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

COURSE NAME	**Power Electronics**
CO Description	Identify different Power Electronic devices, their characteristics and applications.
LO Description	Classify different power diodes and power transistors and list their applications.

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	Power Electronics: Concept, advantages, disadvantages, applications. Construction, working principle, symbol, characteristics, and applications of: **Power diodes** - Rectifier diodes & schottky diode. **Power transistors** - Power MOSFET. Special feature and Symbol of fast recovery diodes, MOS diodes, IGBT, Power BJT	Interactive classroom lecture, PPT, Video, Demonstration, quiz, assignments.	Teacher will introduce subject and encourage students to identify and list key applications. Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments/ quiz/tutorial to make students practice their knowledge.	6	--	Text Books, PPT, Handouts, chalk board, charts, Video lecture- NPTEL and other online resources.	

SCHEME OF ASSESSMENT

S. No.	MethodofAssessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-01	Internal Progressive Test/ Assignment/Quiz	Student will be asked to (and/or):- 1.List advantages, disadvantages, applications of power electronics 2.Identify given Power Electronic devices and relate their construction and characteristics-. 3.Draw the symbol of various power electronic devices and list their application.	10	Question Paper, rubrics, Rating scale	Internal

		*Explore online resources and prepare a presentation on a particular application of power electronics as a case study at start and end of course. Suggested list attached in LO14 . Marks will be awarded for this activity as per LO14.			

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	*0*	*3*	*5*	*0*		*1*	*2*	

COURSE NAME	**Power Electronics**
CO Description	Identify different Power Electronic devices , their characteristics and applications
LO Description	Outline different members of the thyristor family.

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	Thyristor family and other triggering devices: working principle, symbols, characteristics and applications of SCR, DIAC, TRIAC, UJT Special feature and symbols of GTO, MGT, ETO, MTO, Programmable Unijunction transistor (PUT), Complementary Unijunction transistor (CUJT), Silicon Unilateral Switch (SUS), Silicon Bilateral Switch (SBS).	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 online resources.	

SCHEME OF ASSESSMENT					
S. No.	**Method of Assessment**	**Description of Assessment**	**Maximum Marks**	**Resources Required**	**External / Internal**
LO-02	External End sem Theory Exam.	**Student will be asked to(and/or):** 1. Identify different Power Electronic devices and outline the construction and characteristics of any one or more. 2. Draw the symbol of various power electronic devices and list their application. 3. Match the column for device name and corresponding symbols/features.	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	*0*	*3*	*5*	*0*		*1*	*3*	

COURSE NAME	**Power Electronics**
CO Description	Identify different Power Electronic devices , their characteristics and applications.
LO Description	Verify characteristics of power electronics devices.

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	Characteristics of power BJT, power MOSFET, IGBT, SCR UJT, Diac, Triac	Lab demonstration, hands on practice, lab assignments, V-Lab.	• Teacher will explain the contents • Teacher with support from lab staff will demonstrate the procedure of lab experiments. • Student will conduct lab assignment based on these experiments	-	5	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-03	External end semester Practical Exam	**Student will be asked to** : Verify Characteristics of power BJT, power MOSFET, IGBT, SCR, UJT, Diac, Triac	15	Rubrics, Rating scale	External

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

COURSE NAME	**Power Electronics**
CO Description	Analyze operation of SCR.
LO Description	Discuss turn on method and protection techniques of Silicon Controlled Rectifier.

SCHEME OFSTUDY

S. No.	Learning Content	Teaching–Learning Method	Description of T-L Process	Teach Hrs.	Pract. /Tut Hrs.	LRs Required	Remarks
LO-04	Silicon Controlled Rectifier (SCR): dynamic characteristic, turn-on methods (High voltage turn-on, High temperature turn-on, Light turn-on, dv/dt turn-on, Gate turn-on). Overvoltage Protection, Overcurrent Protection, Gate Protection, Over temperature Protection of SCR.	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 online resources.	

SCHEME OF ASSESSMENT

S. No.	Method of Assessment	Description of Assessment	Maximum Marks	Resources Required	External / Internal
LO-04	External End sem Theory Exam.	**Student will be asked to**(and/or): 1. Describe one or more turn on methods of SCR. 2. Draw dynamic characteristic of SCR. 3. Suggest suitable protection of SCR against high current/ high voltage/ fast rise in current/ fast change in voltage/ gate protection and/or over temperature protection	10	Question paper, Rating scale	External

ADDITIONALINSTRUCTIONSFORTHEHOD/FACULTY(IFANY)

RGPV (Diploma Wing) Bhopal	SCHEME FOR LEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	*0*	*3*	*5*	*0*		*2*	*5*	

COURSE NAME	**Power Electronics**
CO Description	Analyze operation of SCR.
LO Description	State principle of firing circuits and commutation technique of SCR.

