   |         |
|----------------|-------------------|-----------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|                |                   |                 | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|                |                   |                 | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMT703        |                   | System Modeling | 60                            | 20               | 20                      | 30                            | 20                      | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

The aim of this course is to

1. Introduce various system modeling and simulation techniques and highlight their applications in different areas.
2. It includes modeling, design, simulation, planning, verification and validation.
3. Solve real world problems which cannot be solved strictly by mathematical approaches.
4. Demonstrating the usefulness of simulation as a tool for problem solving in business, industry, government, and society

**Course Outcomes (COs):**

Upon completion of the course, students will be able:

1. To describe the components of continuous and discrete systems and simulate them.
2. To model any system from different fields.
3. To discuss the simulation methods and select the suitable technique on the problems.
4. Understand different methods for random number generation.
5. To simulate any discrete system using queuing systems.

**Syllabus**

**UNIT I**

**6 Hrs.**

Introduction to Simulation: Introduction – Simulation Terminologies, Application areas, Model Classification, Types of Simulation, Steps in a Simulation study, Concepts in Discrete Event Simulation, Simulation Examples

**UNIT II**

**8 Hrs.**

Mathematical models: Statistical Models, Concepts -Discrete Distribution, Continuous Distribution, Poisson Process, Empirical Distributions, Queuing Models- Characteristics Notation, Queuing Systems, Markovian Models- Generation of Pseudo Random numbers, Properties of random numbers, Techniques for generating random numbers, testing random number generators, Generating Random-Variates- Inverse Transform technique, Acceptance- Rejection technique, Composition & Convolution Method.



**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE<br>CODE | CAT-<br>EGOR<br>Y | COURSE NAME     | TEACHING & EVALUATION SCHEME  |                  |                         |                               |                         |   |   |   |         |
|----------------|-------------------|-----------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|                |                   |                 | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|                |                   |                 | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMT703        |                   | System Modeling | 60                            | 20               | 20                      | 30                            | 20                      | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### UNIT III

**7 Hrs.**

Analysis of Simulation Data: Input Modeling, Data collection, assessing sample independence, hypothesizing distribution family with data, Parameter Estimation, Goodness-of-fit tests, selecting input models in absence of data, Output analysis for a Single system - Terminating Simulations, Steady state simulations.

### UNIT IV

**6 Hrs.**

Verification and Validation: Model Building, Verification of Simulation Models, Calibration and Validation of Models, Validation of Model Assumptions, Validating Input – Output Transformations

### UNIT V

**7 Hrs.**

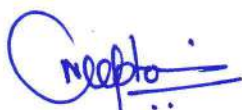
Simulation Of Computer Systems and Case Studies: Simulation Tools, Model Input, High level computer system simulation, CPU Memory Simulation, Comparison of systems via simulation, Simulation Programming techniques, Development of Simulation models.

#### Text Books:

1. Jerry Banks, John Carson, Barry Nelson, and David Nicol, "Discrete Event System Simulation", 5th Edition, Pearson/Prentice Hall, 2010.
2. Averill M. Law, "Simulation Modeling and Analysis", 6th Edition, McGraw-Hill, 2024.
3. Sheldon M. Ross, "Introduction to Probability Models", 13th Edition, Academic Press/Elsevier, 2024.

#### Reference Books:

1. Sheldon M. Ross, "Simulation", 6th Edition, Academic Press/Elsevier, 2024.
2. Averill M. Law, "Simulation Modeling and Analysis", 6th Edition, McGraw-Hill, 2024.



**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CAT-EGOR Y | COURSE NAME     | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|------------|-----------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |            |                 | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |            |                 | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTMT703     |            | System Modeling | 60                           | 20            | 20                   | 30                      | 20                   | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**List of Experiments:**

- 1.Introduction of Petri-nets, Uppaal, SMV.
- 2.Modeling with Petri Nets.
- 3.Primitives for Programming Constructs.
- 4.Sub-structures of Petri Nets.
- 5.Analysis of Petri Nets.
- 6.Introduction to Uppaal.
- 7.Model Checking.
- 8.Simulator and verifier.
- 9.Time and clocks.
- 10.Introduction To SMV.
- 11.SMV in Interactive Mode.
- 12.Case Study: Implementation of various system through modeling and simulation techniques using tools Perti-nets, Uppaal, and SMV.



