Scheme and Syllabus Highlighting New Courses

Department of Electrical & Electronics Engineering

V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UHUC500	HU	Management, Entrepreneurship and IPR	4-0-0	4	50	100	3	-	-
18UEEC500	PC	Electromagnetic Theory	3-0-0	3	50	100	3	-	-
18UEEC501	PC	Electrical Machines-II	4-0-0	4	50	100	3	-	-
18UEEC502	PC	Power Electronics	4-0-0	4	50	100	3	-	-
18UEEC503	PC	Digital Signal Processing	3-0-0	3	50	100	3	-	-
18UEEE51X	PE	Elective –I	3-0-0	3	50	100	3	-	-
18UEEL505	PC	Electrical Machines-I Lab	0-0-3	1.5	50	-	-	50	3
18UEEL506	PC	Power Electronics Lab	0-0-3	1.5	50	-	-	50	3
18UEEL507	PC	Minor Project-I	0-0-3	1	50	-	-	-	-
18UEEL508	HU	Soft Skills/Aptitude	0-0-3	1	50	-	-	-	-
		Total	**21-0-12**	**26**	**500**	**600**		**100**	

HU- Humanity, PC- Program Core and PE-Professional Elective
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Elective-I	
18UEEE511	Data Structures and Algorithm
18UEEE512	Object Oriented Programming Structure
18UEEE513	Internet of Things (IoT)

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VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UEEC600	PC	Power System Analysis and Stability	4-0-0	4	50	100	3	-	-
18UEEC601	PC	High Voltage Engineering and Switchgear & Protection	4-0-0	4	50	100	3	-	-
8UEEE62X	PE	Elective -II	3-0-0	3	50	100	3	-	-
18UEEE63X	PE	Elective–III	3-0-0	3	50	100	3	-	-
18UEEO604	OE	Open-Elective-I	3-0-0	3	50	100	3		
18UEEL605	PC	Electrical Machines-II Lab	0-0-3	1.5	50	-	-	50	3
18UEEL606	PC	Sensors, Control systems and simulation Lab	0-0-3	1.5	50	-	-	50	3
18UEEL607	PC	Minor Project-II	0-0-6	2	50	-	-	50	3
18UEEL608	HU	Soft skills	0-0-3	1	50	-	-	-	-
		Total	**17-0-15**	**23**	**450**	**500**		**150**	

PC- Program Core, PE-Professional Elective and OE- Open Elective
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

18UEEO604	Renewable Energy System **(Open Elective-I)**

Electives - II		**Electives - III**	
18UEEE621	Computer Organization	18UEEE631	Electrical Estimation Specification Codes and Practices
18UEEE622	Computer Communication and Networking	18UEEE632	Nonlinear Control Theory
18UEEE623	PIC Microcontrollers	18UEEE633	Energy Auditing and Demand Side Management
18UEEE624	VLSI Circuits	18UEEE634	Testing and Commissioning of Electrical Equipment
18UEEE625	Software Engineering	18UEEE635	Electrical Drawing and CAD
18UEEE626	Digital Image Processing	18UEEE636	Operating System
18UEEE627	Database Management System	18UEEE637	PLC and SCADA
18UEEE628	Digital System Design using VHDL	---	

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VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UEEC700	PC	Computer Applications to Power Systems	3-0-0	3	50	100	3	-	-
18UEEC701	PC	Electrical Machine Design	3-0-0	3	50	100	3	-	-
18UEEE74X	PE	Elective –IV	4-0-0	4	50	100	3	-	-
18UEEO703	OE	Open Elective-II	3-0-0	3	50	100	3	-	-
18UEEL704	PC	Relay, High Voltage & Power System Simulation Lab	0-0-3	2	50	-	-	50	3
18UEEL705	PC	Major Project-Phase I	0-0-6	2	50	-	-	50	3
18UEEL706	PC	Internship	0-0-6	2	50	-	-	-	-
		Total	**13-0-15**	**19**	**350**	**400**		**100**	

PC- Program Core, **PE**-Professional Elective and **OE**- Open Elective
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Electric Vehicles (**Open Elective-II)** 18UEEO703

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Elective-IV	
AI Applications to Power System	18UEEE741
Modern Trends in Transmission System	18UEEE742
Modern Power System Protection	18UEEE743
Modern Power System Operation and Control	18UEEE744
Digital Image Processing	18UEEE745
Arm Processors	18UEEE746
Embedded Systems	18UEEE747

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SDM College of Engineering and Technology, Dharwad
Department of Electrical & Electronics Engineering
VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UEEC800	PC	Industrial Utilization of Electric Power	4-0-0	4	50	100	3	-	-
18UEEE85X	PE	Elective-V	3-0-0	3	50	100	3	-	-
18UEEO802	OE	Open Elective–III	3-0-0	3	50	100	3	-	-
18UEEL803	PC	Technical Seminar	0-0-3	1	50	-	-	-	-
18UEEL804	PC	Major Project-Phase-II	0-0-14	7	50	-	-	50	3
		Total	**10-0-17**	**18**	**250**	**300**		**50**	

