DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH AND BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	ELECTRONICS AND TELECOMMUNICATION - E03 ELECTRONICS ENGINEERING - E06	FIFTH (V)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK				THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7466	501	EMBEDDED SYSTEM	4	4	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	6	150
2	7467	502	MOBILE AND WIRELESS COMMUNICATION	4	4	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	6	150
3	7468	511	INDUSTRIAL AUTOMATION OR	3	3	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	4	150
	7469	512	CONTROL SYSTEM AND PLC															
4	7470	521	MICROWAVE AND RADAR OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7471	522	SEMICONDUCTOR PACKAGING AND TESTING															
5	7601	531	RENEWABLE ENERGY TECHNOLOGIES OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7602	532	INTERNET OF THINGS															
6			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
7			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
8			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
TOTAL				17	17				150	350		19	8	80	120		25	700

NOTE - (1)* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2)** 4-6 Weeks Summer Internship after IV Semester.

(3)***One Credit will be carried forward to the Six semester major project evaluation.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	700

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RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	EMBEDDED SYSTEM
PAPER CODE	:	7466
SUBJECT CODE	:	501
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	02

Course Content:

Unit I -Embedded C basics operators for

Arduino Familiarizing with the

Arduino IDE. Sketch designing for

Arduino Communication interface

using serial port

Basic understanding of the code with boolean operations, pointer access operations, bitwise operations, compounded operations.

Unit II - Embedded C control structure blocks

Looping mechanism – for, do and while.

The branching operations based on conditions expression

Unit III Introduction to Arduino Mega

Arduino Mega specifications including power ratings, digital and analog peripherals.

Difference between the C language and Embedded C language

Arduino Mega Ports, Pins, Digital and Analog Peripherals

Unit IV Communication with Arduino

Different communication modules available with their real-life application

Communication interface

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1.	Arduino Projects For Dummies (For Dummies Series)	Kennedy George; Davis Bernard; Prasanna SRM	Wiley (5 July 2013) ISBN : 978-1118551479
2.	Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform	Massimo Banzi and Michael Shiloh	Shroff/Maker Media; Third edition (27 December 2014) ISBN : 978-9351109075

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.arduino.cc/reference/en/
b. https://learn.adafruit.com/category/learn-arduino

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EMBEDDED SYSTEM LAB

Course Content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessedin the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Built-in LED state control by push button sketch implementation	I	02*
2.	Built-in LED blinking sketch implementation	I	02
3.	Built-in LED blinking by toggling states based on binary operation	I	02
4.	Built-in LED state control by user interface through serial port	I	02*
5.	User interface for boolean operation and bit wise operation through serial port	I	02
6.	User interface for compounded operation through serial port	I	02
7.	Looping mechanism to check the state of pin and if change print its status on serial port	II	02
8.	Controlling multiple LEDs with a loop and an array	II	02
9.	Use a potentiometer to control the blinking of an LED	III	02*
10.	Uses an analog output (PWM pin) to fade an LED.	III	02
11.	Servo Motor Control using PWM	III	02
12.	Temperature sensor interfacing and sending its reading over serial port	IV	04
13.	I2C light sensor interfacing and sending its reading over serial port	IV	04*
	Total		**30**

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1.	Arduino Projects For Dummies (For Dummies Series)	Kennedy George; Davis Bernard; Prasanna SRM	Wiley (5 July 2013) ISBN : 978-1118551479
2.	Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform	Massimo Banzi and Michael Shiloh	Shroff/Maker Media; Third edition (27 December 2014) ISBN : 978-9351109075

SUGGESTED SOFTWARE/LEARNING WEBSITES:

(a) https://www.arduino.cc/reference/en/

(b) https://learn.adafruit.com/category/learn-arduino

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DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	MOBILE AND WIRELESS COMMUNICATION
PAPER CODE	:	7467
SUBJECT CODE	:	502
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	02

Course Content:

