Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in the Light of NEP-2020
Diploma
Common to EE/EX/EI/MTX w.e.f. 2024

COURSE CODE	CATE GORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDEITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTEE601N		Control Systems	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 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 control system and mathematical modeling of the system.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Demonstrate the understanding of basic elements and modeling of the control system.
2. Analyze the stability in time domain and frequency domain
3. Design the controller and compensators for the system

Syllabus

UNIT I **8Hrs.**
Introduction: Basic Elements of Control System, Open and closed loop control system and their merits and demerits, Block representation of simple systems, Block diagram reduction technique, Signal flow graph of control systems, Mason's gain formula, Transfer function of electrical, Mechanical and electromechanical system.

UNIT II **8 Hrs.**
Time Domain Analysis: Time domain analysis, Type and order of a control system, typical test signals for time response analysis of a control system, Time response of first and second order control systems, Basic ideas of proportional, derivative and integral controllers and PID controllers.

UNIT III **7 Hrs.**
Stability Analysis and Root locus: Concept of stability, Routh Hurwitz criterion- different cases and conditions, Root locus technique, basic theory and properties of root loci, procedure for construction of root loci.

UNIT IV **6 Hrs.**
Frequency domain Analysis: Frequency domain analysis, frequency response, frequency domain specifications, Bode plot, Nyquist stability criterion, relative stability, gain margin, phase margin,

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			THEORY			PRACTICAL		L	T	P	CREDEITS
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DTEE601N		Control Systems	60	20	20	30	20	3	1	2	5

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UNIT V **6 Hrs.**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Solution of state equation: Concepts of Controllability and Observability.

Textbooks:

1. Richard C Dorf; Robert H Bishop, "Modern control system", Pearson Education, 14th Edition, 2022
2. I. J. Nagrath and M. Gopal, "Control System Engineering", Age International Publishers, 7th Edition, 2021.

References:

1. M. F. Golnaraghi and Benjamin C Kuo, "Automatic control systems", New York McGraw-Hill Education, 9th Edition, 2017.
2. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill, 4th Edition, 2014.
3. Joseph J DiStefano, Allen R Stubberud and Ivan J Williams, Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2nd Edition 2014.
4. John J. D'azzo & Constantine H. Houpis, "Linear control system analysis and design", Tata McGraw-Hill, 5th Edition 2003.

List of Experiments:

1. To study the torque-speed characteristics and determine the transfer function of a d,c, motor.
2. To study the characteristics of a small a.c. servomotor and determine its transfer function.
3. To study the performance of various types of controllers used to control the temperature of an oven.
4. Perform impulse response of a transfer function.
5. Perform ramp response of a transfer function.
6. Draw Nyquist plot from a transfer function.
7. Draw root locus from a transfer function.
8. Draw bode plot from a transfer function.

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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*				
DTET502	DC	Embedded Systems	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** – Credit.
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Course Educational Objectives (CEOs):

1. To introduce students to smart devices and how they work in everyday life (like washing machines, mobile phones, and cars).
2. To teach programming of small computers (microcontrollers) that control real-world devices.
3. To develop skills in connecting sensors, displays, and motors to create intelligent systems.
4. To build practical projects that solve real problems using embedded technology.

Course Outcomes (COs):

After completing this course, students will be able to:

1. Understand embedded systems, working smart devices around us work and their applications.
2. Write simple microcontroller programs to control LEDs, motors, and sensors.
3. Interface hardware and connect different components like displays, keyboards, and sensors to microcontrollers.
4. Design practical projects like digital clocks, temperature controllers, and security systems.

Syllabus

UNIT I **7 Hrs.**

Introduction to Embedded system. Characteristics: Real-time operation, low power, small size, reliability Types of embedded systems, Applications in daily life, Basic architecture: Processor, Memory, Input/Output, Software. Difference between general-purpose computers and embedded systems

UNIT II **8 Hrs.**

Introduction to 8051 Microcontroller: Why 8051 is popular for learning Pin diagram and basic architecture CPU, Memory (RAM, ROM), Timers, Interrupts Memory organization: Program memory vs Data memory Special function registers (SFRs) Input/Output ports: Port 0, 1, 2, 3 functions Reading switches and controlling LEDs Addressing modes: Immediate, Direct, Indirect addressing (with simple examples) Basic instruction set: Data transfer, arithmetic, logical, branch instruction limitations.

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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*				
DTET502	DC	Embedded Systems	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** – Credit.
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UNIT III **8 Hrs.**

Programming in C: Basic C programs for 8051, Variables, loops, functions for embedded systems, Basic interfacing.

UNIT IV **8 Hrs.**

Communication basics: Serial communication (UART), I2C protocol SPI protocol, Analog to Digital Converter, Digital to Analog Converter, Interrupts, Timer and counters.

UNIT V **10 Hrs.**

Real-time concepts: What is real-time? Hard vs Soft real-time systems Task scheduling basics Power management: Sleep modes and power saving.

Text Books:

1. Mazidi M. A., "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2nd Edition, 2013.
2. Rajkamal, "Embedded Systems: Architecture, Programming and Design", TMH, 3rd Edition, 2014.

Reference Books:

1. Shibu K. V., "Introduction to Embedded Systems", TMH, 1st Edition, 2009.
2. Lyla B. Das, "Embedded Systems: An Integrated Approach", Pearson Education, 1st Edition,2013.
3. Frank Vahid, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley, 2nd Edition, 2002.

List of Experiments:

1. Basic LED Control - Blinking LED, LED patterns, traffic light simulation.
2. Switch Interfacing - Reading push buttons, toggle switches.
3. 7-Segment Display - Single digit display, counter, digital clock.