PC- Program Core, PE-Professional Elective and OE- Open Elective
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Micro Electro Mechanical Systems **(Open Elective-III)**	18UEEO802
Elective-V	
Modern Trends in Grid Integration	18UEEE851
Power System Dynamics and Stability	18UEEE852
Power System Restructuring and Power Quality	18UEEE853
Reliability Engineering	18UEEE854
Analog and Digital Communication	18UEEE855

Total credits offered during 2nd, 3rd and 4th year = 135

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Scheme of Teaching and Examination

II-Semester M. Tech. (Power Systems Engineering)

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max.	*Max.	Duration	Max.	Duration
20PEPSC200	Artificial Intelligence Techniques to Power	4-0-0	4	50	100	3		
20PEPSC201	FACTS Controllers	4-0-0	4	50	100	3		
20PEPSEXXX	Elective 2	4-0-0	4	50	100	3		
20PEPSEXXX	Elective 3	4-0-0	4	50	100	3		
20PEPSEXXX	Elective 4	4-0-0	4	50	100	3		
20PEPSL202	Power System Laboratory-II	0-0-3	2	50			50	3
20PEPSL203	**Seminar	0-0-2	1	50				
	Total	**20-0-5**	**23**	**350**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

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*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in power systems preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in power system and allied areas.

Course Code	Elective (2, 3, 4)	Credits
20PEPSE231	Reactive Power Management in Power System	4
20PEPSE232	Economic Operation &Control of Power System	4
20PEPSE233	Power System SCADA	4
20PEPSE234	HVDC Power Transmission	4
20PEPSE235	Fundamentals of Smart Grid Technology	4
20PEPSE236	Distributed Generation and Micro Grids	4

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Scheme of Teaching and Examination

III-Semester M. Tech. (Power Systems Engineering)

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PEPSC300	FACTS Controllers	4-0-0	4	50	100	3		
18PEPSEXXX	Elective course-VII	4-0-0	4	50	100	3.		
18PEPSL301	Internship in industry/ R&D organization / Elective course-VIII **	** 2-4 weeks during vacation after 2nd Sem./ 3-0-0	3	50/50	- /100	-/3	50/-	3/-
18PEPSL302	Project Phase-I***	0-0-15	9	50			50	3
Total		**8/11--0-15**	**20**	**200**	**200/300**		**50**	

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CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for **100 marks** and reduced to **50 marks**.

** The students are expected to undergo training in industry for a period of ***2 - 4 weeks*** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired**.** OR The students can take one elective course if they do not undergo internship.

*** Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester.

Course Code	**Elective Courses**
18PEPSE311	Planning of Deregulated Power systems
18PEPSE312	Power systems Reliability Engineering
18PEPSE313	Programmable Logic Controllers and Applications

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Scheme of Teaching and Examination

IV-Semester M. Tech. (Power Systems Engineering)

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PEPSL400	Project Phase-II **	0-0-20	22	100	--	--	100	3
Total		**0-0-20**	**22**	**100**	**--**	**--**	**100**	**--**

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Project phase-I: The students are expected to work on a project for the full semester in an industry or institution

Total Credits offered for the first year: **46**

Total Credits offered for the Second year: **42**

Credits Distribution:

Particulars	Proposed
Program Core Course	20
Program Electives	28
Laboratory Course	04
Seminar	02
Internship/Training	03
Project	31
Total	**88**

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List of New Courses

Sl.No.	Course	Course Code
1	Data Structures and Algorithm	18UEEE511
2	Internet of Things (IoT)	18UEEE513
3	Minor Project-I	18UEEL507
4	Soft Skills/Aptitude	18UEEL508
5	Sensors, Control systems and simulation Lab	18UEEL606
6	Minor Project-II	18UEEL607
7	Soft skills	18UEEL608
8	PLC and SCADA	18UEEE637
9	Electric Vehicles (Open Elective-II)	18UEEO703
10	AI Applications to Power System	18UEEE741
11	Embedded Systems	18UEEE747
12	Major Project-Phase I	18UEEL705
13	Internship	18UEEL706
14	Artificial Intelligence Techniques to Power System	20PEPSC200
15	Programmable Logic Controllers and Applications	18PEPSE313
16	Project Phase-II	18PEPSL400

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SDM College of Engg. & Tech. Dharwad

Department of Electrical and Electronics Engineering

(Professional Competence with Positive Attitude)

18UESL100/18UESL200 Basic Engineering Skills Lab (0-0-2) 1

Contact Hours: 25

Course Learning Objectives (CLOs):

