SEM VI

Professional Core (Theory)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL321
Course Name	Power System Protection
Desired Requisites:	Power System Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs /week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To teach need for power system protection and basic principles of circuit breakers and relays.
2	To discuss protection of feeders, transmission lines, transformers, generators and their implementation using electromagnetic & microprocessor based relays.
3	To discuss causes of over voltages in power system and protection against these over voltages.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Describe** basic principles & working of circuit breakers & fuses and select proper CB/fuse for a particular application.	II	Understanding
CO2	**Classify** the requirements of protection for different parts of a power system and select proper relay scheme.	III	Applying
CO3	**Analyse** the performance of various protection devices and discuss digital relaying techniques.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Over Current Relays** Need of protection, Brief theory and construction of electromagnetic relays. Different time current characteristics of over current relay, Directional relay, Microprocessor based over current relay, Directional over current relay, drawbacks of over current schemes.	7
II	**Arc Interruption Process** Voltage - current characteristics of arc, Principles of DC and AC arc interruption, high resistance and current zero interruption, arc voltage, Transient Restriking Voltage (TRV), Recovery voltage, RRRV, current chopping, resistance switching, capacitive current interruption	6

III	**Circuit Breakers & Fuses** Classification of circuit breakers, brief study of construction and working of Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of CB and testing of CB, Fuse –Rewirable and HRC fuse, fuse characteristics, application and selection of fuse	6
IV	**Protection of Transformer, Generator and Bus Bar** Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection.	7
V	**Protection of Transmission Line** Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages.	7
VI	**Recent Developments in Protection** Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc.	6
Textbooks		
1	S.S. Rao*, "Switchgear & Protection"*, Khanna Pub., XI edition, 2005.	
2	B.Ram & Vishwakarma, *"Power System Protection & Switchgear*", TMH Pub., III edition, 2008.	
References		
1	Oza, Nair, Mehta & Makwana*," Power System Protection & Switchgear",* MGH pub., 2011.	
2	C.R. Mason*, "Art & Science of Protective Relaying",* GE e-book.	
3	Y.G. Paithankar & S.R. Bhide, *"Fundamentals of Power System Protection",* PHI pub., I edition, 2004.	
Useful Links		
1	https://nptel.ac.in/courses/108/101/108101039/	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		3												
CO3			3											
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL322
Course Name	Industrial Drives and Control
Desired Requisites:	DC Machines and Transformer, AC Machines and Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To make students understand concept of fundamental knowledge in dynamics and control of Electric Drives.
2	To strengthen control principles of various DC and AC motors using solid state converters.
3	To cover principles of selection of Electric Motors and highlights the applications of Electrical Drives.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Explain** the various concepts used in Electric drives.	II	Understanding
CO2	**Apply** the control techniques for Electric drives for speed control.	III	Applying
CO3	**Analyse** the performance of various control techniques used in speed control of electric drives and select a drive for particular application.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Fundamentals of Electric Drives** Types & parts of the Electrical drives, Selection criteria of drives, motor rating, selection based on duty cycle, selection of converter rating, fundamental torque equation, speed torques characteristics DC motor & Induction motor, multi quadrant operation of the drive, classification of mechanical load torques, steady state stability of the drive, constant torque and constant HP operation of the drive, closed loop speed control.	7
II	**DC Motor Drives** Methods of speed control, starting and braking operation, single phase and three phases full controlled and half controlled converter fed DC drives, Multi quadrant operation of separately excited DC shunt motor, dual converter fed DC drives, circulating and non – circulating mode of operation, converter fed DC series motor drive, chopper control of DC shunt and series motor drives, four quadrant operation of chopper fed DC shunt motor drive.	7

