

<b>RGPV (DIPLOMA WING) BHOPAL</b>		<b>OBE CURRICULUM FOR THE COURSE</b>		<b>FORMAT- 3</b>	<b>Sheet No. 1/5</b>
<b>Branch</b>	<b>Electronics and Telecommunication Engineering</b>		<b>Semester</b>	<b>V</b>	
<b>Course Code</b>		<b>Course Name</b>	<b>Embedded Systems with Arduino</b>		
<b>Course Outcome 1</b>	Classify embedded systems.			<b>Teach Hrs.</b>	<b>Marks</b>
<b>Learning Outcome 1</b>	Identify the embedded system devices from the real world. <b>(Cognitive)</b>			8	10
<b>Contents</b>	Embedded system: History, Block diagram, Comparison with general purpose computers, classification, applications and simple case studies (in functional diagram level) like Washing Machine, traffic light controller and microwave oven				
<b>Method of Assessment</b>	Internal				
<b>Learning Outcome 2</b>	Compare different microcontrollers. <b>(Cognitive)</b>			8	10
<b>Contents</b>	Microcontroller Types: PIC, AVR, ARM, features and applications AVR microcontroller: Types, Architecture Internal Architectural, Block diagram of controller of ATmega328, Functions of each pins of ATmega328 <b>(Cognitive)</b>				
<b>Method of Assessment</b>	External				

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<b>Branch</b>	<b>Electronics and Telecommunication Engineering</b>		<b>Semester</b>	<b>V</b>	
<b>Course Code</b>	<b>E03</b>	<b>Course Name</b>	<b>Embedded Systems with Arduino</b>		
<b>Course Outcome 2</b>	<b>Make use of ATmega328 and peripheral for use in Arduino board.</b>			<b>Teach Hrs.</b>	<b>Marks</b>
<b>Learning Outcome 3</b>	<b>Select essential peripherals for ATmega328 (Psychomotor)</b>			7	15
<b>Contents</b>	Essential Peripheral circuits: Crystal Circuit, Power supply				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 4</b>	<b>Prepare ATmega328 for programming. (Cognitive)</b>			8	10
<b>Contents</b>	Initial programming configurations of Atmega328: port, counter, timer, Bootloader Circuit, ISP of Atmega328, Comparison of ATmega8 and ATmega328				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 5</b>	<b>Configure timers, counters and ADC of ATmega328. (Cognitive)</b>			7	10
<b>Contents</b>	Configuration of Two 8-bit and One 16-bit Timers and Counters 6-channel ADC Working.				
<b>Method of Assessment</b>	Internal				

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<b>Branch</b>	<b>Electronics and Telecommunication Engineering</b>		<b>Semester</b>	<b>V</b>	
<b>Course Code</b>	<b>E03</b>	<b>Course Name</b>	<b>Embedded Systems with Arduino</b>		
<b>Course Outcome 3</b>	<b>Make use of Arduino software/hardware platform.</b>			<b>Teach Hrs.</b>	<b>Marks</b>
<b>Learning Outcome 6</b>	<b>Illustrate Arduino development board and functional diagram. (Cognitive)</b>			7	10
<b>Contents</b>	Arduino: Birth, Open Source community, Functional Block Diagram of Arduino. Functions of each Pin of Arduino, Arduino Development Board diagram (including different blocks only)				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 7</b>	<b>Explain the basics of the Arduino platform. (Cognitive)</b>			7	10
<b>Contents</b>	Arduino: IDE, I/O Functions, Looping Techniques, Decision Making Techniques Designing of 1 <sup>st</sup> sketch Programming of an Arduino (Arduino ISP), Arduino Boot loader, Serial Protocol (serial port Interfacing), Initialization of Serial Port using Functions, Basic Circuit For Arduino				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 8</b>	<b>Demonstrate the interfacing of basic peripherals with Arduino. (Psychomotor)</b>			8	10
<b>Contents</b>	Interfacing LED, Switch, keypad, LM35, 16x2 LCD, POT and their Arduino codes				
<b>Method of Assessment</b>	Internal				