The student is expected to acquire basic minimum engineering skills with hands on in multiple disciplines of engineering like Civil, Mechanical, Electrical, electronics, computer Science etc. Further, the student will come to know about the role of different streams of engineering in practical systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1,12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Recite the general Engineering principles, laws and applications		1,2	
CO-2	Perform skill exercises to implement simple engineering systems in Civil, Mechanical, Electrical, electronics, computer Science and demonstrate the working	4	3	9
CO-3	Use computer skills to generate/prepare technical write up/report.			10

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO10	PO11	PO12

Mapping Level	2.0	2.0	2.0	3.0					1.0	1.0		

Contents:

Skill Exercises:

1) Acquire the skills of soldering, develop scheme to charge battery employing transformer & conversion circuits and make observations using suitable display equipment.
2) Acquire the skills of setting up of simple circuits with power control, measure electrical quantities, understand electrical behavior of different types of load along with safety and protection aspects.
3) Acquire the skills to set up a circuit to run 3 phase electrical motor and demonstrate the operation with load, record the speed and establish the relation between speed and load.
4) Acquire engineering skills to select sensors (temperature, flow, level etc.), develop an application set up to demonstrate the use of sensors.
5) To Calculate area of a given map/ plan
6) To understand and carry out plumbing activity
7) To prepare a building plan for given requirements
8) To make a fit from given raw material as given in the model drawing.
9) To make sheet metal model using GI sheet as given in development drawing.
10) Disassembling and assembling of components of a given system

Demonstration:

11) Demonstration of working of Public Address (PA) system, different electrical appliances, report generation using word, Excel and interfacing of computer peripherals (Demonstration only).
12) To determine water quality of the given sample of water
13) Demonstration of welding process

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Reference Material/Books:

1) Write up prepared by the Departments
2) E. Hughes - Electrical Technology, 8th edition, Pearson, 2006.

Mode of carrying out the skill exercises:

1. There shall be three faculty members one each from Civil, Mechanical and Circuit stream (preferably from Electrical &Electronics Engineering department) to train the students.
2. The contents are developed taking inputs from Chemical, Civil, Mechanical, E&E, E&C, Computer Science &Engg., Information Science &Engineering.
3. There shall be 10 skill exercises and 2 demonstration sessions
4. Three exercises from Civil, three exercises from Mechanical and four exercises from circuit streams form the list of 10 exercises. One each from circuits and Mechanical / Civil will form demonstration list.
5. A common facility shall be created in the department of Mechanical Engineering to carry out this course.
6. Preparation to carry out all 10 exercises shall be done and kept ready for the students to work
7. A batch of about 35 students will come to this lab once in every week during the allotted time of 2 hrs as per the time table.
8. A batch will be divided in to 10 sub batches each batch consisting of 3 to 4 students
9. All the 10 exercises shall be implemented in cyclic fashion.
10. A total of three faculty members, one each from Civil, Mechanical and Electrical will train the students in their related skill exercise.
11. The students shall prepare the report on the skill exercises conducted using word / excel (computer skills) and submit at the end of the semester for evaluation.
12. There shall be Semester End Examination consisting of one examiner from Civil, one from Mechanical and one from Electrical Engineering. Preferably the examiners shall be the faculty involved in training the students.
13. The students are expected to wear boiler suit and should use insulated shoes.

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18UEEL507	Minor Project-I	(0-0-3) 1

Contact Hours: 36

Course Learning Objectives (CLOs):

The course is included to provide an exposure, focusing more on the domain related problem definitions, building prototypes which can lead to take up the project in the higher semester(s). The work based on using the concepts studied in the core/elective courses studied shall be used to formulate the problem. They are also required to learn to find related material, use appropriate tool to obtain the solution and prepare a report based on the work carried out.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Identify the domain related problem and formulate a problem statement	6		9
CO-2	Propose the technical approach towards the solution.	11	4	9
CO-3	Implement the solution.	4	11	9,10
CO-4	Prepare the report in a specified format.	10		9

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level				2.5		3.0			1.0	2.0	2.5				

Contents:

Domain related problems, Technical solutions, and recommendations.

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Evaluation:

The team consisting of 10-12 students shall be asked to identify the problems related to community and try to propose the solution. The faculty members handling the courses for that semester shall guide the students. A committee consisting of

minimum 3 faculty members shall evaluate at the end for CIE. There is no SEE for Minor project-1.

18UEEL508	Soft Skills/Aptitude	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the significance of communication in the profession.		10	
CO-2	Use the English language with proficiency		10	12
CO-3	Solve Aptitude related problems		9	12
CO-4	Demonstrate the competency in the placement activities.		9	

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level									2.0	2.0		1.0			

Contents:

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

18UEEE511	Data Structures and Algorithm	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn basic features of programming language, a abstract data types and its use in solving given any problem. They will be learning how to use of data structures in application development. They are exposed to standard algorithms and analysis.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain different features of programming language in C & C++.	1	2	
CO-2	Code to implement stack and operations of stack using arrays and pointers.	5	2	
CO-3	Code to implement Queues and tree using arrays and pointers.	5	2	
CO-4	Explain the operations of searching and sorting techniques using code	5	2	
CO-5	Design an algorithm for different optimization techniques and applications.	5	2	

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level	3.0	2.0			3.0										

Prerequisites: Programming experience in C/C++.