III	**Induction Motor Drives** Torque equation, Speed control methods for three phase cage induction motor, braking methods, stator voltage control induction motor drive, VSI fed induction motor drive, constant torque (constant E/F and constant V/F), constant HP operation, closed loop speed control block diagram, Stator current control methods fed induction motor drive, speed torque characteristics of CSI fed drive, closed loop speed control block diagram, comparison of CSI fed and VSI fed induction motor drive.	7
IV	**Slip Ring Induction Motor Drives** Chopper controlled resistance in rotor circuit, slip power recovery using converter cascade in rotor circuit, sub synchronous and super synchronous speed control, Kramer speed control, cyclo - converter in rotor circuit.	6
V	**Synchronous Motor Drives and Brushless DC Motor Drives** VSI fed synchronous motor drives, true synchronous and self-control mode, open loop and closed loop speed control of Permanent magnet synchronous machine, brushless DC motor drives.	6
VI	**Special Drives** Construction and operating principle of switched reluctance motors, Current / Voltage control, torque equation, converter circuits, operating modes and applications of switched reluctance motors. Solar panel VI characteristics, solar powered pump, maximum power point tracking and battery-operated vehicles.	6

Textbooks	
1	*"Fundamentals of Electrical Drives",* G. K. Dubey, Narosa publication, 2nd edition.
References	
1	*"Fundamentals of Electrical Drives",* NPTEL video lecture series by Prof. Shyama Prasad Das, Department of Electrical Engineering, IIT Kanpur.
2	"*Power Electronics - Converter Application",* By N. Mohan T.M. Undel and W. P. Robbins, John Wiely and sons.
3	"*Electrical Drives - Concept and application*", Vedam Subramanyam.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104140/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3												2
CO2			2											2
CO3			2											2
CO4														
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL323
Course Name	Microcontroller and Applications
Desired Requisites:	Analog and Digital Circuits

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 3			

Course Objectives

1	To develop basic knowledge of microcontrollers and their features.
2	To provide skills for programming microcontroller for applications in Electrical Engineering.
3	To enable students to interface and program different peripherals to microcontrollers.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Explain the architecture and features of microcontrollers.	II	Understanding
CO2	Apply programming techniques to implement counters, timers, interrupts and other peripherals.	III	Applying
CO3	Implement the applications related to interface microcontroller with electrical and electronics systems.	III	Applying
CO4	Construct a microcontroller based application.	III	Applying

Module	Module Contents	Hours
I	**Microcontroller Basics** Overview of 8051, features, Architecture, Pin out and pin functions, program memory, data memory, SFR area, PSW, Code memory space, (Internal/External), Port structure, clock circuit, Addressing Modes	6
II	**Programming ports and timers** Introduction to Embedded C programming ,Basic I/O programming ,Development tools for 8051 programs, Programming Timers and counters Timer block diagram and function, Timer modes 0, 1, 2 and their Applications, Timer and Counter Programming	7
III	**Interrupts and Serial Communication** Interrupt structure, Writing ISR, interrupt, Interrupt priorities, Programming for external interrupt. Programming timer interrupts. Serial Communication: Serial communication modes, RS232 signals of PC, Programming through Serial communication	6
IV	**Peripheral Interfacing- I** Interfacing of microcontrollers to external peripherals and programming, LCD interfacing, Interfacing of Analog to Digital Converters and Digital to Analog Converters, Stepper motor interfacing	7

V	**Peripheral Interfacing- II** DC motor interfacing, PWM programming using microcontrollers, Use of Arduino in Power Electronics Applications, Interfacing Temperature Sensors, Relay Interfacing, concept of hardware-in-loop simulation, programming examples	7
VI	**Introduction to Advanced microcontrollers** Introduction to ARM and PIC processors of MSP 430 microcontroller, 16 bit Micro-controllers, overview, features, architecture, addressing modes, Low power operation feature of MSP 430	6