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	Firing Circuits: Main features of firing circuits, RC Firing Circuit, UJT Firing Circuit, DIAC Firing Circuit. Thyristor Turn-off Method (waveform, working and circuit diagram) Natural Commutation, Forced Commutation (Class A,B,C,D,E,F)	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-05	External End sem Theory Exam.	**Student will be asked to** (and/or) 1. Draw and explain the various firing circuit. 2. Select suitable firing circuit for an application. 3. Identify and explain the commutation technique used. 4. List of features required in firing circuits.	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code		Course Code				CO Code	LO Code	FormatNo.4
		E	0	3	5	0		2	6	

COURSE NAME	**Power Electronics**
CO Description	Analyze operation of SCR.
LO Description	Demonstrate firing circuits and commutation technique of SCR.

SCHEME OF STUDY

S. No.	Learning Content	Teaching –Learning Method	Description of T-L Process	Teach Hrs.	Pract. /TutHrs.	LRs Required	Remarks
LO-06	Resistance-Capacitance Firing Circuit, UJT Firing Circuit, DIAC Firing Circuit commutation techniques (using kits or simulation software/tool)	Lab demonstration, hands on practice, lab assignments, V-Lab.	• Teacher will explain the contents • Teacher with support from lab staff will demonstrate the procedure of lab experiments. • Student will conduct lab assignment based on these experiments	--	5	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-06	Internal practical	Student will be asked to 1. Demonstrate and explain one or more firing circuit. 2. Demonstrate commutation technique	10	Rubrics,, Rating scale	Internal

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	0	3	5	0		3	7	

COURSE NAME	**Power Electronics**
CO Description	Compare uncontrolled and controlled rectifier.
LO Description	Analyze uncontrolled rectifier using diode.

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	Circuit diagram, working, waveforms and formula with derivation of- Single Phase Half Wave Uncontrolled Rectifier with Resistive load, Single Phase Full Wave Uncontrolled Rectifier - Mid-Point Configuration with Resistive load and Uncontrolled Bridge Rectifier	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	External End sem Theory Exam.	**Student will be asked to**(and/or): 1. Derive formulae for half wave rectifier and explain its circuit and working through waveforms 2. Explain waveform and working of full wave rectifier with resistive load and state it formulae. 3. Compare midpoint configuration and bridge configuration of full wave rectifier. 4. Compare half wave and full wave rectifiers.	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	0	3	5	0		3	8	

COURSE NAME	**Power Electronics**
CO Description	Compare uncontrolled and controlled rectifier
LO Description	Analyze controlled rectifier using SCR.

SCHEME OF STUDY

S. No.	Learning Content	Teaching–Learning Method	Description of T-L Process	Teach Hrs.	Pract. /TutHrs.	LRs Required	Remarks
LO-08	Circuit diagram, working, waveforms of - Single phase Half Wave Controlled Rectifier with Resistive load (formula with derivation), Single Phase Full Wave Controlled Rectifier (formula without derivation)- Mid-Point Configuration with Resistive load, Controlled Bridge Rectifier with resistive load Three Phase Controlled Rectifier (formula without derivation)- Half Wave Controlled Rectifier and Fully Controlled Bridge Rectifier with resistive load 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.	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-08	External End sem Theory Exam.	**Student will be asked to(and/or):** 1. Explain each configuration of controlled rectifier through waveforms 2. Compare uncontrolled and controlled rectifiers 3. Derive formulae for half wave controlled rectifier and explain its circuit and working through waveforms. .	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	*0*	*3*	*5*	*0*		*3*	*9*	

COURSE NAME	**Power Electronics**
CO Description	Compare uncontrolled and controlled rectifier
LO Description	Simulate uncontrolled and controlled rectifier

SCHEME OF STUDY

S. No.	Learning Content	Teaching –Learning Method	Description of T-L Process	Teach Hrs.	Pract. /TutHrs.	LRs Required	Remarks
LO-09	Half Wave Uncontrolled Rectifier, Half Wave Controlled Rectifier, Full Wave Uncontrolled Rectifier , Full Wave Controlled Rectifier, three phase controlled rectifier(any simulation software or kit)	Lab demonstration, hands on practice, lab assignments, V-Lab.	• Teacher with support from lab staff will demonstrate the procedure of lab experiments. • Student will conduct lab assignment based on these experiments.	-	5	Lab manual, charts, 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-09	External end sem Practical Exam	**Student will be asked to:** 1. Observe the waveforms for given uncontrolled and controlled rectifier and measure output voltages.	15	Rubrics, Rating scale	External

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)											
RGPV (Diploma Wing) Bhopal	**SCHEMEFORLEARNING OUTCOME**	**Branch Code**			**Course Code**			**CO Code**	**LO Code**	FormatNo.**4**	
		E	*0*	*3*	*5*	*0*		*3*	*10*		

COURSE NAME	**Power Electronics**
CO Description	Select a power conversion device as per application.
LO Description	Compare different types of Inverters

SCHEME OF STUDY

S. No.	Learning Content	Teaching– Learning Method	DescriptionofT-L Process	Teach Hrs.	Pract. /TutHrs.	LRs Required	Remarks
LO-10	Principle of inverters. Basic Classification of inverters. Circuit diagram ,working and wave form of- Single phase voltage source inverter , Three Phase voltage source inverters with180 degree mode. PWM Inverters –Single Pulse Modulation, Series Inverter Parallel Inverter	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	Internal Progressive Test/ Assignment/Quiz	**Student will be asked to** 1.Explain principle of inverter with diagram and waveform 2.Explain single phase and three phase voltage source inverter 3.Compare series and parallel inverter 4. Explain PWM inverter	10	Question paper, Rating scale	Internal

ADDITIONAL INSTRUCTIONS FOR THE HOD/ FACULTY (IF ANY)												
RGPV (Diploma Wing) Bhopal		**SCHEMEFORLEARNING OUTCOME**		**Branch Code**			**Course Code**			**CO Code**	**LO Code**	Format No. **4**
				E	*0*	*3*	*5*	*0*		*4*	*11*	
COURSE NAME	**Power Electronics**											
CO Description	Select a power conversion device as per application.											
LO Description	Classify chopper circuits											

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	Principle of choppers Control Strategies of choppers Time Ratio Control, Current-limit Control Basic classifications of Chopper Circuits, Step-Up and Step-Down Choppers Applications Simple numerical	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.	6	--	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-11	External end sem Theory Exam.	**Student will be asked** **1.** Outline the principle of chopper with functional circuit diagram **2.** Classify types of chopper **3.** Describe step up/step down chopper. **4.** Give applications of chopper **5.** Solve simple numerical on chopper- Duty cycle and voltage up-down.	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	*0*	*3*	*5*	*0*		*4*	*12*	

COURSE NAME	**Power Electronics**
CO Description	Select a power conversion device as per application.
LO Description	Analyze output of inverters and choppers.

SCHEME OF STUDY

S. No.	Learning Content	Teaching –Learning Method	Description of T-L Process	Teach Hrs.	Pract. /TutHrs.	LRs Required	Remarks
LO-12	Draw input output wave form of inverter and choppers(kits or simulation software)	Lab demonstration, hands on practice, lab assignments, V-Lab.	• Teacher with support from lab staff will demonstrate the procedure of lab experiments. • Student will conduct lab assignment based on these experiments.	-	5	Lab manual, charts, 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-12	Internal practical	**Student will be asked to** **1.** Draw input output wave form of inverter **2.** Draw input output wave form of chopper circuit. **3.** Survey on various inverters available in markets. (Online/Offline)	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	FormatNo.4
		E	0	3	5	0		5	13	

COURSE NAME	**Power Electronics**
CO Description	Identify the applications of power electronic devices.
LO Description	Summarize applications of power electronic devices.

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	Introduction with functional block diagram of:- Induction Heating Di-electric heating (Principle, Applications, merits &demerits over other systems) HVDC Transmission, types of HVDC link. SMPS, Concept of Switched Mode Power Supplies. UPS, Offline and Online UPS	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	External End sem Theory Exam.	**Student will be asked to (**and/or) 1. Explain the given application of power electronic devices. (short notes)	10	Question paper, Rating scale	External

RGPV (Diploma Wing) Bhopal	SCHEMEFORLEARNING OUTCOME	Branch Code			Course Code			CO Code	LO Code	FormatNo.4
		E	0	3	5	0		5	14	

COURSE NAME	**Power Electronics**
CO Description	Identify the applications of power electronic devices.
LO Description	Explore further applications of power electronic devices as a case study

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	**Suggested list for case study** - Ultrasonic Applications, Induction heater, Welding, Electronic Ignition, High power audio amplifier system, Alarm actuator, Speed control of d.c. motor /stepper motor/servo motor, ECM (electronic control module) of car.	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.	5	--	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-14	Internal - Seminar	**Student will be asked to (**and/or): 1. Prepare a presentation on any major application of power electronics and present in seminar	10	Rubrics, Rating scale	Internal