Contents:

Unit-I

Basic Programming Features: Data types, Memory allocation, arrays, structures, unions, pointers, recursion, and file operations**,** **08 Hrs.**

Unit-II

Abstract Data Types: Conceptualization. Implementation of operations on Stack including display and searching using arrays and pointers(Linked List) **08 Hrs.**

Unit-III

Implementation of: Queues, Circular queues, double ended queue, priority queue and Trees using arrays and pointers(Linked List). **08 Hrs.**

Unit-IV

Searching and Sorting Techniques: Conceptualization, Implementation of: Linear and Binary search, Hashing, sorting techniques: bubble sort, insertion sort, selection sort, quick sort, merge sort, heap sort. **08 Hrs.**

Unit-V

Algorithm Design: Divide and Conquer method and applications (Max-Mm), Greedy strategy method and applications (Job sequencing, Optimal merge patterns),Dynamic Programming method and applications (Multistage graphs, travelling sales problem), Backtracking method and applications (Sum of sets) Branch and Bound method and applications (Travelling Sales problem. **07 Hrs.**

Reference Books:

1) Yedidyah, Augenstein and Tenenbaum, “Data Structures Using C and C++’,2/e, PHI- India,2011.
2) E. Balagurusamy, “Programming in ANSI C”, 4/e, Tata McGraw-Hill.
3) Sartaj Sahni, “Data Structures, Algorithms and Application in C++”, 2/e, University Press, 2005.
4) Thomas H Coreman, Charles E Leiserson& Ronald L Rivest, “Introduction to Algorithms”, 1/e, Prentice Hall of India, August 2000.
5) Adam Drozdek, “Data Structures & Algorithms in C++”, 2/e, Vikas Publishing House, 2004.

18EEE513	Internet of Things (IoT)	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn the basic concept of Internet of things, its general architecture, technology, and the design principles behind it. The students are required to get exposure to the handling of data and understand the concept of cloud paradigm being used in IoT environment. Students are also required to understand the role of sensors in IoT and the basics of embedded computing besides understanding certain case studies on IoT application.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to PO’s(1 to 12)/PSO’s(1 to 3)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Describe the fundamental concept of IoT, design principles and different communication technologies used in IoT paradigm.	1,5		
CO-2	Recite the different data handling protocols and aspects of cloud computing as applicable to IoT.	1,5		2,3
CO-3	Explain the different types of sensors and the data communication protocols for these sensors as applicable to IoT.	1,5		2,3
CO-4	Select a suitable embedded platform for the IoT application.	1,5		2,3
CO-5	Analyze the smart grid technology and different other case studies based on IoT applications.	2		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	3.0	1.5	1.0		3.0	3.0									

Prerequisites:1.Any one basic programming language 2. Digital Electronics
3. Microcontrollers

Contents:

Unit-I

Overview of IoT: Definitions, vision, smart and hyper connected devices. IoT conceptual framework, IoT architectural view. Technology behind IoT, major components of IoT system, sources of IoT. M2M communication

Design principles for connected devices: Introduction, systems, layers, and design standardization modified OSI model for IoT. ITU-T reference model.

Communication technology: Wireless communication technology, RFID, ZigBee IP, Wi-Fi, Wired communication technology, Comparison of communication technologies.

08 Hrs.

Unit-II

Data handling and Cloud computing paradigm: Introduction to internet-based communication, protocols, version 4 and 6, TCP IP suite, IP addressing in IoT.

Data handling: Introduction, data acquiring and storage, organizing data, data analytics.

Cloud computing: Introduction, computing methods, deployment methods, everything as a service, service models, services using Nimbits, public platforms. **08 Hrs.**

Unit-III

Sensors and network: Sensor technology, analog and digital sensors, examples, sensing the things-barcodes, QR codes, motion sensors, pressure sensors, environmental monitoring sensors, participatory sensing, industrial IoT, actuators.