**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics**  
**(2021-2025)**

| COURSE<br>CODE | CATE-<br>GORY | COURSE NAME   | TEACHING & EVALUATION SCHEME  |                  |                         |                               |                         |   |   |   |         |
|----------------|---------------|---------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|                |               |               | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|                |               |               | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTEI702        | DSE           | MEMS and NEMS | 60                            | 20               | 20                      | 30                            | 20                      | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

The main goal of this course is to make learners gain knowledge of designing and fabrication process which is essential for simulation of nanoelectronics devices.

1. To understand the limitations of silicon electronics and progress of nanoelectronics.
2. To study the significance of tunneling effect in nano electronic devices.
3. To understand the concepts of coulomb blockade and electron transport.
4. To emphasize the importance of electronic property of materials at a mesoscopic level

**Course Outcomes (COs):**

1. Students will understand the diver's electronic device fabrication.
2. Students will have in-depth technical knowledge in one or more areas of specialization.
3. Students will have practical understanding of the major engineering concepts and demonstrate application of their theoretical knowledge of the concepts and help to get the academic and industrial jobs.
4. Students will be able to interact scientifically with industry both within and outside of a classroom setting.
5. Students will develop an appreciation of continuing educational and professional development.

**Syllabus**

**UNIT I**

**7 Hrs.**

**UNIT I OVERVIEW AND INTRODUCTION**

New trends in Engineering and Science: Micro and Nano scale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Micro electromechanical Systems, Applications of Micro and Nano electromechanical systems, Micro electromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals.

**UNIT II MEMS FABRICATION TECHNOLOGIES**

**8 Hrs.**

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching,

**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics**  
**(2021-2025)**

(2021-2025)

| COURSE CODE | CATE-GORY | COURSE NAME   | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|-----------|---------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |           |               | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |           |               | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTEI702     | DSE       | MEMS and NEMS | 60                           | 20            | 20                   | 30                      | 20                   | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

### UNIT III MICRO SENSORS

7 Hrs.

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

### UNIT IV MICRO ACTUATORS

7 Hrs.

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.

### UNIT V NANOSYSTEMS AND QUANTUM MECHANICS

7 Hrs.

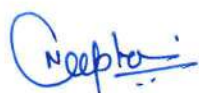
Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

#### Text Books:

1. Marc Madou, "Fundamentals of Micro fabrication", CRC press 1997.
2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001

#### References:

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006
3. www.tutorials point.com.

  
Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics**  
**(2021-2025)**

| COURSE CODE | CATE-GORY | COURSE NAME   | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|-----------|---------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |           |               | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |           |               | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTEI702     | DSE       | MEMS and NEMS | 60                           | 20            | 20                   | 30                      | 20                   | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

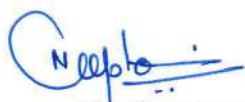
\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**List of Experiments:**

1. To diagram the output's properties, Comparison of n- and p-channel MOSFET transfer characteristics.
2. To create 2-input NAND, NOR XOR, and XNOR logic gates and then visualise their dynamic features using CMOS technology.
3. Create a positive and negative latch and then draw its features using multiplexers.
4. Using multiplexers, create a master/slave positive/negative edge triggered register and then visualise its properties.
5. To plan CMOS and NMOS inverter circuitry.
6. Common-source amplifier frequency response analysis.
7. Frequency response analysis of common drain amplifiers
8. Single-Stage Cascode Amplifier Design and Simulation.
9. The Cascode Current Mirror Amplifier, a Very Simple Current Mirror, and Their Design and Simulation.
10. Building and simulating a 5-transistor differential amplifier.