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<b>Branch</b>	<b>Electronics and Telecommunication Engineering</b>		<b>Semester</b>	<b>V</b>	
<b>Course Code</b>	<b>E03</b>	<b>Course Name</b>	<b>Embedded Systems with Arduino</b>		
<b>Course Outcome 4</b>	<b>Develop small projects based on Arduino</b>			<b>Teach Hrs</b>	<b>Marks</b>
<b>Learning Outcome 9</b>	<b>Interface a motor driver L293D with Arduino. (Cognitive)</b>			7	10
<b>Contents</b>	Motor Driver L293D, IR Sensor, Interfacing L293D and IR sensor with Arduino,				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 10</b>	<b>Utilize Arduino in a simple home automation system. (Cognitive)</b>			7	10
<b>Contents</b>	Interfacing of Relay Driver ULN2803 with Arduino, Code for Home automation ( fans, lights, AC, fridge etc.) and its Control				
<b>Method of Assessment</b>	Internal				
<b>Learning Outcome 11</b>	<b>Preparing ATmega328 for an independent bootable microcontroller in a circuit. (Psychomotor)</b>			8	15
<b>Contents</b>	Basic ATmega328 Circuit, Interfacing of USB-UART, Initialization of serial port and its code.				
<b>Method of Assessment</b>	External				

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<b>Branch</b>	<b>Electronics and Telecommunication Engineering</b>		<b>Semester</b>	<b>V</b>	
<b>Course Code</b>		<b>Course Name</b>	<b>Embedded Systems with Arduino</b>		
<b>Course Outcome 5</b>	<b>Utilize the embedded system concepts in robotics.</b>			<b>Teach Hrs</b>	<b>Marks</b>
<b>Learning Outcome 12</b>	Define robotics and its terminologies. <b>(Cognitive)</b>			8	10
<b>Contents</b>	History of robots, Classification of robots, Present status and future trends. Basic components of robotic systems. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Specifications of robots. Definition of Forward and Reverse Kinematics				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 13</b>	<b>Identify the basic sensors used in robotics.</b> <b>(Cognitive)</b>			7	10
<b>Contents</b>	Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.				
<b>Method of Assessment</b>	External				
<b>Learning Outcome 14</b>	<b>Assemble a simple robot using Arduino with ATmega328.</b> <b>(Psychomotor)</b>			8	10
<b>Contents</b>	Implementation of small project demonstration of robot (e.g. line follower robot, robotic arm etc.) using Arduino with ATmega328.				
<b>Method of Assessment</b>	Internal				

### Suggested List of Experiments:

S.N.	Experiment	CO
1.	Install and configure Arduino IDE.	
2.	Identify different Arduino development board hardware and choose the corresponding board in the Arduino IDE.	
2.	Write and execute LED blinking program.	
4.	Interface computer serial port to generate LED blinking pattern.	
5.	Write a program to use a switch to ON/OFF an LED.	
6.	Make a counter using a single digit 7 segment display to count from 0 to 9.	
7.	Write and execute a program to display "HELLO WORLD" on a 16x2 LCD display.	
9.	Write a program to monitor temperature using LM35 and display the temperature on 16x2 LCD display	
10.	Write and execute a program to control the intensity of LED light using a POT.	
11.	Write and execute a program to control the speed of a DC motor using L293D.	

**Note:** These practical experiments(CO1to CO4) should preferably be performed on Arduino Kits+Components+Breadboard, however for self learning; students should be introduced to software/online simulation platforms like TinkerCAD etc.

### Reference Books/Web Portals:

S.N.	Title	Author/Publisher
1	Arduino Made Simple: With Interactive Projects	By Ashwin Pajankar BPB Publications
2	Getting Started with Arduino: The Open Source Electronics Prototyping Platform	By Massimo Banzi, Michael Shiloh Make Community, LLC
3	Programming Arduino: Getting Started with Sketches	By Simon Monk McGraw-Hill Education
4		
5	<a href="http://spoken-tutorial.org">spoken-tutorial.org</a>	

6.	<a href="http://nptel.ac.in">nptel.ac.in</a>
7.	<a href="http://swayam.gov.in">swayam.gov.in</a>