Data communication protocols for sensors: RFID technology-Principle, design challenges, wireless sensor networks technology. **08 Hrs.**

Unit-IV

Embedded computing basics: Embedded software and hardware units, embedded platform for prototyping-Arduino, Intel Galileo, Intel Edison, Raspberry Pi, Beagle bone, things always connected to the cloud. Prototyping embedded device software, Devices, gateways, Internet, and web/cloud services **08 Hrs.**

Unit-V

IoT applications and Case studies: Introduction to smart grid and a possible IoT based smart grid, Smart home, smart cities, Street light control and monitoring. **07 Hrs.**

Reference books:

1) Internet of Things, Architecture and design principles, Raj Kamal, McGraw Hill Publication, 2017
2) David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome
3) Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
4) Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
5) Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)

18UEEL606 Sensors, Control systems and simulation Lab (0 - 0 - 3) 2

Contact Hours: 36

Course Learning Objectives: (CLOs)

The automation in the power systems and also in many of the industrial applications has gained lots of importance in the recent times. Hence it is necessary to understand the operation of sensors in the measurement applications and also to have hands on experience of using the different types of sensors in control system. The students are expected to learn conducting experiments to be able to use different types of sensors for the measurement of various analog quantities specified. They are also expected to obtain the performance characteristics of the sensors used. They shall also conduct the experiments to study the response of the electrical system to different types of inputs and simulate the same using MATLAB SIMULINK.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Demonstrate the fundamental skill of using the sensors and measure their characteristics	4		9,PSO3
CO-2	Obtain the characteristics of servomotors.	4		9, PSO3
CO-3	Design and analyze the performance of the second order systems	4		3,9, PSO3
CO-4	Simulate the second order systems and obtain the time domain response.	4	5	9, PSO3

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level			1.0	3.0	2.0				1.0						1.0

Prerequisites:1. Control Systems2. Microcontrollers

Contents:

Prescribed Experiments:

Note: Minimum of 10 experiments is to be conducted.

1. Study of capacitive sensors using Opamps.
2. Measurement of temperature using Opamp based sensor.
3. Measurement of displacement using LVDT.
4. Measurement of Distance using Distance sensor interfaced to Arduino.
5. Obtain parameter under consideration vs voltage characteristics of the following sensors i) Thermistor ii) LDR iii) proximity sensor
6. Obtain parameter under consideration vs voltage characteristics of the following i) Photo transistor ii) Strain gage iii) smoke sensor
7. Demonstration of a system or circuit using a sensor. Viz, timer circuit using LDR.
8. Obtaining characteristics of DC and AC servomotors.
9. Design and performance analysis, of second order system, analytically and experimentally.
10. Obtaining frequency response of second order system & sketching Bode plot.
11. Simulation of 3rd order system using MATLAB to obtain Phase Margin & Gain Margin with the help of Bode plot.
12. Simulation of 2nd order system using MATLAB & obtaining time domain Response.

Reference Books:

1) Sensors, control systems and simulation Laboratory Manual.
2) Roy & Choudary, “Operational amplifiers and Linear Integrated circuits”, 2/e, New Age International 01-Jan-2003.
3) Cooper D & A D Heifrick, “Modern Electronic Instrumentation and Measuring Techniques”, PHI, 1998.
4) I. J. Nagrath and M. Gopal “Control Systems Engineering: 3/e, Wiley Eastern Ltd, 2003.
5) K. Ogata, “Modern Control Engineering”, 4/e, PHI, 2004.

18UEEL607	Minor Project-II	(0-0-4) 2

Contact Hours: 24

Course Learning Objectives (CLOs):

This course is included having had an exposure to the project work in the previous semesters. The students are expected to locate the state of the art technology in his/her domain of interest by an extensive literature survey and select a topic from an

emerging area relevant to their branch/interdisciplinary and define the problem for the project work. They are also expected to provide solutions through developing prototypes for industrial needs.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Identify the domain related preferably real time problem and formulate a problem statement	4	6	9
CO-2	Propose the technical approach towards the solution.	4	11	9
CO-3	Implement the solution / demonstrate the working of prototype, execution of codes, etc.	4	11	9,10
CO-4	Prepare the project report in a specified format.	10		9

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level				3.0		2.0			1.0	2.0	2.0				

Contents:

Domain related problems, real time problems, Technical solutions, and recommendations. This project work is to supplement and prepare the students to take up major project work at higher semesters

Evaluation:

A team consisting of not more than 4 students shall be guided by a faculty member. A committee consisting of minimum 3 faculty members (guide as one member) shall evaluate at the end for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners appointed by COE based on the suggestions by the respective HoD.