**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CATE GORY | COURSE NAME             | TEACHING &EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|-----------|-------------------------|-----------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |           |                         | THEORY                      |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |           |                         | END SEM University Exam     | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTMT714     |           | Virtual Instrumentation | 60                          | 20            | 20                   | 30                      | 20                   | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

**\*Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

To understand the concept of:

1. Introduction of Virtual Instrumentation.
2. LABVIEW programming.

**Course Outcomes (COs):**

After successfully completing the course students will be able to:

1. Describe the concept Virtual Instrumentation.
2. Design various circuit on LABVIEW.

**Syllabus**

**UNIT I**

**7 Hrs.**

Virtual instrument and traditional instrument, Hardware and software in virtual instrumentation, Virtual instrumentation for Test, control & design, Graphical system design using LABVIEW, Graphical programming & textual programming.

**UNIT II**

**8 Hrs.**

Introduction to LabVIEW: Introduction, advantages of LABVIEW software environment, palettes, front panel controls & indicators, Block diagram, Data flow program. Repetition and Loops: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, case structure.

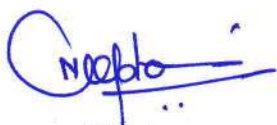
**UNIT III 7 Hrs.**

Arrays: Introduction, arrays in LABVIEW, creating one – dimensional array controls, indicators and constants, creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages within arrays, arrays functions.



**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CATEG ORY | COURSE NAME             | TEACHING &EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|-----------|-------------------------|-----------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |           |                         | THEORY                      |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |           |                         | END SEM University Exam     | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTMT714     |           | Virtual Instrumentation | 60                          | 20            | 20                   | 30                      | 20                   | 3 | 0 | 2 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

#### UNIT IV

7 Hrs.

Plotting Data: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs & charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph.

#### UNIT V

8 Hrs.

File Input/ Output: File formats, file write & read, generating filenames automatically, String handling: string functions, LABVIEW string formats, parsing of strings.

#### Text Books:

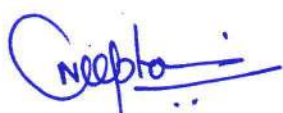
1. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, "LabView: Advanced Programming Techniques", 2nd Edition, CRC Press, 2007.
2. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.

#### Reference books:

1. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", PHI Learning Pvt. Ltd., March 2010

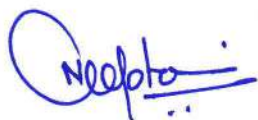
#### List of Experiments:

1. Creating Virtual Instrumentation for simple applications.
2. Design a program for loops and charts.
3. Design a program for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Simulation of CRO using LABVIEW.
7. Simulation of Function Generator using LABVIEW.
8. Simulating reactor control using Virtual Instrumentation.
9. Real time temperature control using Virtual Instrumentation.
10. Real time sequential control of any batch process.



**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| B.Tech. in Mechatronics (Sem. 2022) |           |                        |                              |               |                      |                         |                      |   |   |   |         |
|-------------------------------------|-----------|------------------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
| COURSE CODE                         | CATE-GORY | COURSE NAME            | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|                                     |           |                        | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|                                     |           |                        | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTMT721                             |           | Automotive Electronics | 60                           | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C – Credit.

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

To understand the concept of:

1. Automotive Electronics and it's evolution and trends
2. Automotive systems & subsystems overview.
3. Sensors and sensor monitoring mechanisms aligned to automotive systems.
4. Design of various automotive control systems using Model based development technique.

**Course Outcomes (COs):**

After successfully completing the course students will be able to:

1. Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry.
2. Interface automotive sensors and actuators with microcontrollers
3. Develop, simulate and integrate control algorithms for ECUs with hardware.

**Syllabus**

**UNIT I**

**7 Hrs.**

Automotive Systems, Design Cycle and Automotive Industry Overview. Overview of Automotive Industry: Leading players, Automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes.