Textbooks	
1	Muhammad Mazidi, Janice Mazidi and Rolin McKinlay, 'The 8051 Microcontroller and Embedded systems using Assembly and C', Pearson Education, 2nd Edition, 2007
2	Kenneth Ayala ,'8051 Architecture, Programming and Applications', 3rd Edition, 2007
3	Massimo Banzi and Michael Shiloh, Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media; 3rd edition, 2014
References	
1	Subrata Ghoshal, 'Embedded Systems and Robots- Projects using the 8051 Microcontroller', Cengage Learning, 1st Edition, 2009
2	Michael Margolis, 'Arduino Cookbook', Shroff/ O'Reilly,2nd Edition, 2012
3	Mazidi, RolinMc Kinlay and Danny Causey, 'PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education, 2007
4	Andrew N. Sloss, 'Arm System Developer's Guide: Designing and Optimizing System Software', Elsevier Publication, 2005
5	Texas Instruments MSP 430 microcontroller: Guide and Datasheets
Useful Links	
1	https://nptel.ac.in/courses/106/108/106108100/
2	https://nptel.ac.in/courses/117/104/117104072/
3	https://nptel.ac.in/courses/108/102/108102045/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3											
CO2					3									
CO3					3									
CO4			3											2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information	
Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EL324
Course Name	Energy Audit and Management
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits: 3			

Course Objectives	
1	To create awareness in the students about energy conservation and its importance.
2	To develop skills for energy auditing and energy management in industrial environment

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Explain** energy conservation, its importance and necessity of Energy audit.	II	Understanding
CO2	**Calculate** the financial analysis for energy economics.	III	Applying
CO3	**Analyse** Energy Efficiency in Electrical and Thermal Utilities	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Energy Conservation and Management** Energy Conservation and its importance, Energy strategy for future, Energy Conservation Act2001 and its features, Energy Pricing, Energy Sector Reforms, Energy And Environment, Energy Security, Objectives and Principles of Energy Management.	7
II	**Energy Audit** Energy audit Definition as per EC-act 2001, Need of Energy Audit, Types of Energy Audit, Energy Audit Reporting Format, Understanding Energy and Costs, Benchmarking, Energy Performance, Energy Audit Instruments, Duties and Responsibilities of Energy Auditor.	7
III	**Energy Action Planning, Monitoring And Targeting** Energy action Planning Steps, Top Management Support, Energy Manager Duties & responsibilities, Evaluating Energy Performance, Energy monitoring & Targeting – Set up, Key Elements, Data & Information Analysis, Relating Energy Consumption & Production, CUSUM Technique, Case Study	7
IV	**Energy Economics** Financial Analysis Techniques – Pay Back Period, Net Present Value, Return on Investment, Internal Rate Of Return, Time Value Of Money, Cash Flow, Risk & Sensitivity analysis.	6

V	**Energy Efficiency in Electrical Utilities** Electricity Billing, Electrical Load Management and Maximum Demand Control, Power Factor Improvement & Benefits, Assessment of Transmission and Distribution Losses, Estimation Of Technical Losses in Distribution System, Commercial Losses, Demand Side Management, Energy Saving Opportunities With Pumps and Fans.	7
VI	**Energy Efficiency in Thermal Utilities** Energy Conservation in Boilers, Steam Turbine, Industrial Heating System, Heat Exchangers, Heat Pumps, Efficiency Improvement, Energy Conservation in Buildings, Climate responsive Buildings, Thermal load modelling in Building	5
Textbooks		
1	Amlan Chakrabarti, "*Energy Engineering and Management*", PHI, 2011.	
References		
1	Bureau of Energy Efficiency, "*General Aspects of Energy Management & Energy Audit1.1, 1.2 &1.3*", BEE, e-books.	
Useful Links		
1	https://beeindia.gov.in/content/energy-auditors	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1							2							
CO2	2													
CO3		2												
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Professional Core (Lab)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL371
Course Name	Power System Protection Lab
Desired Requisites:	Power System Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To develop hands on skills to test and verify protective relay operation, used in power system protection
2	To demonstrate electromagnetic and digital relays to illustrate their operating characteristics
3	To experience to use power system analysis software for developing protection schemes for simple electrical systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Demonstrate** the working of over current, earth fault relays and plot the I-t characteristics	III	Applying
CO2	**Execute** experimental study of a microcontroller based relays.	III	Applying
CO3	**Design** a scheme for over current relay co-ordination using simulation software / hardware.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Experiments:

1. Arrange the set-up & perform an experiment to verify the Current-Time characteristics of a shaded pole type over current relay.
2. Arrange the set-up & perform an experiment to verify the Current-Time characteristics of a shaded pole type earth fault relay.
3. Arrange the set-up & perform an experiment to demonstrate the operation & use of Directional over current relay.
4. Assemble a circuit to obtain & verify various Current-Time curves for Digital over Current Relay.
5. Demonstrate the application of Quadrilateral Distance relay for detection of fault on transmission lines.
6. Conduct a simulation study to develop relay co-ordination scheme of over current relays for a simple radial feeder system.
7. Conduct an experiment to illustrate the over current relay co-ordination on the Transmission Line Simulator.
8. Conduct a simulation study to explain the Circuit Breaker operation under fault condition.