18UEEL608	Soft Skills & Aptitude	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the significance of communication in the profession.		10	
CO-2	Use the English language with proficiency		10	12
CO-3	Solve Aptitude related problems		9	12
CO-4	Demonstrate the competency in the placement activities.		9	

Contents:

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level	1.0		1.0		3.0	2.0				2.0	1.0				

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

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18UEEE637	PLC and SCADA	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives: (CLOs)

The automation in the power systems and also in many of the industrial applications has gained lots of importance in the recent times. The Programmable Logic Controllers (PLC) is one of the important resources of automatic process control systems. The complex control strategies can be effectively realized by means of PLCs. The students shall be able to understand the concept of PLC based systems, the general architecture of PLCs and the operation of PLCs. Apart from this the students shall know the basic ladder programming of PLCs and understand the different logical concepts as applicable to industrial automation. The students shall also understand the basic concept of SCADA system and its components.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Recite the fundamentals aspects programming logic controllers and the I/O devices uses in PLC system.	1		
CO-2	Construct the ladder diagrams for different process control applications using PLC		1,2	3
CO-3	Write the programs based on simple logical applications based on PLC.		2,3	PSO-3
CO-4	Use the timers and counters for the practical applications in the PLC based system.		2,3	PSO-3
CO-5	Understand the basics of SCADA and the SCADA systems.	1		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

Mapping Level	2.67	2.0	1.67											1.0

Prerequisites:1. Digital Electronics2. Control Systems3. Microcontrollers

Contents:

Unit-I

Programmable Logic Controllers: Introduction, Hardware, Architecture and PLC systems. Input output devices: Sourcing and sinking, Signal conditioning, remote connections, Networks Processing inputs, I/O addresses **07 Hrs.**

Unit-II

Fundamental PLC Wiring Diagrams and Ladder diagram: Ladder programming-ladder diagrams, logic functions, latching, multiple outputs, entering ladder programs, functional blocks, program examples, location of stop and emergency switches **08 Hrs.**

Unit-III

Programming in PLC: Instruction lists, Sequential function charts, structured text **Internal relays:** Ladder programs, battery- backed relays, one - shot operation, set and reset, master control relay, example programs, jump and call subroutines **08 Hrs.**

Unit-IV

Timers and counters in PLC system: Different types of timers, programming the timers, OFF- delay timers, pulse timers, programming examples, forms of counter, programming, up and down counting, timers with counters, sequencer.

Shift register and data handling: Shift registers, ladder programs, registers, and bits. Case studies in PLCs. **08 Hrs.**

Unit-V

Application of PLC in power system SCADA: SCADA SYSTEM- Introduction, definition and history of Supervisory Control and Data Acquisition, typical power system SCADA Architecture, Communication Requirements, Desirable properties of SCADA system, advantages, disadvantages, and applications of SCADA. SCADA Architecture. **08 Hrs.**

Note: The Ladder programs shall be written based on a suitable PLC configuration.

Reference books:

1) Programmable Logic Controllers –W. Bolton-Elsevier publisher
2) Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI.
3) Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.
4) PLC and SCADA theory and practice, Rajesh Verma, University Science Press, Laxmi Publications Pvt Ltd; First edition (1 January 2016)

5) Programmable Logic Controllers – Programming Method and Applications by J. R. Hackworth and F.D. Hackworth Jr. – Pearson, 2004

18UEEO703	Electric Vehicles	(3 – 0 – 0) 3

Contact Hours:39

Course Learning Objectives (CLOs):

The students are expected to learn the working of Electric Vehicles and recent trends. To analyse different power converter topology used for electric vehicle application. To develop the electric propulsion unit and its control for application of electric vehicles. To design converters for battery charging and explain transformer less topology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.	1,2		
CO-2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.	1,2		
CO-3	Energy storage for EV and charging from renewable and grid sources.	1,2		
CO-4	Develop the electric propulsion unit and its control for application of electric vehicles and	1,2		
CO-5	Basic Design of Electric Vehicles	1,2	3	

Prerequisites: Power Electronics

POs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
Mapping Level	3.0	3.0	2.0												

Contents:

Unit-I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Non-constant FTR, General Acceleration, Propulsion System Design. **07 Hrs**.

Unit-II

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **08 Hrs.**

Unit-III

Energy storage for EV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Supercapacitors. Power Electronic Converter for Battery Charging: Charging methods for battery, Termination methods, charging from grid, charging from Renewable Energy Sources. **08 Hrs.**

Unit-IV

Electric Propulsion: EV consideration, DC motor drives, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration, and control of Drives. **08 Hrs.**

Unit-V

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of Parallel Hybrid Electric Drive Train Design: design of engine power capacity, design of electric motor drive capacity, transmission design. **08 Hrs.**

Reference Books:

1) Iqbal Husain - Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2) M. Ehsani, Y. Gao, S. Gay and Ali Emadi- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2003.
3) Sheldon S. Williamson - Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.

4) C.C. Chan and K.T. Chau - Modern Electric Vehicle Technology, OXFORD University, 2001.
5) Chris Mi, M. Abul Masrur, David Wenzhong Gao - Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, 2011.

18UEEE741 AI Applications to Power System (4 - 0 - 0) 4

Contact Hrs: 52

Course Learning Objectives (CLOs):

The students are expected to learn basic concepts of AI, soft and hard computing. They study about artificial intelligence and relevance of fuzzy logic, fuzzification and defuzzification. Further, they are expected to learn genetic algorithms and apply AI techniques to power system applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Discuss soft, hard computing techniques, expert systems, fuzzy systems, and genetic algorithm	1		2
CO-2	Illustrate the concepts of feed forward neural networks, learning and understanding of feedback neural networks.	3	1	2
CO-3	Design and develop fuzzy logic for simple systems.	3	1	2
CO-4	Design and develop genetic algorithms for simple systems.	3	1	2
CO-5	Assess Fuzzy logic, Expert System and Genetic Algorithm application in power systems operation and control.	3,5		

PO's	**PO -1**	**PO-2**	**PO-3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**
Mappin	2.0	1.3	2.3		3.0										

g Level		3	3												

Prerequisites: 1. A course higher level language 2. Mathematics

Contents:

Unit-I

Introduction: Introduction, definition of AI, difference between soft computing techniques and hard computing systems, Expert Systems, brief history of ANN, Fuzzy Logic and Genetic Algorithm. **09 Hrs.**

Unit-II

Artificial neural networks: Introduction, human brain, model of artificial neuron, neural network architectures, characteristics of neural network, learning methods, architecture of back propagation network, back propagation learning. **11 Hrs.**

Unit-III

Fuzzy logic: Introduction, Fuzzy versus crisp, fuzzy sets - membership function – basic fuzzy set operations – properties of fuzzy sets, crisp relations- fuzzy Cartesian product, operations on fuzzy relations, fuzzy logic - fuzzy quantifiers-fuzzy inference, fuzzy rule-based system, defuzzification methods. **12 Hrs.**

Unit-IV

Genetic algorithms: Working principles, difference between genetic algorithm and traditional methods, different types of coding methods, fitness function, reproduction, different types of cross over methods in genetic algorithm, mutation. **11 Hrs**.

Unit-V

Applications of AI techniques in electrical systems: Applications of ANN, Fuzzy logic, Expert System and Genetic Algorithm in power systems operation and control. **09 Hrs.**

Reference Books:

1) S. Rajasekaran, G. A. V. Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms” PHI,1/e, New Delhi, 2003.

2) Abe Springer, “Neural Networks and Fuzzy Systems Theory and Applications”, Science & Business Media, 2012.

3) D. E. Goldberg,” Genetic Algorithms” Pearson Education India,1/e, Dec -2006.

4) Weerakorn Ongsakul, “Artificial Intelligence in Power System Optimization” CRC Press, May-2013

18UEEE747 Embedded Systems (4 - 0 - 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn about Embedded Systems**.** Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. They also know Sensors and Actuators, Communication Interface, Development Languages, RTOS Based Embedded System Design, Operating System Task Scheduling, memory management. Further they are exposed to Device Drivers, Integration and Testing of Embedded Hardware, Firmware and Advanced Microcontrollers.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Outline the difference between embedded and desktop system.		1	
CO-2	Recognize the best technology suitable for embedded systems		1,3	
CO-3	Explain real-time operating systems & basic kernel services of an OS and concept of task, processes & threads, basic of multi-tasking and different scheduling algorithms,	1		
CO-4	Comprehend different types of messages passing techniques &analyse inter process communication & the need for task synchronization in Multi-tasking environment	1	3	
CO-5	Demonstrate the knowledge of integration and testing of embedded systems including advanced microcontrollers.	4		1

PO's	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**

Mapping Level	2.2		2.0	3.0											

Prerequisites: 1. Microcontrollers 2. C-programming language

Contents:

Unit-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. **09 Hrs.**

Unit-II

Typical Embedded System: Core of the Embedded System, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System components, Embedded Firmware Design Approaches and Development Languages. **11 Hrs**.

Unit-III

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. **10 Hrs**.

Unit-IV

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS. **10 Hrs.**

Unit-V

Integration and Testing of Embedded Hardware and Firmware & Advanced: Microcontrollers, Out of Circuit Programming, in system Programming, in application Programming, Use of Factory Programmed Chip, Overview of PIC and ATMEL Family of Microcontrollers. **12 Hrs**.

Reference Books:

1) Shibu K.V, “Introduction to Embedded Systems” 1/e, Tata McGraw Hill, 2013.
2) Jonathan W. Valvano, “Embedded Microcomputer Systems”, 3/e, Cengage Learning, 2011.
3) Lyla B. Das, “Embedded Systems an Integrated Approach”, First Impression, Pearson, 2013.
4) Raj Kamal, “Introduction to Embedded Systems”, Tata McGraw Hill, 2/e,2008.

5) Tammy Noergaard, “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Newnes,2/e, 2012.

18UEEL706	Internship	(0 - 0 - 6) 2

Duration: 4 Weeks.