**UNIT II**

**8 Hrs.**

Introduction to Modern Automotive Systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles. Spark and Compression Engines: Ignition systems, Fuel delivery systems, Engine control functions, Fuel control, electronic systems in engines.

**UNIT III**

**7 Hrs.**

Automotive transmissions: Transmission fundamentals, Types MT, AT, CVT and DCT. Vehicle Braking Fundamentals: Vehicle dynamics during braking, Hydraulic brake system components, Introduction to antilock braking systems.

**UNIT IV**

**8 Hrs.**

Steering Control: Steering system basics, Fundamentals of electronically controlled power steering, electronically controlled hydraulic systems and electric power steering systems, Passenger safety and convenience, Occupant protection systems, Tyre pressure monitoring systems.

**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CATE-GORY | COURSE NAME            | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|-------------|-----------|------------------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |           |                        | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|             |           |                        | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTMT721     |           | Automotive Electronics | 60                           | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit.

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

#### UNIT V

9 Hrs.

Automotive Sensors and Actuators Systems Approach to Control and Instrumentation: Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in Engine Control Units (ECU), Avoiding redundancy, Sensor, modeling, Smart Nodes.

#### Text Books:

1. William Ribbens, "Understanding Automotive Electronics: An Engineering Perspective", 8th Edition, Butterworth-Heinemann (Elsevier), 2017.
2. Robert Bosch GmbH, "Bosch Automotive Handbook", 11th Edition, Wiley, 2022.

#### Reference books:

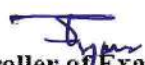
1. James D. Halderman, "Automotive Electricity and Electronics", 6th Edition, Pearson, 2020.
2. David G. Alciatore (with Michael B. Histand), "Introduction to Mechatronics and Measurement Systems", 5th Edition, McGraw-Hill Education, 2019.



**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

**Name of Program: Bachelor of Technology in Robotics and Automation w.e.f. 2021**

| SUBJECT CODE | Category | SUBJECT NAME             | TEACHING & EVALUATION SCHEME |               |                      |                         |                      |   |   |   |         |
|--------------|----------|--------------------------|------------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|              |          |                          | THEORY                       |               |                      | PRACTICAL               |                      | L | T | P | CREDITS |
|              |          |                          | END SEM University Exam      | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BTRA601      | EC       | Advanced Control Systems | 60                           | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit.

\***Teacher Assessment** shall be based on the following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

## Course Educational Objectives (CEOs):

The course will provide understanding of linear and nonlinear control systems. Students will understand the Conventional and Intelligent Control Systems.

## Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Develop of state models for linear continuous – time and discrete – time systems.
2. Demonstrate non-linear system behavior by phase plane and describing function methods.
3. Design pole assignment and state observer using state feedback.
4. Develop the describing function for the nonlinearity present to assess the stability of the system.
5. Develop Lyapunov function for the stability analysis of nonlinear systems.
6. Study the design of optimal controller.

## UNIT I

9 Hrs.

### Introduction to Control

Review of Linear Control System: Modeling through differential equations and difference equations, state space method of description and its solution, discretization of continuous time, state space model, Laplace and z-domain analyses of control systems, PID Controller, Controllability, Observability & Stability, Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

## UNIT II

8 Hrs.

### State Variable Design

Introduction to state Model, effect of state Feedback, Necessary and Sufficient Condition for Arbitrary Pole-placement, pole placement Design, design of state Observers, separation principle, servo design, State Feedback with integral control.

## UNIT III

9 Hrs.

### Phase Plane Analysis

Features of linear and non-linear systems, Common physical non-linearities, Methods of linearization, Concept of phase portraits, Singular points, Limit cycles, Construction of phase portraits, Phase plane analysis of linear and non-linear systems, Isocline method.



