

COURSE: Non CRS PATTERN

Name of the Faculty: Technology and Engineering

Name of the Programme: Master of Engineering- Electrical Engineering (Industrial Electronics)

Mode of Learning: REGULAR

Semester Number (For Example 01,02,03, etc.):					01								
Maximum Courses/Papers for the present Semester:					07								
Minimum Courses/Papers for the present Semester:					07								
Maximum marks for the present Semester:					550								
Minimum marks for the present Semester:					00								
Total Credits for the present Semester:					NIL								
Sr. No.	Department (NAME OF THE DEPARTMENT WHICH IS TEACHING THE PAPER)	Type of Course Core/ Elective/ Foundation/ IDE/ Compulsory etc.	Title of Paper	Group (if any)	Hours of Teaching per week [Credit*]	Teaching Learning Method [TLM]	Assessment Method [AM]	Assessment Type [AT] UA/IA	UA Marks	IA Marks	Total Marks	Minimum marks for Passing	Remarks for Minimum /Maximum Course/Paper/Subject/ Selection
1	Electrical Engineering	Core Compulsory	DC Converters (ELE2141)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			
2	Electrical Engineering	Core Compulsory	DC Converters (TW, Practical and Viva) (ELE2141L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
3	Electrical Engineering	Core Compulsory	Power Electronics Devices and Circuits (ELE2142)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			
4	Electrical Engineering	Core Compulsory	Power Electronics Devices and Circuits (TW, Practical and Viva) (ELE2142L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
5	Electrical Engineering	Core Compulsory	Applied Signal Processing & Filter Design (ELE2134)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			

6	Electrical Engineering	Core Compulsory	Applied Signal Processing & Filter Design (TW, Practical and Viva) (ELE2134L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
7	Electrical Engineering	Core Compulsory	AC Voltage Controllers (ELE2143)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			

Semester Number (For Example 01,02,03, etc.):					02								
Maximum Courses/Papers for the present Semester:					07								
Minimum Courses/Papers for the present Semester:					07								
Maximum marks for the present Semester:					550								
Minimum marks for the present Semester:					00								
Total Credits for the present Semester:					NIL								
Sr. No.	Department (NAME OF THE DEPARTMENT WHICH IS TEACHING THE PAPER)	Type of Course Core/ Elective/ Foundation/ IDE/ Compulsory etc.	Title of Paper	Group (if any)	Hours of Teaching per week [Credit*]	Teaching Learning Method [TLM]	Assessment Method [AM]	Assessment Type [AT] UA/ IA	UA Marks	IA Marks	Total Marks	Minimum marks for Passing	Remarks
1	Electrical Engineering	Core Compulsory	Inverters (ELE2242)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			
2	Electrical Engineering	Core Compulsory	Inverters (TW, Practical and Viva) (ELE2242L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
3	Electrical Engineering	Core Compulsory	Control of Electric Drives (ELE2243)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			
4	Electrical Engineering	Core Compulsory	Control of Electric Drives (TW, Practical and Viva) (ELE2243L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
5	Electrical Engineering	Core Compulsory	Embedded Applications in Industrial Control (ELE2235)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			

6	Electrical Engineering	Core Compulsory	Embedded Applications in Industrial Control (TW, Practical and Viva) (ELE2235L)	NA	03	Laboratory	Term Work, Practical and Viva	UA	50	--	50	20	UA=50
								IA	--	--			
7	Electrical Engineering	Core Compulsory	Advanced Power Electronics (ELE2244)	NA	04	Lecture	Theory	UA	70	--	100	40	UA=70 IA=30
								IA	--	30			

Semester Number (For Example 01,02,03, etc.):					03 & 04								
Maximum Courses/Papers for the present Semester:					01								
Minimum Courses/Papers for the present Semester:					01								
Maximum marks for the present Semester:					300								
Minimum marks for the present Semester:					00								
Total Credits for the present Semester:					NIL								
Sr. No.	Department (NAME OF THE DEPARTMENT WHICH IS TEACHING THE PAPER)	Type of Course Core/ Elective/ Foundation/ IDE/ Compulsory etc.	Title of Paper	Group (if any)	Hours of Teaching per week [Credit*]	Teaching Learning Method [TLM]	Assessment Method [AM]	Assessment Type [AT] UA/ IA	UA Marks	IA Marks	Total Marks	Minimum marks for Passing	Remarks
1	Electrical Engineering	Core Compulsory	ME Dissertation (ELE2403)	NA		Project	Dissertation	UA	300	--	300	120	UA=300
								IA	--	--			



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ME ELECTRICAL (Industrial Electronics)

M E Electrical (Industrial Electronics) Part I

Bloom's Taxonomy Levels:

1. Remember 2. Understand 3. Application 4. Analysis 5. Evaluation 6. Creation

Programme Name: M E Electrical (Industrial Electronics)

Programme Specific Outcome(PSO)

PSO 1: Students will be able to apply specialized knowledge in classical as well as modern topics in the broad field of power semiconductor devices, power electronics converters, electrical drives, power electronics applications to power system and power quality, enabling post graduates to analyse, design, operate and integrate power electronics systems.

PSO 2: Students will be able to apply the knowledge of ethical and management practices required to work in a team as well as a team leader.

PSO 3: To inculcate research attitude and life long learning in hard and soft skills.

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Syllabus of Courses

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering	Academic Year	2021-22						
M E Electrical Engineering (Industrial Electronics) : Regular Programme									
Year	I	Core / Elective / Foundation Power Electronics Devices And Circuits	Credits / Hours per week	L: 4 hrs/week Pr. : 3hrs/week					
Semester	I	Year of Introduction : 2021 Year of Revision : NIL	Maximum Marks / Grade	100+50 = 150					
Mode of Transaction		Lectures and Laboratory							
Course Outcome (CO) CO 1 Evaluate mathematical principles for circuits with switches and diodes with different passive elements and their combinations. CO 2 Explain the theory of recovery of trapped energy. CO 3 Discuss static and dynamic characteristics of various power electronic devices. CO 4 Evaluate parameters of various power devices. CO 5 Interpret over voltage and over current protection circuits for various power devices. CO 6 Understand series and parallel connections, methods of equalization and driver circuits for various power devices.									
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Profession



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									nal Ethics (PE)
1	Circuits with Switches and Diodes: Switched DC/AC source with R, RC, RL, inductive and RLC ci Recovery of trapped energy.	07	15	4,5	CO1 CO2	PSO1	Emp,SD	G	PE
2	Power Devices: Characteristics, specifications and ratings of thyristor family, Power MOSFETs, Power transistors, IGBTs, MCT, SIT, SITH etc. Their advantages and limitations.	12	25	3	CO3 CO4	PSO1 PSO2			
3	Turn-on and Turn-off characteristics: Turn-on and turn-off characteristics of thyristor family, Power MOSFETs, Power transistors, IGBTs, MCT, SIT, SITH etc and corresponding driver circuits. Thyristor commutation circuits	12	25	3	CO3 CO4	PSO1 PSO3			
4	Faults and Protections: Overvoltage and overcurrent failures. Protection against overvol and overcurrent. Failures due to rate of rise of voltage and curren protection against them. Radio frequency and electromagnetic interference and filters for RFI & EMI. Heat sink calculations methods for cooling of devices. Various circuits for the reduction of turn-off losses of devices.	12	25	5	CO5	PSO1 PSO2 PSO3			
5	Series and Parallel Connections: Requirement of series and parallel connections. Series and parallel connections for different power devices and method of equalizati Driver circuits for series and parallel connections. String efficie	09	10	2	CO6	PSO1			

Reference Books

1.	Power Semiconductor Circuits - S.B. Dewan & A. Straughen
2.	Power Electronics - Ned Mohan - Wiley Science
3.	Power Electronics - B.K. Bose, Jaico Publishers



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4.	SCR Manual - G.E. Company, 6th edition
5.	Power Electronics - B.W. Williams ELBS Series.