The students are to undergo internship in Private industries/R&D organizations/Centers of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get an exposure to the external world for a period of **4 weeks** in the summer vacation after VI sem and before start of VII semester. The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. The student shall present his/her work before a panel of examiners consisting of HoD, Guide and one faculty member during VII semester as final exam. The performance shall be communicated to the CoE office and the same shall reflect in the VII semester grade card.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO’s (1 to12)/ PSO’s (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Know the industrial environment.	1,10	7, 9,11	6,12
CO-2	Acquire knowledge and skill to use in professional career.	1	2, 4, 5	3
CO-3	Acquire the ability of report preparation and presentation skills.	8,10		
CO-4	Follow the code of practice in Electrical & Electronics Engineering related activities.	1		6, 8

PO’s	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**
Mapping Level	3.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	3.0	2.0	1.0			

Prerequisites: Knowledge of both theory and practical courses learnt in all the previous Semesters and relevant value-added information.

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II- Semester M.Tech.(Power Systems Engineering)

22PEPC200 Artificial Intelligence Techniques to Power System (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs):

1) To impart knowledge on basic concepts of AI, soft and hard computing.
2) To explain the concepts of artificial intelligence, fuzzy logic, and genetic algorithms.
3) To apply the AI techniques to power system applications.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Differentiate between Soft Computing and hard Computing techniques	1	3	2
CO-2	Study concepts of artificial neural networks, fuzzy logic, and genetic algorithms	4	1,3	2
CO-3	Apply appropriate AI framework for solving power system problems	4	3	2

PO's	PO-1	PO-2	PO-3	PO-4
Mapping Level	2.5	1.0	2.0	3.0

Contents:

1) Introduction

Introduction, definition of AI, difference between soft computing techniques and hard computing systems, Expert Systems, brief history of ANN, Fuzzy Logic, and Genetic Algorithm. **06 Hrs.**

2) Artificial Neural Networks

Introduction Models of Neuron Network, Architectures, Knowledge representation, Neural networks–Learning, Multi – layer perceptron using Back propagation Algorithm (BPA), Self-Organizing Map (SOM), Radial Basis Function Network, Functional Link Network (FLN). **14 Hrs.**

3) Fuzzy Logic

Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy Cartesian Product, operations on Fuzzy relations, Fuzzy-logic, Fuzzy Quantifiers, Fuzzy Inference Fuzzy Rule based system, De-fuzzification methods.

10 Hrs.

4) Genetic Algorithms

Introduction, Encoding, Fitness Function, Reproduction operators, Genetic Modeling, Genetic operators, Cross over, Single site cross over, Two-point cross over, Multi point cross over, Uniform cross over, Matrix cross over, Cross over Rate, Inversion &Deletion, Mutation operator, Mutation, Mutation Rate, Bit–wise operators, Generational cycle , convergence of Genetic Algorithm.

10 Hrs.

5) Applications of Soft Computing Techniques

Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Small Signal Stability (Dynamic stability) Reactive power control, speed control of DC and AC Motors.

12 Hrs.

Reference Books:

1) S. Rajasekaran and G. A. V. Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.
2) Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011
3) Kevin Warwick, Arthur Ekwue, Raj Aggarwal, Artificial Intelligence Techniques in Power Systems.

III- Semester M.Tech.(Power Systems Engineering)

18PEPSE313 Programmable Logic Controllers and Applications (4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLOs):

The automation in the power systems and also in many of the industrial applications has gained lots of importance in the recent times. The Programmable Logic Controllers (PLC) is one of the important resources of automatic process control systems. The complex control strategies can be effectively realized by means of PLCs. The students shall be able to understand the concept of PLC based systems, the general architecture of PLCs and the operation of PLCs. Apart from this the students shall know the different controllers used in PLC applications

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level(3)	Moderate Level(2)	Slight Level(1)
CO-1	Recite the various aspects programming logic controllers			3
CO-2	Construct the ladder diagrams for different process control applications using PLC		3	
CO-3	Understand the operation of PLC registers, timers and counters		3	
CO-4	Use the different controllers for the PLC applications in process control.			4

PO's	PO-1	PO-2	PO-3	PO-4
Mapping Level			**2.5**	**1.0**

Prerequisites: Digital Electronics, Microcontrollers, Control System

Contents:

I. PLC Basics

PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

8 Hrs.

II. PLC Programming

Input instructions, outputs, operational procedures, programming examples using contacts and coils, drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system. **8 Hrs.**

III. PLC Registers:

Characteristics of Registers, module addressing, holding registers, input registers, output registers. **8 Hrs.**

IV. PLC Functions

Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions**.** **8 Hrs.**

V. Data handling functions

SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions. **10 Hrs.**

VI. Analog PLC operation:

Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions. **10 Hrs.**

Reference Books:

[1] Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI

[2] Programmable Logic Controllers – Programming Method and Applications by J. R. Hackworth and F.D. Hackworth Jr. – Pearson, 2004.

[3] Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.

[4] Programmable Logic Controllers –W. Bolton-Elsevier publisher

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S. Kurakundi.

Head of the Department
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