Chairperson  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



Chairperson  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
Controller of Examinations  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

  
Registrar  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## UNIT IV

8 Hrs.

### Control of Nonlinear Dynamics

Lyapunov's Stability Theorems, Lyapunov's Method for Linear Time Invariant Systems, Stability of Nonlinear Systems by Method of Lyapunov, Krasovskii's Theorem on Lyapunov Function, Application of Lyapunov Function to Estimate Transients.

## UNIT V

9 Hrs.

### Optimal Control

Formulation of the Optimal Control Problem, Optimal Control System Design Using Second Method of Lyapunov, Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversal condition Bolza problem, Pontryagin's maximum principle.

### Text Books:

1. M. Gopal, "Modern Control System Theory", New Age International Publishers, 2002.
2. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
3. G. J. Thaler, "Automatic Control Systems", Jaico Publishing House, 2000.

### References:

1. K. Ogata, "Modern Control Engineering", 4th edition, PHI, New Delhi, 2002.
2. B.S. Manke, "Advanced Control System", Khanna Publication.
3. D.S. Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.
4. M. Gopal, "Digital Control and State Variable Methods: Conventional and Intelligent Control Systems", McGraw Hill 4<sup>th</sup> Edition, 2012

Chairperson  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

Chairperson  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

Controller of Examinations  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

Registrar  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CATEG<br>ORY | COURSE NAME           | TEACHING & EVALUATION SCHEME  |                  |                         |                               |                         |   |   |   |         |
|-------------|--------------|-----------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |              |                       | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|             |              |                       | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMT722     |              | Aerospace Electronics | 60                            | 20               | 20                      | 0                             | 0                       | 3 | 1 | 0 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

To understand the concept of:

1. Basics of avionics and its need.
2. Digital avionics architecture and various avionics data buses.
3. Control and display technology and navigation system.
5. Air data systems and auto pilot.

**Course Outcomes (COs):**

After successfully completing the course students will be able to:

1. Explain basics of avionics.
2. Describe architecture of digital avionics.
3. Analyze Navigation system, performance of various cockpit display technologies and air system.

**Syllabus**

**UNIT I**

**7 Hrs.**

Aerospace Electronics in civil and military aircraft and space systems, Integrated avionics and weapon systems, avionics subsystems, design, technologies.

**UNIT II**

**8 Hrs.**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

**UNIT III**

**7 Hrs.**

Control and display technologies: CRT, LED, LCD, EL and plasma panel, Touch screen, Direct voice input (DVI).

Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**UNIT IV**

**7 Hrs.**

Radio navigation: ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS, Inertial Navigation Systems (INS), Inertial sensors, INS block diagram, Satellite navigation systems, GPS.



**Chairperson**

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Shri Vaishnav Institute of Technology and Science**  
**Choice Based Credit System (CBCS) in the Light of NEP-2020**  
**B.Tech. in Mechatronics w.e.f. 2022**

| COURSE CODE | CATEG<br>ORY | COURSE NAME           | TEACHING & EVALUATION SCHEME  |                  |                         |                               |                         |   |   |   |         |
|-------------|--------------|-----------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |              |                       | THEORY                        |                  |                         | PRACTICAL                     |                         | L | T | P | CREDITS |
|             |              |                       | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BTMT722     |              | Aerospace Electronics | 60                            | 20               | 20                      | 0                             | 0                       | 3 | 1 | 0 | 4       |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**UNIT V**

**8 Hrs.**

Air data quantities: Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning, Auto pilot, Basic principles, Longitudinal and lateral auto pilot.

**Text Books:**

1. Albert D. Helfrick, "Principles of Avionics", 9th Edition, Avionics Communications Inc., 2017.
2. E.H.J. Pallett, "Aircraft Instruments and Integrated Systems", Pearson India, 2011.

**Reference books:**

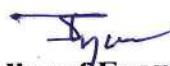
1. Cary R. Spitzer, Uma Ferrell, and Thomas Ferrell (Editors), "Digital Avionics Handbook", 3rd Edition, CRC Press, 2015.



**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore