Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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

SUBJECT CODE	Cate-gory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assess-ment*	END SEM University Exam	Teachers Assess-ment*				
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.

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UNIT IV **8 Hrs.**

Control of Nonlinear Dynamics

Lyapunov's Stability Theorems, Lyapunovs 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, Pontyazin'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 4th Edition, 2012

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Name of Program: B.Tech. in Electronics and Communication with Specialization in IOT (w.e.f. 2018)

SUBJECT CODE	Catego-ry	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*				
BTECIOT701	EC	**Real Time Operating Systems**	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 Objectives:-

The subject aims to provide the student with:
1. To understand the concepts of Operating System.
2. To obtain hands-on experience in programming Real time OS.

Course Outcomes:-
After completion of the course student will be able
1. Explain the operating system concepts and types of operating system.
2. Demonstrate deadlock and memory management techniques.
3. Demonstrate concepts of real time operating system implementation

Syllabus

UNIT I **9 Hrs.**
Introduction to Operating System, Goals of an OS, Operation of an OS, Computer Architecture, Classes of Operating Systems, Structure of an Operating System, Memory Management: Single User Contiguous Scheme, Dynamic Partitions, Best-Fit Versus First-Fit Allocation, Deallocation, Paged Memory Allocation, Demand Paging, Page Replacement Policies, Segmented Memory Allocation.

UNIT II **8 Hrs.**
Process Management: Processes and programs, Implementing processes, Threads, Process Synchronization, Semaphores, Monitors, Scheduling terminology and its concepts, Deadlock: Detection, Prevention and Avoidance.

UNIT III **9 Hrs.**
Introduction to RTOS, Cortex-M Processor Architecture, ARM Cortex-M Assembly Language, Pointers in C, Memory Management,MSP432 I/O programming, Interrupts, First in First Out (FIFO) Queues, Edge-triggered Interrupts, UART Interface, Basic principles of Input Capture, Pulse Width modulation on MSP432, OS Considerations for I/O Devices, Debugging.

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UNIT IV **8 Hrs.**

Thread Management: Parallel, distributed and concurrent programming, Introduction to threads, States of a main thread, Two types of threads, Thread Control Block, Creation of threads, Switching threads, Profiling the OS, Semaphores, Thread Synchronization, Process Management, Dynamic loading and linking

UNIT V **9 Hrs.**

Time Management: Cooperation, Blocking semaphores, First in First out Queue, Thread Sleeping, Deadlocks, Monitors, Fixed Scheduling.

Real-time Systems: Data Acquisition Systems, Priority scheduler, Debouncing a switch, Texas Instruments RTOS, FreeRTOS

Text Books:

1. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach", McGraw Hill Education; Third Edition,2017
2. Ann Mciver Mchoes ,Ida M. Flynn , "Understanding Operating Systems"., Cengage Learning Sixth Edition
3. Jonathan W. Valvano, "Real-Time Operating Systems for ARM Cortex-M Microcontrollers", Volume 3, Fourth Edition, 2017

References:

1. Rob Williams, "Real Time Systems Development"., First Edition, Elsevier 2006
2. Phillip A. Laplante, Seppo J. Ovaska, "Real Time Systems Design And Analysis: Tools for the Practitioner", Fourth Edition IEEE Press, 2012
3. Andrew S. Tanenbaum, Herbert Bos "Modern Operating Systems", Pearson, Fourth Edition, 2012

List of Experiments:

1. To develop the process scheduling algorithm.
2. TINY OS
3. Creation of tasks and task communication using TINY OS
4. Task pending and deletion from TINY OS
5. Task Suspension in TINY OS
6. Understand DEADLOCK in TINY OS
7. Porting TINY OS on microcontroller
8. Traffic light controller using TINY OS

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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*				
BTRA602		Computer Aided Design and Manufacturing	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):
This course provides a fundamental understanding of

1. Design concepts with the help of computer applications.
2. Comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies and Manufacturing.

Course Outcomes (COs):
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student will be able to understand the various Design concepts with the help of computer application.
2. Students will be able to acquire knowledge of the applications of computers in design and manufacturing of real-world product.

Syllabus

UNIT I **8 Hrs.**

Introduction: Introduction to CAD, Why CAD Software, Scope, Objective, Benefit, Limitation & Evaluation, Engineering Design Process, Design Considerations, Total Life Cycle, Information Requirements of Mfg. Organizations, Business Forecasting and Aggregate Production Plan, MPS, MRP and Production Activity Control (PAC), Introduction of CAD, CAE, CAM, CAP, CAPP, CATD And CAQ.

UNIT II **8 Hrs.**

Graphics Fundamentals and Standards: Raster Scan, Coordinate Systems for Model (M/ WCS) User and Display, Database for Graphic Modelling, PDM, PIM, EDM, Define EDM, Features of EDM, Basic Transformations of Geometry-Translation, Scaling, Rotation and Mirror, Need for CAD Data Standardization, Developments in Drawing Data Exchange Formats, GKS, PHIGS, CORE, IGES, DXF STEP DMIS and VDI.

UNIT III **9 Hrs.**

Geometric Modeling in CAD : Introduction to Geometric Modeling, Types of Geometric Model(2D And 3D), Types of Geometric Modeling(Wireframe Modeling-2D and 3D, Surface and Solid or Volume Modeling), Solid Modeling- Linear, Extrusion and Rotational Sweep, Boundary Representation, Constructive Solid Geometry (CSG), Curve Representation, Types of

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Curve Representation, Introduction to Analytical (Line, Circle And Ellipse) and Synthetic Curves (Spline, Bezier, B-Spline and NURBS).

UNIT IV **9 Hrs.**

Computer-Aided Manufacturing: Computer-Aided Manufacturing, Computer Applications in a Manufacturing Plant, Key Aspects of CAM in a Manufacturing System and Manufacturing Control, NC, CNC, DNC Machines and Machine Center, Classification of NC Machine, Nomenclature of NC Machine Axes, NC Modes of Position And Motion Control (Point To Point, Line, 2D, And 3D Contouring).

UNIT V **9 Hrs.**

NC Part Programming and Computer Integrated Manufacturing: NC Part Programming; ISO Standard for Coding, Preparatory Functions(G)-Motion, Dwell, Unit, Preset, Cutter Compensation, Coordinate and Plane Selection Groups; Miscellaneous (M) Codes, Absolute and Incremental Programming.

Introduction to CIM, Scope, Objectives and Benefits of Computer Integrated Manufacturing; CIM Wheel.

Text Books:

1. P. Radhakrishnan, Subramanian S and Raju V, "CAD/CAM/CIM"; New Age Pub., 2008.
2. Mikell P. Groover and Emory W. Zimmer, "CAD/CAM Computer Aided Design and Manufacturing", 2008.

References:

1. S. Kant Vajpay, "Principles of CIM", PHI, 1995.
2. Rao PN, "CAD/CAM"; TMH, 2010.
3. David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, "Computer Integrated Design and Manufacturing", McGraw-Hill, 1991.

List of Experiments:

The students will be required to carry out the following exercises using educational software (Auto CAD, Creo, Solid works, Master CAM etc).

1. Setting of drawing environment by setting drawing units, naming the drawing, naming layers, setting line types of different layers.
2. To Draw Orthographic Projection Drawings (Front, Top and side) of a given model.
3. Draw 3D models by extruding, revolve, sweep, loft & other 3D Modelling commands in Creo.
4. Prepare Assembled 3d CAD models of knuckle joint, cotter joint & Plummer block through Creo CAD modelling software.
5. 3D Assembly of Flange Coupling
6. 3D Assembly of Screw Jack
7. 3D Assembly of Connecting rod.
8. 3D Assembly of Universal Joint.
9. Use of CAM software for writing CNC programs
10. Write the program prepare any work piece through CNC Machine.

Shri Vaishnav Vidyapeeth Vishwavidyalaya

Name of Program: Bachelor of Technology in Electronics & Communication

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*				
BTEC515	EC	Data Communication and Computer Networks	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 Objectives:

1. Introduce the concept of communication protocols and give an overview of Data Communication Standards.
2. Allow the student to gain expertise in specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes:

Student will be able to:

1. Understand the principles of Open Systems and the Transport/Application protocols, which facilitate them.
2. Analyze the services and features of the various layers of data networks.
3. Explain the importance of data communications and the Internet in supporting business communications and daily activities.

Syllabus:

UNIT I **08 Hrs.**

Introduction: data communications, network criteria, categories of networks, network performance and transmission impairments, network devices, protocols and standards, data representation, data transmission, transmission modes, transmission media, LAN topologies, network models, layered tasks, the OSI model, TCP/IP protocol suite, addressing, encoding, switching technique and multiplexing.

UNIT II **10 Hrs.**

Data link control, point-to-point and multi-point links, flow control techniques, error control techniques, HDLC as a bit oriented link control protocol, Ethernet, fast Ethernet, gigabit Ethernet, token ring, token bus, FDDI , multiple access protocols-pure and slotted aloha, wireless LANs: IEEE &02.11 and Bluetooth, introduction to virtual circuit switching including frame relay, X.25.

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UNIT III **10 Hrs.**

Network layer design issues, routing versus forwarding, static and dynamic routing, unicast and multicast routing, distance-vector, link-state, shortest path computation, dijkstra's algorithm, congestion control algorithms, network layer protocols (IP, ICMP, ARP, RARP, DHCP, BOOTP), IP addressing, IPv4, IPv6.

UNIT IV **10 Hrs.**

UDP, TCP and SCTP, multiplexing with TCP and UDP, principles of congestion control, Approaches to congestion control, Quality of service, flow characteristics, techniques to improve QoS.

UNIT V **07 Hrs.**

Domain name system , domain name space, dynamic domain name system, electronic mail and file transfer, WWW, HTTP, SNMP, overview of digital signature and digital certificates technology, cryptography – basic concepts, public/private key encryption.

Text Books:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw–Hill, Fourth Edition, 2011.
2. Andrew S. Tanenbaum, "Computer Networks", Pearson education, Fourth Edition, 2009.

References:

1. Prakash C. Gupta, "Data Communications and Computer Networks", PHI, Second Edition, 2014.
2. Ajit Pal, "Data Communications and Computer Networks", PHI, First Edition, 2014.
3. Wayne Tomasi , "Introduction to Data communications and Networking", Pearson education, First Edition, 2009.

List of Experiments:

1. To study of Different Types of Network Equipment's.
2. To perform data transmission using RS-232 Interface.
3. To perform Synchronous and Asynchronous transmission.
4. To perform Parallel and Serial transmission.
5. To implement Ring topology using DB-9.
6. To implement cross cable connection and straight cable connection.
7. To study of network IP.
8. To implement & simulate various types of routing algorithm using Network Simulator.
9. To simulate STOP AND WAIT Protocols on NS-2.
10. To simulate various Routing Protocol on NS-2.
11. To simulate various Network Topologies on NS-2.
12. To configure routers, bridges and switches and gateway on NS-2.

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Name of Program: Bachelor of Technology in Robotics and Automation

w.e.f. 2021

	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*				
BTRA613		Neural Network and Fuzzy Logic	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):
This course introduces the basics of Neural Networks and also provides detailed overview of Fuzzy sets.

Course Outcomes (COs):
After the successful completion of this course students will be able to
1. Identify and describe Fuzzy Logic and Artificial Neural Network techniques in building intelligent machines.
2. Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems.
3. Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem

Syllabus:

UNIT I **9 Hrs.**
Introduction to Fuzzy Sets: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT II **9 Hrs.**
Uncertainty based Information: Information & Uncertainty, Types of uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets, Defuzzyfication, Design a fuzzy logic controller: Mamdani & Sugeno Architecture. Adaptive fuzzy systems: Neural and Fuzzy intelligence, Fuzziness as multivalent, fuzziness in probabilistic world, randomness verses ambiguity.

UNIT III **8 Hrs.**
Introduction and how brain works, Neural network architectures, Taxonomy of Neural network architectures, Neuron as a simple computing element, Back propagation networks: architecture, Backpropagation learning, Standard back propagation algorithms, Selection of various parameters, Variations applications of back propagation algorithms. Hopfield neural network.

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UNIT IV **8 Hrs.**

Genetic algorithms basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Convergence of GA, Genetic modelling: Inheritance operators, Cross over, Inversion and deletion, Mutation operator, Bit-wise operators.

UNIT V **8 Hrs.**

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, hybrid systems, integration of fuzzy logic, neural networks and genetic algorithms, non-traditional optimization techniques like ant colony optimization, Particle swarm optimization, Neural network applications, fuzzy logic applications.

Text Books:

1. Rajasekharan and Rai "Neural Networks, Fuzzy logic, Genetic algorithms: Synthesis and Applications" PHI Publication, 2020.
2. George J Klir and Tina A. Folger, "Fuzzy Sets Uncertainty an Information", Prentice Hall of India, New Delhi, 2000.

References:

1. Limin Fu, "Neural Networks in Computer Intelligence", McGraw Hill, 2003.
2. James A Freeman, "Simulating Neural Networks", Adison Publication, 1995.
3. Bart, Kosko, "Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence", Prentice Hall of India, 1994.

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Name of Program: Bachelor of Technology in Electronics & Communication

Specialization in IOT (w.e.f. 2018)

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*				
BTEC723	EC	Advanced Microcontroller and Embedded Systems	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 Objectives:

1. To teach programming for MSP432 using high level language such as C.
2. To teach students how a microcontroller can be used as a computer within a single integrated circuit.
3. To present the microcontrollers input/output interface capabilities for developing embedded systems with microcontrollers.
4. To illustrate how a microcontroller is a component within embedded systems controlling the interaction of the environment with system hardware and software.

Course Outcomes:

After successful completion of the course, student will be able:

1. To understand the generalized architecture of advanced microcontroller MSP432 and its programming.
2. To interface MSP432 with analog peripherals & communication systems.
3. To design an embedded system using MSP432 for a particular task.

Syllabus

UNIT I **9 Hrs**

Introduction to Microcontrollers & Embedded System

Background of Microcontrollers: Definition, Classification, Features & Applications, Architecture of Cortex M4 and its features, MSP–EXP432P401R and its Booster Packs, Energia: Development Environment, Libraries, Fundamental Programming Concepts.

Embedded System: Definition, Characteristics, Block diagram, Design Process, Case study: Weather monitoring system.

UNIT II **7 Hrs**

MSP432 Operating Parameters and Interfacing

Operating Parameters, Input Devices, Output Devices, High Power DC Interfaces, Interfacing to DC Devices, AC Devices, Educational Booster Pack Mk-II, Grove Starter Kit for LaunchPad Application.

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UNIT III **9 Hrs**

MSP432 Memory System and Power System

Memory System: Basic Memory Concepts, Memory Operations in C Using Pointers, Memory Map, Flash Memory, Direct Memory Access (DMA), External Memory: Bulk Storage with an MMC/SD Card.

Power Systems: Operating Modes and Speed of Operation, Power Supply System, Power Control Module, Operating Modes, Transition PSS and PCM Registers, Battery Operation.

UNIT IV **8 Hrs**

Time-Related Systems, Resets and Interrupts

Time-related Signal Parameters: Frequency, Period, Duty Cycle, MSP432 Clock System, Energia-related Time Functions, Watchdog Timer, Timer32, Timer A, Real-Time Clock, MSP432 Resets, Interrupts, MSP432 Interrupt System, Energia Interrupt.

UNIT V **9 Hrs**

Analog Peripherals & Communication Systems

Programming the MSP432 ADC System, Voltage Reference, Comparator, Serial Communication Concepts, MSP432 UART, Serial Peripheral Interface-SPI, Inter-Integrated Communication - I2C Module

Text Books:

1. Dung Dang, Daniel J. Pack, Steven F. Barrett, "Embedded Systems Design with the Texas Instruments MSP432 32-bit Processor" Morgan & Claypool Publisher, 2017.
2. Ying Bai, "Microcontroller Engineering with MSP432: Fundamentals and Applications" Taylor & Francis,CRC Press, 2017

References:

1. Chris Nagy, "Embedded Systems Design using the TI MSP430 Series" Newnes, 2003.
2. John H. Davies, "MSP430 Microcontroller Basics" Newnes, 2008.
3. Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier, "Introduction to Embedded Systems: Using Microcontrollers and the MSP430" Springer, 2014.
4. Raj Kamal, "Embedded Systems: Architecture, Programming and Design" TMH, 2008.

List of Experiments:

1. Introduction to MSP–EXP432P401R Launch Pad, Code Composer Studio and Energia.
2. Interfacing LED using MSP432.
3. Interfacing 7-segment display to MSP432.
4. Interfacing dot-matrix display to MSP432.
5. Setting up communication interface using IR sensors.
6. Interfacing MSP432 with various sensors
7. Driving stepper motor using MSP432.
8. Interfacing memory to MSP432
9. Setting up wireless communication Network.
10. Setting up IoT link for various sensors using MSP432.

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Name of Program: Bachelor of Technology in Electronics & Communication with Specialization in IOT w.e.f. 2021 Batch

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTECIOT604	EC	Embedded System with Raspberry pi and Arduino	0	0	0	30	20	0	0	2	1

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):

1. To describe the basic functionality of Raspberry Pi B+ board.
2. To present the basics of the Python programming language to prepare students for programming on the Raspberry Pi.
3. To communicate with devices through the pins of the Raspberry Pi.

Course Outcomes (COs):

After completing this course, students will be able to:

1. Setup and operate the Raspberry Pi
2. Understand the basics of the Linux OS used on the Pi and the basics of the X Windows System (the GUI environment)
3. Program the Pi for different applications

Syllabus:

UNIT I

Introduction and familiarization with Arduino

Introduction to Arduino with Hardware Overview board with pin layout, Download and Installation of the Arduino IDE, Arduino IDE and Sketch Overview, Understanding Arduino Syntax, Program notation: variables, functions, control flow, Arduino conventions, Analog I/O and Serial Communications.

UNIT II

Microcontroller overview with specifications

Microcontroller overview and Architecture Atmel ATmega 328 / AVR family, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC, Timers, PWM, analog / digital IO, , Pin functions, Atmega328p specifications, I/O interfacing with Atmega328p.

UNIT III

Interfacing with Arduino board

Introduction to Arduino IDE, writing, saving, compiling and uploading sketches, interfacing discrete LEDs, Binary counter, Seven Segment LEDs, Interfacing LCD, switch Interface, Interfacing with different type of sensors and communication modules.

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UNIT IV

Introduction and familiarization with Raspberry Pi board

Introduction to Raspberry Pi board and installation, introduction to Linux, preparation of Boot SD card, configuration of Raspberry Pi and networking with host computer, interfacing with Raspberry Pi board, accessing GPIO pins.

UNIT V

Introduction to Python Programming

Python IDE for Raspberry Pi, Python expressions, functions and operations for controlling the pins of Raspberry Pi,

Text Books:

1. Mike McRoberts: "Beginning Arduino" Apress, 2nd Edition, 2013
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons 2013

References:

1. Massimo Banzi, "Getting Started with Arduino", O'Reilly Media, Inc." 2011
2. Wolfram Donat "Learn Raspberry Pi programming in python", Apress ,2014
3. Richard Grimmett, "Raspberry Pi Robotics Essentials", Packt Publishing Ltd 2015

List of Experiments:

1. Understanding Arduino IDE and Arduino board family.
2. Understanding I/O access on ATMega328p.
3. Experimenting data transfer using Serial Communication.
4. Experimenting data transfer using SPI Communication.
5. Establishing i2c interface with ATMega328p.
6. Understanding Raspberry Pi Board Architecture.
7. Installing and configuring Raspbian OS on Raspberry Pi.
8. Blinking LED using Raspberry Pi.
9. Network configuration on Raspberry Pi.
10. Interfacing Sensor using Raspberry Pi.

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