Textbooks	
1	S.S. Rao, *"Switchgear & Protection",* Khanna Pub., XI edition, 2005
2	B.Ram and Vishwakarma, *"Power System Protection & Switchgear",* TMH Pub., III edition, 2008.
References	
1	Oza, Nair, Mehta and Makwana, *"Power System Protection and Switchgear"*, MGH pub., 2011.
2	C.R. Mason, *"Art and Science of Protective Relaying",* GE e-book.
3	Y.G. Paithankar and S.R. Bhide, *"Fundamentals of Power System Protection",* PHI pub., I edition, 2004.
Useful Links	
1	https://nptel.ac.in/courses/108/101/108101039/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2	3	3												
CO3		2												
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL372
Course Name	Industrial Drives and Control Lab
Desired Requisites:	DC Machines and Transformer, AC Machines and Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To impart knowledge on performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using solid state converters.
2	To develop the skills for the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation and suitability for a particular operation
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Demonstrate** experiments on basics of DC and AC drives.	III	Applying
CO2	**Analyze** the performance of drives using hardware circuits and simulation.	IV	Analysing
CO3	**Evaluate** performance of drives using hardware circuits and simulation**.**	VI	Evaluating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Verify Speed – Torque characteristics of chopper fed D. C. series motor. (Hardware)
2. Analyze the performance of chopper fed D. C. drive for closed – loop speed control (simulation).
3. Demonstrate operation and application of single-phase full wave, half controlled converter for open loop speed control of D. C. shunt motor. (Hardware).
4. Demonstrate operation and application of single-phase full wave, full controlled converter for open loop speed control of D. C. shunt motor. (Hardware).
5. Analyze the performance of converter fed D. C. drive for closed loop speed control. (Simulation).
6. Study the operation of two quadrant single phase converter fed 5 HP DC drive (Simulation).
7. Study the four-quadrant operation of 5 HP DC motor using single phase converter. (Simulation).
8. Study the operation of four quadrant chopper fed DC drive (simulation).
9. Assess the performance of rotor resistance control method for speed control of Slip – Ring Induction motor. (Simulation)
10. Demonstrate speed control of Induction motor using V/f method. (Hardware)
11. Analyze the operation of Induction motor drive with Six – step VSI control (Simulation).
12. Demonstrate the operation of brushless DC motor drive with software Simulation. (Simulation)
13. Demonstrate speed control of Induction motor using Kramer speed control method. (Hardware)

Textbooks	
1	*"Fundamentals of Electrical Drives", G. K. Dubey, Narosa publication, 2nd edition.*
References	
1	"Modern Power Electronics and AC drives" by B. K. Bose, Prentice Hall of India Pvt. India
2	"*Power Electronics - Converter application*" By N. Mohan T.M. Undeland and W. P. Robbins, John Wiley and sons
3	"*Electrical Drives - Concept and application*" Vedam Subramanyam.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104140/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3												
CO2		2												2
CO3			2											2
CO4														

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

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AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL373
Course Name	Microcontroller and Applications Lab
Desired Requisites:	Analog and Digital Circuits Lab

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: #			

Course Objectives

1	To develop the necessary skills required for programming 8051 and Arduino microcontroller implement real world applications.
2	To understand the practical problems in electrical systems and implement programs for same.
3	To introduce various programming softwares and implement microcontroller based applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Use** simulation tools to analyze microcontroller based systems.	III	Applying
CO2	**Apply** programming techniques to implement counters, timers, interrupts and other peripherals.	III	Applying
CO3	**Execute** programs to interface microcontrollers with electrical and electronics systems.	III	Applying
CO4	**Construct** programs for electrical applications using microcontrollers.	III	Applying

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to different Development Boards, Keil/Arduino IDE, Using Keil/Arduino IDE to assemble a program, Hex file format, Downloading and running the program
2. Demonstrate the flashing of GPIO ports of using delay.
3. Implement a 8-bit up and down counter using microcontroller.
4. Devise a running light scheme using GPIO pins of microcontroller.
5. Demonstrate the process of serial communication using 8051 and Arduino microcontroller
6. Construct a C program using 8051 to generate pulses using various timer modes
7. Execute programs to demonstrate interrupts for 8051.
8. Construct a C program to interface LCD with Arduino.
9. Devise a Arduino based relay control for single phase ac loads.
10. Construct a C program to interface stepper motor with Arduino.
11. Construct a temperature control system using Arduino
12. Demonstration of Hardware-in-loop simulation using Arduino and Matlab /Simulink

Textbooks	
1	Muhammad Mazidi, Janice Mazidi and Rolin McKinlay, "*The 8051 Microcontroller and Embedded systems using Assembly and C"*, Pearson Education, 2nd Edition, 2007
2	Kenneth Ayala , "*8051 Architecture, Programming and Applications",* 3rd Edition, 2007
3	Massimo Banzi and Michael Shiloh, Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media; 3rd edition, 2014
References	
1	Subrata Ghoshal, "*Embedded Systems and Robots- Projects using the 8051 Microcontroller"*, Cengage Learning, 1st Edition, 2009
2	Michael Margolis, "*Arduino Cookbook"*, Shroff/ O'Reilly,2nd Edition,2012
3	Mazidi, RolinMc Kinlay and Danny Causey, "*PIC Microcontroller and Embedded Systems using Assembly and C for PIC18*", Pearson Education.
Useful Links	
1	https://nptel.ac.in/courses/106/108/106108100/
2	https://nptel.ac.in/courses/117/104/117104072/
3	https://nptel.ac.in/courses/108/102/108102045/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3											
CO2					3									
CO3					3									
CO4			3											
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL341
Course Name	Mini-Project-3
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To acquire the skills of electrical and electronic circuit design and assembly.
2	To develop the skills of analysis and fault diagnosis of the electrical and electronic circuit as per design.
3	To test the electrical and electronic circuit assembly.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Understand** the basics concepts used in Mini Project.	III	Understanding
CO2	**Analyse** and infer the reference literature critically and efficiently.	IV	Analysing
CO3	**Construct** the model of the project.	VI	Creating
CO4	**Evaluate** the performance of the project.	V	Evaluating
CO5	**Write and Present** the report of the project.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Visit to a local industry or search for the study of problems of industry.
2. Prepare the problem based hardware Mini project.
3. Evaluate the performance of project.
4. Prepare a report on the same.

Note :

Student will have to perform a group project based on above points which will be evaluated as In Semester Examination (LA1, LA2 and Lab ESE).

Textbooks

References

Useful Links

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3			1					
CO2		3							3					
CO3	1		3											
CO4				2	3									
CO5									3					
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Professional Elective-2

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B.Tech., Sem VI
Course Code	6EL331
Course Name	Professional Elective II: ANN and Fuzzy Control
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To make students understand operation and performance of ac and dc machines.
2	To make students learn characteristics of ac and dc machines.
3	To develop skills to choose ratings of ac and dc machines for various applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the architecture and features of neural networks	II	Understanding
CO2	Explain programming techniques to implement neural networks	III	Understanding
CO3	Implement the applications related to electrical and electronics	IV	Applying

Module	**Module Contents**	**Hours**
I	**Neural Networks and Architecture** Fundamentals of Neural Networks: What is Neural Network, Model of Artificial Neuron, Learning rules and various activation functions, Single layer Feed-forward networks, Perceptron learning, MLP structures.	7
II	**Back propagation Networks** Delta and LMS rules, Back propagation Networks, Architecture of Back-propagation (BPN) Networks, Back-propagation Learning, Variation of Standard Back propagation algorithms.	7
III	**Unsupervised networks** Associative Memory: Auto correlators, Heterocorrelators, Multiple Training Encoding Strategy, Exponential BAM, and Associative Memory for Real coded pattern pairs, Applications	7
IV	**Adaptive Resonance Networks** Adaptive Resonance Theory: Cluster Structure, Vector Quantization, Classical ART Network, Simplified ART Architecture, ART1 and ART2 Architecture and algorithms, Applications, Sensitivities of ordering of data.	6
V	**Radial and Convolution Networks** Convolution networks, pooling, working and design, Radial basis function network, working	6
VI	**Application to Electrical** Control system design with neural network- controller design, tuning and learning, Power system applications, Load forecasting and fault analysis	6

Textbooks	
1	Simon Haykin, “Neural Network”, Pearson Publications, 2005.
2	Bishop, C. M., “Neural Networks for Pattern Recognition”, Oxford University Press. 1995.
3	S.Rajasekaran and G.A. Vijayalakshmi Pai., “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI publications,2012.
References	
1	Chin Teng Lin, C. S. George Lee , “Neuro-Fuzzy Systems” , PHI.pub. 2007.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_ge07/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	
CO2			2										2	
CO3					2								2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL332
Course Name	Professional Elective II: Nonlinear and Digital Control System
Desired Requisites:	Control System Engineering

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To make students identify various characteristics of nonlinear systems.
2	To develop skills for analyzing nonlinear systems.
3	To make students familiar with digital control system.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Construct mathematical models of digital control system.	III	Applying
CO2	Analyze the nonlinear systems using various basic and commonly used tools.	IV	Analysing
CO3	Calculate the compensators and controllers for digital control system.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Nonlinear System** Properties of nonlinear system, Multiple Equilibrium States, Chaos, Sensitive to input amplitude, Limit Cycle, Bifurcation, Jump Phenomenon, Common Physical Nonlinearities, Dead Zone, Saturation, Hysteresis, Backlash, Classification of Nonlinearities	5
II	**Analysis of Nonlinear System** Linearization, Phase Plane Analysis, Classification of Equilibrium States, Node,Focus, Saddle Point, Centre, Prediction of Limit Cycle using Phase Plane, Describing Function Method, Lyapunov Stability for Non-linear and Linear Systems.	7
III	**Digital Control System** Review of Z transforms, Z transform method for solving difference equation,Impulse Sampling and Data Hold, Pulse Transfer Function, Sampling Theorem, Mapping between S Plane and Z Plane, Stability Analysis, Transient and SteadyState Analysis.	7
IV	**Design of Digital Control System** Construction of Root Locus, Design based on Root Locus, P,PI,PD,PID Controllers, Lead, Lag, Lead-Lag Compensators, Frequency Response Analysis, Bode Diagram.	8

V	**State Space Analysis of Digital Control System** State Space representation of Digital System, Controllable Canonical form,Observable Canonical form, Diagonal form, Jordan form, Solving State Space Equations, State Transition Matrix, Properties of State Transition Matrix, Pulse Transfer Function Matrix. Discretization of Continuous Time State SpaceEquation.	6
VI	**State Space Design of Digital Control System** Controllability, Controller Design in State Space, Design via Pole Placement for Controller Design, Ackermann's Formula for Controller Design, Observability, Observer Design, Design via Pole Placement for Observer Design, Ackermann's Formula for Observer Design, Deadbeat Design, Design for Deadbeat Response	6

Textbooks	
1	K. Ogata, "Discrete Time Control Systems", Second Edition, Pearson Education, 2005, ISBN: 9788120327603
2	C.L. Phillips, J.M. Parr, "Feedback Control Systems", Fifth Edition, Pearson Education,2013, ISBN: 9789332507609
References	
1	I.J. Nagrath, M.Gopal "Control Systems Engineering", New Age International, Sixth Edition, 2018, ISBN: 9789386070111
2	B.C. Kuo, "Digital Control Systems", Oxford University Press, Second Edition, 2012, ISBN: 9780198083542
Useful Links	
1	https://nptel.ac.in/courses/108/106/108106162/
2	https://nptel.ac.in/courses/108/102/108102113/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		2												
CO3			2											

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL333
Course Name	Professional Elective III: Introduction to Electric Vehicle
Desired Requisites:	Electrical Machines, Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 3			

Course Objectives	
1	To develop basic knowledge related to architecture of Electric Vehicles
2	To provide knowledge related to design aspects and dynamics of Electric vehicles
3	The course aims at enabling students to understand the motor specifications and charging standards for Electric vehicles.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the architecture and features of Electric Vehicles	II	Understanding
CO2	Interpret the topologies and various design considerations for Electric vehicles	II	Understanding
CO3	Calculate the vehicle dynamics for Electric propulsion systems	III	Applying

Module	**Module Contents**	**Hours**
I	**Introduction to Electric Vehicles** Background of Electric Vehicles, Electric Vehicle System, Components of Electric Vehicles, Advantages of Electric Vehicles, Efficiency, Pollution Comparison with conventional vehicles, Fundamentals of Electric Vehicles	6
II	**Types of Electric Vehicles and Architecture of EVs** Concept of Electric, Hybrid and Plug-in Electric Vehicles, Typical configuration of Hybrid Electric Vehicle, Topologies of HEVs: Series, Parallel and Series-Parallel Configuration, Topologies of Plug-in Hybrid Electric Vehicles, Fuel Cell Electric Vehicles, Solar Powered Electric Vehicles	7
III	**Design Considerations for Electric Vehicles** Introduction to EV design fundamentals, Aerodynamic Consideration, Rolling resistance, Transmission efficiency, Consideration of vehicle mass, Basics of Electric vehicle chassis and body design, general issues in Electric vehicle design	6

IV	**Vehicle Dynamics** Roadway fundamentals, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion power: Force velocity characteristics, Vehicle gradability, Velocity and Acceleration: Velocity Profile, Distance traversed, tractive power, Energy Required, Propulsion System Design for EV systems	7
V	**EV Drive systems** Types of motors used in EV, Requirements of EV drive systems, Series Hybrid Electric Drive Train - Operation Patterns, Control Strategies, Parallel Hybrid Electric Drive Train – Operation Pattern, Control Strategies	7
VI	**Electric Vehicle Chargers and Charging Standards** EV charging: requirements and Classification, Charging standards for Electric vehicles, Introduction to AC and DC chargers for EV systems, Working of Electric Vehicle Supply Equipment (EVSE), Fast Chargers for EV systems, ARAI Testing standards for Electric Vehicles	6

Textbooks	
1	Iqbal Husain ,‘ Electric and Hybrid Vehicles: Design Fundamentals ’, CRC Press, 2003
2	James Larminie, John Lowry, “ Electric Vehicle Technology Explained”, Wiley , 2nd edition, 2012

References	
1	Sheldon Williamson, ‘ Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles ’, Springer-Verlag, 2012
2	M. Ehsani, Y. Gao, S. Gay and A. Emadi , Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press, 2005.

Useful Links	
1	https://nptel.ac.in/courses/108/103/108103009/
2	https://nptel.ac.in/courses/108/102/108102121/
3	https://nptel.ac.in/courses/108/106/108106170/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												
CO3		3												

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Open Elective 2

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information	
Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6OE350
Course Name	Open Elective 2: Industrial Automation
Desired Requisites:	Basic Electrical Engineering, Basic Mechanical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	This course intends to develop basics of ladder logic programming for PLC.
2	It provides the foundation level knowledge of SCADA System.
3	It gives overview of various types of controller for closed loop control.
4	It provides the applications of variable speed drives in industries.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Explain** the working of various types of measuring instruments, controllers and actuators for implementation in industrial automation.	II	Understanding
CO2	**Identify** the use of various actuators in industrial automation	III	Applying
CO3	**Apply** the knowledge of PLC and SCADA for Industrial Automation.	III	Applying
CO4	**Explore** the use of variable speed drives for Industrial Automation.	III	Applying