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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*				
DTET502	DC	Embedded Systems	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** – Credit.
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4. LCD Interfacing - Text display, scrolling messages, menu system.
5. Keypad Interfacing - 4x4 keypad, password entry system.
6. Temperature Monitoring - LM35 sensor, digital thermometer with alarm.
7. Motor Control - DC motor speed control, stepper motor control.
8. Serial Communication - Data transfer between microcontroller and PC.
9. ADC Application - Light intensity measurement, voltage monitoring.
10. Mini Project - Complete system (Security alarm, Automatic water level controller, Digital clock with alarm).

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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*				
DTMT502	BEC	Design of Mechatronics System	60	20	20	30	20	3	0	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):
The subject aims to provide the student with:
1. Understanding of Mechatronics system design.
2. Understanding of design process.
3. Implementation of the design process.

Course Outcomes (COs):
Students will:
1. Explain application of mechatronics system.
2. Describe various design processes.
3. Demonstrate approach of mechatronics in day-to-day appliances.

Syllabus

UNIT I **8 Hrs.**

Introduction: Mechatronics design issue, key elements of Mechatronics: Information system, Mechanical system, Electrical system, Computer system, Sensors and Actuators,

UNIT II **6 Hrs.**

Design process: Type of design, Integrated product design, Mechanism, load condition design and flexibility, structures, man machine interface, industrial design and ergonomics, information trans fer, safety.

UNIT III **8 Hrs.**

Real time interfacing: Advanced approaches in Mechatronics. elements of Data Acquisition and Control System, overview of I/O process, Installation of I/O chard and software.

UNIT IV **8 Hrs.**

Case Study: Thermal cycle Fatigue of a Ceramic Plate, PH control system, De-Icing Temperature Control System, Skip control of CD player, speed control of a DC Motor and speed control of a Stepper Motor.

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w.e.f. 2023

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*				
DTMT502	BEC	Design of Mechatronics System	60	20	20	30	20	3	0	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 V **9 Hrs.**

Case Study (Mechatronics): Pick and Place robot, car park barrier system, Automatic Camera, car engine management system, Bar Code Reader, coin counter, automatic washing machine, automatic windscreen wiper in Car Systems, automatic room heating system, Intelligent Mechatronic Devices.

Text Books:

1. Devdas Shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011.
2. Georg Pelz, "Mechatronic Systems: Modeling and simulation" with HDLs, John Wiley and sons Ltd, 2003.

References:

1. Bishop, Robert H, "Mechatronics Handbook", CRC Press, 2002.
2. Bradley, D. Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991, First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor and Francis, Indian Reprint, 2013.

List of Experiments.

1. To study mechatronics systems and elements of mechatronics systems.
2. To study and analysis of Mechatronics products and systems in manufacturing.
3. To perform various PLC Ladder logics through Siemens PLC kit and Step-7 Micro/Win software.
4. To design and develop networks for control valve study on H- simulator and P- simulator
5. To perform an experiment using Electro pneumatic kit.
6. To perform function of X-Y table and conveyer belt using PLC interface with PC.
7. Analysis of Speed control stepper and servo motor using microprocessor kit.
8. Design program for Pic and Place Robot.
9. To make ladder logic for Automatic door opening and closing.
10. To study and perform control valves function on electro pneumatic trainer kit.

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Diploma(All Branches) w.e.f. 2023

COURSE CODE	CATEGORY	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*				
DTET504		PLC Lab	0	0	0	30	20	0	0	4	2

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. Fundamentals of Programmable Logic Controllers and their industrial applications.
2. PLC programming using Ladder Logic and basic programming languages.
3. Interfacing input/output devices with PLC systems.

Course Outcomes (COs):
After completing the course students will be able to:

1. Explain the architecture and working principles of PLC systems.
2. Develop ladder logic programs for basic industrial automation applications.
3. Interface sensors, actuators, and control devices with PLC.
4. Troubleshoot and commission simple PLC-based control systems.

List of Experiments:

1. Study of PLC hardware architecture and I/O modules.
2. Introduction to PLC programming software and ladder logic basics.
3. Programming exercises on basic logic gates (AND, OR, NOT, NAND, NOR) using PLC.
4. Programming for motor control applications:
   - Single motor start/stop control
   - Forward-reverse motor control
5. Programming for timers and counters:
   - ON-delay timer application
   - OFF-delay timer application
   - Up counter and down counter applications
6. Design and implementation of sequential control circuits using PLC.
7. Traffic light control system simulation using PLC.
8. Automatic star-delta starter control using PLC.
9. Conveyor belt control system using PLC.
10. Temperature monitoring and control using PLC with analog inputs.

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COURSE CODE	CATEGORY	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*				
DTET504		**PLC Lab**	0	0	0	30	20	0	0	4	**2**

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.

Text Books:

1. Frank D. Petruzella, "Programmable Logic Controllers", 6th Edition, McGraw-Hill Education, 2022.
2. M. T. White, "PLCs for Beginners: An Introductory Guide to Building Robust PLC Programs with Structured Text", Packt Publishing, 2024.

Reference Books:

1. Gary A. Dunning, "Introduction to Programmable Logic Controllers", 3rd Edition, Delmar Cengage Learning, 2006.
2. Ashraf Said AlMadhoun, "PLC SCADA for Beginners: Understanding and Implementing Industrial Automation Systems", Springer, 2023.
3. Himanshu Kumar, "Advanced Industrial Automation: PLC Programming in Simplest Way with 110 Solved Examples", Notion Press, 2020.
4. R. G. Jamkar, "Industrial Automation Using PLC SCADA & DCS", Dreamtech Press, 2019.

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