Laboratory : 6-10 Experiments/Simulations based on syllabus contents.

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Syllabus of Courses

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M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation DC CONVERTERS	Credits / Hours per week					L: 4 hrs/week Pr. : 3hrs/week		
Semester	I	Year of Introduction : 2021 Year of Revision :NIL	Maximum Marks / Grade					100+50 = 150		
Mode of Transaction		Lectures and Laboratory								
Course Outcome (CO) CO 1 Determine the variousparameters of the power converters with applicable constraints. CO 2 Analyze the performance characteristics of various types of power converter. CO 3 Design the controller fora given circuit. CO 4 Understand the power quality problems and suggest solutions. C0 5 Explain the working of the various power converters.										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional



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									Ethics (PE)
1	Controlled half wave rectifier: Analysis of half wave controlled rectifier with R, L, RL, RC, RLE load circuits.	06	12	2,4,5	CO1 CO2 CO5	PSO1 PSO3	SD	G	PE
2	m-phase and full wave controlled rectifiers: Single phase full wave rectifiers with RLE load. Series connection of converters. Effect of transformer leakage reactance. Three phase full wave controlled rectifier with different loads. m-phase controlled rectifiers with different loads. Single phase and three phase half controlled rectifier with different loads. Calculation of critical inductance for rectifiers. Dual converters. Typical triggering circuits for all cases.	13	25	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
3	Power factor and Harmonics: Power factor control. Static reactive power compensation. Power factor improvement. Harmonics on ac and dc sides. Harmonic control of converter fed systems. PWM in controlled rectifier.	09	17	2,4	CO1 CO4	PSO1 PSO3			
4	DC to DC Converters: Types of chopper circuits. Analysis of class-A, B and C Choppers.	10	19	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
5	Switched mode power supplies: DC to DC conversion with Electrical Isolation. Control of switch mode DC power supplies. Power supply protection. Electrical isolation in the feedback loop. Designing to meet the power supply specifications.	07	14	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
6	Controllers and their Optimization: Proportional, Derivative, Integral, Proportional Derivative, Proportional-Integral, Proportional-Integral-Derivative Controllers. Their theory, Circuits, Analysis, Comparison and Optimization.	07	13	6	CO3	PSO1 PSO3			

Reference Books

1.	Power Semiconductor Circuits by S.B. Dewan & A. Straughen
2.	Power Electronics By Ned Mohan
3.	Thyristorised power controllers - G.K. Dubey
4.	Thyristor Phase controlled converters and Cycloconverters by B.R. Pelly
5.	Switched mode power supply design- P.R.K. Chetty
6.	Switched mode power converter - K.Kit Sum
7.	Thyristors - Sugandhi and Sugandhi - John Wiley
8.	Introduction to Modern Power Electronics - A.M. Trzynadlowski - John Wiley



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Laboratory : 6-10 Experiments/Simulations based on syllabus contents.

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Syllabus of Courses

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M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation Applied Signal Processing and Filter Design	Credits / Hours per week					L: 4 hrs/week Pr. : 3hrs/week		
Semester	I	Year of Introduction : 2021 Year of Revision :NIL	Maximum Marks / Grade					100+50 = 150		
Mode of Transaction		Lectures and Laboratory								
Course Outcome (CO) CO 1 Determine the various parameters of the power converters with applicable constraints. CO 2 Analyze the performance characteristics of various types of power converter. CO 3 Design the controller for a given circuit. CO 4 Understand the power quality problems and suggest solutions. CO 5 Explain the working of the various power converters.										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional



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									Ethics (PE)
1	Controlled half wave rectifier: Analysis of half wave controlled rectifier with R, L, RL, RC, RLE load circuits.	06	12	2,4,5	CO1 CO2 CO5	PSO1 PSO3	SD	G	PE
2	m-phase and full wave controlled rectifiers: Single phase full wave rectifiers with RLE load. Series connection of converters. Effect of transformer leakage reactance. Three phase full wave controlled rectifier with different loads. m-phase controlled rectifiers with different loads. Single phase and three phase half controlled rectifier with different loads. Calculation of critical inductance for rectifiers. Dual converters. Typical triggering circuits for all cases.	13	25	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
3	Power factor and Harmonics: Power factor control. Static reactive power compensation. Power factor improvement. Harmonics on ac and dc sides. Harmonic control of converter fed systems. PWM in controlled rectifier.	09	17	2,4	CO1 CO4	PSO1 PSO3			
4	DC to DC Converters: Types of chopper circuits. Analysis of class-A, B and C Choppers.	10	19	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
5	Switched mode power supplies: DC to DC conversion with Electrical Isolation. Control of switch mode DC power supplies. Power supply protection. Electrical isolation in the feedback loop. Designing to meet the power supply specifications.	07	14	2,4,5	CO1 CO2 CO5	PSO1 PSO3			
6	Controllers and their Optimization: Proportional, Derivative, Integral, Proportional Derivative, Proportional-Integral, Proportional-Integral-Derivative Controllers. Their theory, Circuits, Analysis, Comparison and Optimization.	07	13	6	CO3	PSO1 PSO3			

Reference Books

1.	Digital Signal Processing: Principles, Algorithms and Applications: John G. Proakis and Dimitris G. Manolakis (Prentice Hall India)
2.	Digital Signal Processing: A Computer Based approach: Sanjit K. Mitra (Tata McGraw Hill)
3.	Digital Signal Processing – A practical Approach: Emmanuel Ifeachor and Barry Jervis, Addison Wesley publishing company
4.	Digital Signal Processing Using MATLAB & Wavelets, Michael Weeks, 2 nd edition, INFINITY SCIENCE PRESS
5.	Discrete-Time Signal Processing: A.V. Oppenheim and R.S. Schaffer (Prentice Hall India)
6.	Digital Signal Processing Using MATLAB Vinay K. Ingle, John G. Proakis, 3rd Edition, 2012, Cengage learning



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Laboratory : 6-10 Experiments/Simulations based on syllabus contents.

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 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering		Academic Year				2021-22			
M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation AC Voltage Controllers	Credits / Hours per week				L: 4 hrs/week			
Semester	I	Year of Introduction : 2021 Year of Revision : NIL	Maximum Marks / Grade				100			
Mode of Transaction		Lectures								
Course Outcome CO1: Explain single phase AC voltage converters. CO2: Analyse single phase and three phase AC Voltage controllers CO3: Develop ACVC and Cyclo converters for different load. CO4: Apply ACVC and Cyclo converter for industrial applications										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics



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										(PE)
1	Single phase ac voltage controller: Symmetrical phase angle triggered ac voltage controllers. Resistive load. Series RL load. Fourier co-efficient for series R and RL and RC load. Single phase transformer tap changer	06	15	1,2	CO1	PSO1	SD	G	PE	
2	Power factor correction of single phase thyristor controlled load with phase angle triggering: Analytical properties of the load branch. P.F. correction of a thyristor-controlled resistive load by passive impedance elements. Power factor correction of thyristor controlled resistive loads by thyristor switching circuits.	10	15	2,3,4,5	CO1 CO2 CO3	PSO2				
3	Analytical properties of integral-cycle control: Harmonic spectra of integral cycle waveforms. RMS load voltage and load power. Power factor. Rectified integral-cycle control of single phase loads, Power factor correction of single- phase thyristor controlled resistive load with integral- cycle triggering.	10	20	2,3,4	CO1 CO2 CO3	PSO2				
4	Three phase ac voltage controllers: Three phase resistive circuits with voltage control by symmetrical phase angle switching of thyristors. Three phase resistive circuits with voltage control of the three-wire star-connected, three phase four wire star connected, line control delta, phase control delta, series resistance-inductance load by thyristor switching.	10	20	1,2,3,4,5,6	CO3 CO4	PSO2				
5	Phase controlled cycloconverter: Basic principle of circulating and non-circulating current mode of operation. Harmonics distortion in output voltage. Loading effect of the cycloconverter on the input system. Cycloconverter control problems and techniques associated with discontinuous current. Cycloconverter circuits. Principles of firing pulse timing control. Firing pulse generator circuit principles. Principle of cycloinverter.	10	20	2,3,4,5,6	CO3 CO4	PSO2				
6	Analysis of the cycloconverter: Harmonic analysis of the output voltage of the cycloconverter. Analysis of the input current of the cycloconverter. Effect of the input source impedance.	06	10	2,3,4,5,6	CO3 CO4	PSO2				
Reference Books										
1.	Power Semiconductor Controlled drives by G K Dubey-Prentice Hall Incorporation									
2.	Thyristor Control of AC motors by J.M.D. Murphy-Prgamon Press									
3.	Fundamentals of Electrical Drives-G K Dubey-Narosa Publishing House									



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4.	Thyristor DC Drives - P.C. Sen - John Wiley & Sons.
5.	Analysis of thyristor power conditioned motor by S.K. Pillai University Press
6.	Power-Electronics and motor control by W. Shepherd Cambridge University Press

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M E Electrical (Industrial Electronics) Part II

Syllabus of Courses

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering	Academic Year	2021-22							
M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation Embedded Applications in Industrial Control	Credits / Hours per week					L: 4 hrs/week Pr. : 3hrs/week		
Semester	II	Year of Introduction : 2021 Year of Revision : NIL	Maximum Marks / Grade					100+50 =150		
Mode of Transaction		Lectures and Laboratory								
CO1: Design embedded system for industrial applications by interfacing different components of the system. CO2: Develop embedded programs for low power microcontrollers for robotic applications. CO3: Create ARM based basic and advanced programs for MEMs sensor-based applications. CO4: Assess the different type of sensors, signal conditioning elements and Controller principles for real life applications. CO5: Develop PLC Ladder diagram for various real-world problems/applications. CO6: Explain the architecture and features of a digital signal processor for real-time implementations.										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship(Ent)/ Skill Develop	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G)	Relation to Gender (G), Environ ment and Sustaina bility (ES), Human



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							ment (SD)		Values (HV)and Professio nal Ethics (PE)
1	Introduction to embedded systems, Classification of architecture models, Networking in Embedded systems-(I2C, CANBUS, MODBUS, USB), Serial and Parallel port interfaces, High-speed I/O interfacing, Transducers and their interfacing.	10	16	5,6	CO1 CO4	PSO1	SD	G	PE
2	Microcontrollers based Industrial Applications: Development of PID control Algorithm in Assy Lang. and controlling temperature through ON/OFF control or proportionate control. Interfacing of keyboard & 7-Segment Led Display & Lcd display, Industrial timer/counter, Power factor & Frequency measurement, Waveform generation using DAC, stepper motor controller. Interfacing of I2C EEprom & Dac. Interfacing of Serial Printer using UART/RS232, HMI interfacing through RS485-Modbus communication protocol.	16	35	6	CO1 CO2	PSO1 PSO3			
3	Controlling Principles and Methods, Design of analog/digital controllers, Discrete State Process Control, PLC Architecture and ladder logic programming, Industrial applications using PLC.	10	20	5,6	CO4, CO5	PSO1 PSO3			
4	C8051F340 microcontroller & Applications: Introduction to C8051F340 microcontroller, advance features e.g. ADC, USB, etc. Interfacing DC BLDC motor using PWM & interfacing IR sensors for Line follower robot. Open loop Speed control of DC motor.	06	10	5,6	CO1, CO2	PSO1 PSO3			
5	DSP Overview: Architecture, Computing Unit IEEE floating point	06	14	5,6	CO6	PSO1 PSO4			



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	operation, multifunction computing, address generation, program sequencer, instruction cycle & operation, Interrupts, Timer, memory buses & interfacing, internal data transfer & context switching, hardware design, software preliminaries, syntax code notation, tools, Applications for servo control.								
6	Introduction to Cortex M7 microcontroller STM32F746: Enhanced Features, Block Diagram & Basic functions. Interfacing with MEM sensors, Accelerometer, Gyro.	04	05	5,6	CO3	PSO1 PSO3			
Reference Books									
1.	Interfacing Sensors to the IBM PC – W. Tompkins, J.G. Webster (PH Intl)								
2.	Process Control Instrumentation Technology - Curtis D Johnson (4th Ed.)								
3.	D.V. Hall : Microprocessors And Interfacing, Programming and hardware.								
4.	Datasheets for C8051F340 and Cortex-M7.								
5.	Manuals for DSP Processor (C28X)								

Laboratory : 6-10 Experiments/Simulations based on syllabus contents.

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Syllabus of Courses

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering		Academic Year		2021-22					
M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation INVERTERS	Credits / Hours per week		L: 4 hrs/week Pr. : 3hrs/week					
Semester	II	Year of Introduction : 2021 Year of Revision : NIL	Maximum Marks / Grade		100+50= 150					
Mode of Transaction		Lectures and Laboratory								
Course Outcome (CO) CO 1 Explain the working of VSI, CSI and resonant inverters for different loads. CO 2 Analyze the performance of VSI, CSI and resonant inverter. CO 3 Estimate the various parameters of inverters. CO 4 Apply advanced control techniques for analyzing and designing power converters. CO 5 Explain the working of different types, features and applications of Multilevel Inverters.										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)an



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Department of Electrical Engineering
2 year Post Graduate Course
ME ELECTRICAL (Industrial Electronics)

										d Profess ional Ethics (PE)
1	Single Phase Bridge Inverters: Analysis of single phase bridge inverter using different loads. Three phase inverters: Analysis of three phase bridge inverter using R, R-L for 180 degrees, 150 degrees and 120-degree mode of operation, Calculation of instantaneous current for each mode for different loads configuration.	11	21	2,4,5	CO1 CO2 CO3	PSO1 PSO3	SD	G	PE	
2	Voltage Control and harmonic reduction: Different modulation techniques adopted for single phase and three phases; like single pulse modulation, multiple pulse with modulation, sinusoidal pulse width modulation, and modified sinusoidal pulse-width modulation. Voltage control by phase displacement control. Advanced modulation techniques and SHE method	10	19	2,4,5	CO3 CO4	PSO1 PSO3				
3	Current source inverter : Single phase current source inverter. Single phase capacitor commutated CSI with R load. Single phase Auto sequential commutated CSI. Three phase current source inverter. Comparison of CSI & VSI	09	18	2,4	CO1 CO2 CO3	PSO1 PSO3				
4	Resonant inverters: Series resonant inverters with unidirectional and bidirectional switches. Full bridge inverters with bidirectional switches. Frequency response for series loaded, parallel loaded and series parallel loaded. Parallel resonant inverters, class E resonant inverters. Class E resonant converter, ZCS resonant converter, ZVS resonant converter Resonant DC-link inverters.	12	23	2,4,5	CO1 CO2 CO3	PSO1 PSO3				
5	MULTILEVEL INVERTERS: Multilevel concept – Classification of multilevel inverters – Diode clamped Multilevel inverter – principle of operation – main features – improved diode Clamped inverter – principle of operation – Flying capacitors multilevel inverter-principle of operation – main features – cascaded multilevel inverter – principle of operation – main features – Multilevel inverter applications – reactive power compensation – back to back intertie system – adjustable drives - Switching device currents – dc link capacitor voltage balancing – features of Multilevel inverters – comparisons of multilevel converters.	10	19	2	CO5	PSO1 PSO3				
Reference Books										
1.	Power Semiconductor Circuits by S.B. Dewan & A. Straughen									
2.	Power Electronics By Ned Mohan									
3.	Thyristorised power controllers - G.K. Dubey									
4.	Thyristor Phase controlled converters and Cycloconverters by B.R. Pelly									
5.	Switched mode power supply design- P.R.K. Chetty									



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6.	Switched mode power converter - K.Kit Sum
7.	Thyristors - Sugandhi and Sugandhi - John Wiley

Laboratory : 6-10 Experiments/Simulations based on syllabus contents.



		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering			Academic Year			2021-22			
M E Electrical Engineering (Industrial Electronics) : Regular Programme											
Year	I	Core / Elective / Foundation Control Of Electric Drives			Credits / Hours per week			L: 4 hrs/week Pr. : 3hrs/week			
Semester	II	Year of Introduction : 2021 Year of Revision : NIL			Maximum Marks / Grade			100+50 = 150			
Mode of Transaction		Lectures and Laboratory									
Course Outcome (CO) CO1: Explain concept of electric and solid state drives , dynamics of drives CO2: Analyze DC drives and its control CO3: Develop Closed loop control for Drives. CO4: Explain Induction motor drives and various controlling methods of induction motor and special machines.											
Unit No.	Topic			Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional



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									Ethics (PE)
1	Introduction: Solid state drive and its elements, dynamics of motor-load system, converter-motor system, and speed control and multi- quadrant operation drive specifications	05	10	1,2	CO1	PSO1	SD	G	PE
2	Rectifier Controlled DC Motor: Single phase half/fully controlled rectifier fed separately excited motor, three phase fully controlled rectifier fed separately excited motor, armature current ripple and its effect on the motor performance, rectifier source interaction, PWM rectifier, current control, multi-quadrant operation of fully controlled rectifier fed dc motor	12	15	2,3,4,5	CO1 CO2 CO3	PSO2			
3	Chopper controlled DC motor: Motoring operation of chopper fed separately excited and DC series motors, regenerative, dynamic & composite braking of DC motors, current control, and multi quad control of chopper fed DC motor.	09	20	2,3,4	CO1, CO2 CO3	PSO2			
4	Closed loop control of DC drives: Single quadrant variable speed drives, four quadrant variable speed drives.	05	15	1,2,3,4,5,6	CO1, CO2, CO3,	PSO2			
5	AC Drives: a) Control of I.M. by ac voltage controller static rotor resistance control of I.M., static Scherbius drive, modified, Kramer's drive, frequency controlled I.M. drive, Control of I.M. by voltage source inverter and current source inverter. Cyclo Converter drives. b) Synchronous motor drives: Self-controlled Synchronous motor drives using CSI, VSI & cyclo converter. c) Closed loop control of I.M. drives & synchronous drives.	13	30	2,3,4,5,	CO1, CO3, CO4,	PSO2			
6	Switched Reluctance Motor Drive: Various drive configurations, Sensor and sensorless control of SRM, reduction in torque pulsation	08	10	2,3,4,5,	CO1, CO3, CO4	PSO2			

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सत्यं शिवं सुन्दरम्	FACULTY OF TECHNOLOGY AND ENGINEERING THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA VADODARA Department of Electrical Engineering 2 year Post Graduate Course ME ELECTRICAL (Industrial Electronics)								
	Permanent Magnet Motor Drive: Vector control of the PMSM drive, Direct torque control of PMSM drive, Sensor and sensorless control of PMBLDC and PMSM drives								
Reference Books									
1.	Power Semiconductor Controlled drives by G K Dubey-Prentice Hall Incorporation								
2.	Thyristor Control of AC motors by J.M.D. Murphy-Prgamon Press								
3.	Fundamentals of Electrical Drives-G K Dubey-Narosa Publishing House								
4.	Thyristor DC Drives - P.C. Sen - John Wiley & Sons.								
5.	Analysis of thyristor power conditioned motor by S.K. Pillai University Press								
6.	Power-Electronics and motor cpntrol by W. Shepherd Cambridge University Press								
7	T.J.E. Miller, Brushless Pm and Reluctance Motor Drives, Clarendon Press Oxford								
8	Recent IEEE Publication & Transactions on Power Electronics, Industry Applications and Power Delivery								

Laboratory : 6-10 Experiments/Simulations based on syllabus contents.