Module	**Module Contents**	**Hours**
I	**Measurement of Various Process Parameters** Measurement of quantities such as temperature, pressure, force, displacement, speed, flow, level, humidity, pH etc., signal conditioning, estimation of errorsand calibration.	6
II	**Process Control and Various Controllers** Introduction to process control, PID controller and tuning, various control configurations such as cascade control, feed forward control, split range control, ratio control, override control and selective control.	6
III	**Actuators** Introduction to various actuators such as flow control valves, Hydraulic andpneumatic, servo motors, symbols and characteristics.	6
IV	**PLC** Introduction to sequence control and relay ladder logic, basic PLC system, I/O modules, scan cycle, programming of timers, counters and I/O programming.	7

V	**SCADA for Industrial Automation** Components of SCADA systems, functions, classification of SCADA, networking and communication protocols.	7
VI	**Variable Speed Drives** Role of variable speed drives in automation, DC drives, AC drives and synchronous motor drives applications of variable speed drives.	7

Textbooks	
1	John W. Webb, Ronald A. Reis "Programmable logic controllers, principles & applications" by PHI publication, Eastern Economic Edition.
2	C. D. Johnson, "Process control & instrumentation techniques".Pearson Education
References	
1	George Stephanopoulos, "Chemical Process Control - An introduction to Theory and Practice", Prentice-Hall of India, 1st Edition 1984.
2	"Fundamentals of Electrical Drives", G. K. Dubey, Narosa publication, 2nd edition.
Useful Links	
1	https://nptel.ac.in/courses/108105063
2	https://archive.nptel.ac.in/courses/108/106/108106022/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2													
CO2		2			2										
CO3						2								2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISEshall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B.Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6EL375
Course Name	Humanities 2- Project Management (Universal values, ethics)
Desired Requisites:	B.Tech. (Electrical Engineering)

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	2 Hrs/ Week	30	30	40	100
		Credits: 2			

Course Objectives	
1	To prepare the students to manage projects by exploring both technical and managerial challenges and preparing the budget.
2	To make aware the students about leadership and ethical qualities in dealing with real life Project
3	To induce qualities for working in interdisciplinary and cross functional teams with effective Communication skills, economical and managerial challenges and commercial management.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Grasp and perceive the project activities with respect to resources required and the constraint for feasibility or completion within time	II	Understanding
CO2	Estimate and prepare budget for project completion, Understand commercial management	IV	Analyzing
CO3	Figure out and schedule the project and assess for controlling critical path networks	V	Evaluating

List of Experiments / Lab Activities/Topics

List of Topics(Applicable for Interaction mode):

1. Introduction to Project Management.
2. Project Cost, Planning, feasibility, risk.
3. Critical Path Networks - Principles of Resource Scheduling.
4. Executing and Controlling.
5. Commercial Management and various regulations.
6. Study and use of software related to Project Management System.
7. Universal values and ethics in regards to project management.

Textbooks

1	Dennis Lock , "Project Management", Gower Publishing Limited, 2013
2	Samuel J. Mantel, Jr., Jack R. Meredith, Scott M. Shafer, Margaret M. Sutton, "Project Management in Practice", John Wiley & Sons, Inc., 2011

3	B.C. Punmia and Khandelwal, "Project Planning and Control with PERT and CPM", Lakshmi Publications Pvt. Ltd., 2001
4	Horald Kerzner, "Project Management: A systems approach to planning, scheduling and Controlling", John Wiley & Sons Inc., 2009
5	Meri Williams , "The Principles of Project Management", Sitepoint Pvt Ltd., 2008.
References	
1	K. Nagarajan, "Project Management", New Age Int., 2nd ed. 2004.
2	B.M.Naik, "Project Management-Scheduling and Monitoring by PERT/CPM", 1984
3	William R Duncan, " A guide to the project management body of knowledge", PMI Publications, 1996
Useful Links	
1	https://www.apm.org.uk/resources/what-is-project-management/
2	https://www.projectmanager.com/project-management

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								1					1	1	
CO2									2					2	
CO3							1						2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.