RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	5	0		1	1	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	Classify embedded systems.
LO Description	Identify the embedded system devices from the real world.

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-01	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	Interactive classroom lecture, PPT, demonstration, quiz, assignments	Teacher will explain the contents and provide handouts to students. Teacher will conduct quiz/ assignments/ tutorial.	8	--	Text Books, PPT, Handouts, chalk board, charts. Videos lectures-NPTEL & others	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-01	Mid Semester Theory Exam/Assignment	**Student will be asked to** (and/or): 1. Draw the block diagram of embedded systems and explain each block. 2. What are the different fields where embedded systems are used? 3. Explain the embedded system used in automatic washing machines. 4. Explain the embedded system used in traffic lights.	10	Question paper, Rating scale	Internal

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	5	0		1	2	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	Classify embedded systems.
LO Description	Compare different microcontrollers.

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-02	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	Interactive classroom lecture, PPT, demonstration, quiz, assignments, tutorial	Teacher will explain the contents and provide handouts to students. Teacher will conduct quiz/assignments/ tutorial to make students practice their knowledge.	8	--	Text Books, PPT, Handouts, chalk board, charts, Numerical Problems Workbook	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-02	End Semester Theory Exam	**Student will be asked to**(and/or): 1. Define a microcontroller. 2. Compare microprocessors with microcontrollers. 3. Write names of some popular microcontrollers with advantages,	10	Question paper, Rating scale	External

		disadvantages and applications. 4. Explain the functional/pin diagram of Atmega328 microcontroller.			

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	**SCHEME FOR LEARNING OUTCOME**	Branch Code			Course Code			CO Code	LO Code	Format No. **4**
		E	0	3	5	0		1	3	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of ATmega328 and peripherals for use in Arduino board.**
LO Description	**Select essential peripherals for ATmega328**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-03	Essential Peripheral circuits: Crystal Circuit, Power supply	Lab demonstration, hands on practice, lab assignments,	●Teacher with support from lab staff will demonstrate the procedure of lab experiments. ●Student will conduct lab assignment based on these experiments.	--	7	Components: Crystal, power supply(adaptor, battery etc.) connecting wires, Lab manual, charts, experimental trainer instruments,	

SCHEME OF ASSESSMENT					
S. No.	**Method of Assessment**	**Description of Assessment**	**Maximum Marks**	**Resources Required**	**External / Internal**
LO-03	Practical test in laboratory	**Student will be asked to** 1. Connect appropriate crystal and essential circuit to microcontroller Atmega328. 2. Connect appropriate power supply and essential circuit to microcontroller Atmega328.	15	Rubrics/Rating scale	External
ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)					

RGPV (Diploma Wing) Bhopal	**SCHEME FOR LEARNING OUTCOME**	**Branch Code**		**Course Code**			**CO Code**	**LO Code**	Format No. **4**
		E	*0*	*3*	*5*	*0*	*2*	*4*	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of ATmega328 and peripheral for use in Arduino board.**
LO Description	**Prepare ATmega328 for programming.**

SCHEME OF STUDY							
S. No.	**Learning Content**	**Teaching – Learning Method**	**Description of T-L Process**	**Teach Hrs.**	**Pract. /Tut Hrs.**	**LRs Required**	**Remarks**

LO-04	Initial programming configurations of Atmega328: port, counter, timer, Bootloader Circuit, ISP of Atmega328, Comparison of ATmega8 and ATmega328	Interactive classroom lecture, PPT, demonstration, quiz, assignments, tutorial	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	8	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-04	End Semester Theory Exam	**Student will be asked to**(and/or): 1. How the different ports are initialized in ATmega328? 2. What do you mean by ISP of any microcontroller? 3. Compare ATmega328 and ATmega8 microcontrollers. 4. What is a bootloader circuit?	10	Question paper, Rating scale	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. **4**
		E	0	3	5	0		2	5	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of ATmega328 and peripheral for use in Arduino board.**
LO Description	**Configure timers, counters and ADC of ATmega328.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-05	Configuration of Two 8-bit and One 16-bit Timers and Counters 6-channel ADC Working.	Interactive classroom lecture, PPT, Video, demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-05	Mid Semester Theory Exam/Assignment	**Student will be asked to** (and/or): 1. How are the different counters initialized in ATmega328? 2. How are the different timers initialized in ATmega328? 3. What are the different analog input/output pins in ATmega328 and how do they work?	10	Question paper + Rating scale.	Internal

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	5	0		3	7	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of Arduino software/hardware platform.**
LO Description	**Illustrate Arduino development board and functional diagram.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. / Tut Hrs.	LRs Required	Remarks
LO-06	Arduino: Birth, Open Source community, Functional Block Diagram of Arduino. Functions of each Pin of Arduino, Arduino Development Board diagram (including different blocks only)	Interactive classroom lecture, PPT, Video, Demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others. Arduino board	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-06	End Semester Theory Exam	**Student will be asked to**(and/or): 1. What is Arduino? Define open source hardware? 2. Write the functions of each pin of Arduino. 3. Draw and explain the block diagram of the Arduino development board.	10	Question paper , Rating scale	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	5	0		3	8	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of Arduino software/hardware platform.**
LO Description	**Explain the basics of Arduino platform.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-07	Arduino: IDE, I/O Functions, Looping Techniques, Decision Making Techniques Designing of 1st 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	Interactive classroom lecture, PPT, Video, demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal

LO-07	End Semester Theory Exam	**Student will be asked to** (and/or): 1. What is an Arduino IDE? 2. What are the different essential blocks in an Arduino program? 3. Explain ISP of Arduino. 4. Explain serial port interfacing of an Arduino board.	10	Question paper , Rating scale	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	**SCHEME FOR LEARNING OUTCOME**	Branch Code			Course Code			CO Code	LO Code	Format No. **4**
		E	0	3	5	0		3	8	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Make use of Arduino software/hardware platform.**
LO Description	**Demonstrate the interfacing of basic peripherals with Arduino.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. / Tut Hrs.	LRs Required	Remarks
LO-08	Basic Interfacing and I/O Concept Interfacing of: LED, Switch, keypad, LM35, 16x2 LCD, POT and their Arduino codes	Lab demonstration, PPT, hands on practice, lab assignments.	●Teacher with support from lab staff will demonstrate the procedure of lab experiments. ●Student will conduct lab assignment based on these experiments.	--	8	Arduino board, components (LEDs, switch, 7seg, POT, LM35 etc.), wires, breadboard, Lab manual, computer with relevant simulation software (Arduino IDE) and high speed internet.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-08	Practical test in laboratory	**Student will be asked to** 1. Write and execute an LED blinking program. 2. Write and execute a program for single digit 7 segment display. 3. Demonstrate how a POT is interfaced and programmed in Arduino? 4. Demonstrate how a temperature sensor LM35 is interfaced and programmed in Arduino? 5. Demonstrate how a 16x2 LCD display is interfaced and programmed in Arduino?	10	Rubrics, Rating scale	Internal
ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)					

RGPV (Diploma Wing) Bhopal	**SCHEME FOR LEARNING OUTCOME**	Branch Code			Course Code			CO Code	LO Code	Format No. **4**
		E	*0*	*3*	*5*	*0*		*4*	*10*	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Develop small projects based on Arduino.**

LO Description	Interface a motor driver L293D with Arduino.

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-09	Motor Driver L293D, IR Sensor, Interfacing L293D with Arduino with relevant program and connection diagram.	Interactive classroom lecture, PPT, Video, Demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz / tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-09	End Semester Theory Exam	**Student will be asked to** (and/or): 1. What is L293D? 2. What is an IR sensor? 3. How a DC motor is interfaced with an Arduino? 4. How an IR sensor is interfaced with Arduino?	10	Question paper, Rating scale.	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	5	0		4	10	

COURSE NAME	Embedded Systems with Arduino
CO Description	Develop small projects based on Arduino.

LO Description	Utilize Arduino in a simple home automation system.

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-10	Interfacing of Relay Driver ULN2803 with Arduino, Code for Home automation (fans, lights, AC, fridge etc.) and its Control	Interactive classroom lecture, PPT, Video, demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-10	Mid Semester Theory Exam/Assignment	**Student will be asked to**(and/or): 1. What is a relay? 2. How relays can be interfaced with Arduino? 3. Draw a planning diagram of home automation system with proper pin connection to the Arduino board.	10	Question paper , Rating scale.	Internal

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

CO Description	**Develop small projects based on Arduino.**
LO Description	**Preparing ATmega328 for independent bootable microcontroller in a circuit.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-11	Basic ATmega328 Circuit, Interfacing of USB-UART, Initialization of serial port and its code	Lab demonstration, PPT , hands on practice, lab assignments.	●Teacher with support from lab staff will demonstrate the procedure of lab experiments. ●Student will conduct lab assignment based on these experiments.	--	8	Arduino board, components, Lab manual, charts, Handouts, experimental trainer instruments/kit with measuring instruments, computer with relevant simulation software and high speed internet.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-11	Practical test in laboratory	**Student will be asked to** 1. Map Arduino pins to corresponding pins of ATmega328 microcontroller. 2. Draw and explain a typical standalone circuit application of ATmega328. 3. How USB-UART is interfaced with ATmega328?	15	Rubrics, Rating scale	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

	OUTCOME						Code	Code	
		E	0	3	4	0		5	12	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Utilize the embedded system concepts in robotics.**
LO Description	Define robotics and its terminologies.

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-12	History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Specifications of robot. Definition of Forward and Reverse Kinematics	Interactive classroom lecture, PPT, Video, demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	8	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-12	End Semester Theory Exam	**Student will be asked to**(and/or): 1. What is a robot? 2. What are the different parts of robot? 3. Where does the concept of embedded system come into the making of a robot? 4. What are the basic terminologies in robotics? 5. Define forward and reverse kinematics.	10	Question paper , Rating scale.	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. **4**
		E	0	3	4	0		5	13	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Utilize the embedded system concepts in robotics.**
LO Description	**Identify the basic sensors used in robotics.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-13	Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.	Interactive classroom lecture, PPT, Video, demonstration, quiz, assignments.	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments / quiz / tutorial to make students practice their knowledge.	7	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and others.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-13	End Semester Theory Exam	**Student will be asked to** (and/or): 1. Why sensors are needed in robotics. 2. List different sensors and their applications in robotics.	10	Question paper , Rating scale.	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	Format No. 4
		E	0	3	4	0		5	15	

COURSE NAME	**Embedded Systems with Arduino**
CO Description	**Utilize the embedded system concepts in robotics.**
LO Description	**Assemble a simple robot using Arduino with ATmega328.**

SCHEME OF STUDY

S. No.	Learning Content	Teaching – Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-14	Implementation of small project demonstration of robot (e.g. line follower robot, robotic arm etc.) using Arduino with ATmega328.	Lab demonstration, PPT , hands on practice, lab assignments.	●Teacher with support from lab staff will demonstrate the procedure of lab experiments. ●Student will conduct lab assignment based on these experiments.	--	8	Lab manual, charts, Handouts, experimental trainer instruments/kit with measuring instruments, computer with relevant simulation software and high speed internet.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal

LO-14	Practical test in laboratory	**Student will be asked to** 1. How the electronic parts of your robot is assembled? 2. How the electrical parts of your robot is assembled? 3. How the mechanical parts of your robot is assembled? 4. Demonstrate the ATmega328 based small robotic project.	10	Rubrics, Rating scale	Internal
ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)					