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Syllabus of Courses

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering		Academic Year				2021-22			
M E Electrical Engineering (Industrial Electronics) : Regular Programme										
Year	I	Core / Elective / Foundation Advanced Power Electronics	Credits / Hours per week				L: 4 hrs/week			
Semester	II	Year of Introduction : 2021 Year of Revision : NIL	Maximum Marks / Grade				100			
Mode of Transaction		Lectures								
Course Outcome (CO) CO1 Develop various DC to DC converters CO2 Compare different configuration of Active Filters CO3 Explain Various methods for power factor improvement for converters CO4 Explain facts controller. CO5 Evaluate HVDC System CO6 Explain different energy converter systems										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	Element s of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and



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									Professional Ethics (PE)
1	Bidirectional Power Converters: Bidirectional DC-DC Converter - Analysis and control Design. System description and comparison of Unidirectional and Bidirectional Buck Boost Converter. Model representation of the Bidirectional Converter. Comparison of "Average" and "Switched" Models. Single-loop control. The Bidirectional converter with Cascade Control. Applications.	12	20	1,2	CO1	PSO1	SD	G	PE
2	Front-End (AC-DC) Converters: Conventional methods of power factor improvements: Semiconverter, extinction angle control, symmetrical angle control – active front-end converters – Single phase: Boost, voltage doubler and PWM rectifiers –voltage and current controlled three-phase PWM rectifiers Integration of Energy Conversion Technologies: Introduction & importance, sizing, Optimized integrated systems, Interfacing requirements, Distributed versus Centralized Control, Grid connected Photovoltaic systems –classifications, operation, merits & demerits; Islanding Operations, stability and protection issues, load sharing, operation & control of hybrid energy systems, Solar Photovoltaic applications. IEEE & IEC standards for renewable energy grid integrations.	08	15	2,3,4,5	CO3 CO6	PSO2			
3	Static VAR Compensator: Static Var systems for	10	20	2,3,4	CO4	PSO2			



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	Reactive Power Control in Electrical Energy System. Types of static Var systems using thyristor converters : i) Saturated reactor ii) Thyristor controlled reactor(TCR) iii) thyristor switched capacitor (TSC) iv) Combined TCR and TSC compensator v) Thyristor controlled series compensator vi) static phase shifters (SPS) vii) Static condensers (StatCom).								
4	High Voltage DC Transmission (HVDC): Role of HVDC, traditional role of HVDC, New role of HVDC. Design of different converters & inverters. Modes of operation of rectifiers & inverters. HVDC Control system and their characteristics. Modelling of HVDC system. Types of HVDC links, reactive power requirement & filtering.	08	15	1,2,3,4,5,6	CO5	PSO2			
5	Flexible AC Transmission System (FACTS): Fundamental requirement of AC transmission system. Factors affecting stability and voltage control. FACTS devices. Design of controllers. Modern static compensator; reactive power co-ordination, harmonic elimination, power quality. Device modelling. Dynamic performance of transmission system.	08	30	2,3,4,5,6	CO4	PSO2			
6	Active filters: Requirement of active filters, types of active filters, their implementation. Harmonic survey and solution for active filters. Quality monitoring using wavelet transform.	06	15	2,3,4,5,6	CO2	PSO2			

Reference Books

1.	Power Semiconductor Controlled drives by G K Dubey-Prentice Hall Incorporation
2.	Thyristor Control of AC motors by J.M.D. Murphy-Prgamon Press
3.	Fundamentals of Electrical Drives-G K Dubey-Narosa Publishing House
4.	Thyristor DC Drives - P.C. Sen - John Wiley & Sons.



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5.	Analysis of thyristor power conditioned motor by S.K. Pillai University Press
6.	Power-Electronics and motor control by W. Shepherd Cambridge University Press
7	Ali Keyhani Mohammad Marwali and Min Dai, Integration and Control of Renewable Energy in Electric Power System, John Wiley publishing company, 2 nd Edition, 2010