Unit I - Overview of Cellular Systems

Evolution 2g/3G/4G/5G

Cellular Concepts – Frequency reuse, Cochannel and Adjacent channel Interference

Unit II - Wireless propagation

Link budget, Free-space path loss, Noise figure of receiver

Multipath fading, Shadowing, Fading margin, Shadowing margin

Unit III Antenna diversity, wireless channel capacity and MIMO

Unit IV Overview of CDMA , OFDM and LTE

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Wireless Communications – Principles and Practice	T. S. Rappaport,	(2nd edition) Pearson ISBN 9788131731864
2	Modern Wireless Communications	Haykin & Moher	Pearson 2011 (Indian Edition) ISBN : 978-8131704431

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MOBILE AND WIRELESS COMMUNICATION LAB

Course Content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessedin the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	To understand the cellular frequency reuse concept to find the co-channel cells for a particular cell.	I	04
2.	To understand the path loss	II	04
3.	Understand the path loss with shadowing	II	04
4.	Understanding the Flat fading	II	04
5.	Understanding the Frequency selective fading	II	04
6.	Understanding the Multipath channel for the following objectives 1. No Fading 2. Flat Fading 3. Dispersive Fading	II	04
7.	To simulate a dipole antenna (λ, λ/4, λ/2, 3λ/2) for a particular frequency using 4NEC2	III	04
8.	Perform following experiments using CDMA trainer kit 1. PSK modulation and demodulation experiment 2. Bit synchronization extraction experiment 3. Error correction encoding experiment	IV	04
	Total		**32**

REFERENCES/SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Wireless Communications – Principles and Practice	T. S. Rappaport,	(2nd edition) Pearson ISBN 9788131731864
2	Modern Wireless Communications	Haykin & Moher	Pearson 2011 (Indian Edition) ISBN : 978-8131704431

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DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	INDUSTRIAL AUTOMATION
PAPER CODE	:	7468
SUBJECT CODE	:	511
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course Content:

Unit I -Industrial automation overview and data acquisition
Architecture of Industrial Automation Systems.
Measurement Systems Characteristics
Data Acquisition Systems

Unit II -Control Generation
Introduction to Automatic Control
P-I-D Control
Feedforward Control Ratio Control
The branching operations based on conditions expression

Unit III Sequential control and PLC
Introduction to Sequence Control, PLC , RLL
PLC Hardware Environment

Unit IV Industrial control application
Hydraulic Control Systems
Pneumatic Control Systems
Energy Savings with Variable Speed Drives
Introduction To CNC Machines

REFERENCES / SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1.	Industrial Instrumentation, Control and Automation	S.Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House, 2013 ISBN : 978-8184954098
2.	Electric Motor Drives, Modelling, Analysis and Control	R. Krishnan	Prentice Hall India, 2002 ISBN : 978-0130910141

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INDUSTRIAL AUTOMATION LAB

Course Content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessedin the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Develop a data acquisition system using arduino	I	04
2.	Temperature control system using PID	II	04
3.	Level control system based on error feedback	II	04
4.	PLC programming using Relay ladder Logic for AND , OR XOR and NOR gate	III	04
5.	PLC, RLL programming using CASCADE method	III	04
6.	PLC timer, counter, registers and analog input/output functions	III	04
7.	Variable Speed drive of an induction motor	IV	04
8.	PLC/ microcontroller based computer numerical control machinejob completion	IV	04
	Total		**32**

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Industrial Instrumentation, Control and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House, 2013 ISBN : 978-8184954098
2	Electric Motor Drives, Modelling, Analysis and Control	R. Krishnan	Prentice Hall India, 2002 ISBN : 978-0130910141

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SEMESTER V

COURSE TITLE	:	CONTROL SYSTEM AND PLC
PAPER CODE	:	7469
SUBJECT CODE	:	512
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course Objective:
The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electronic automated systems in processs and manufacturing industries.

Course Contents:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit -I Basics of Control Sysem	1) Explain with sketches the working of the given type of control systems. 2) Compare the given 3) Control systems based on the given parameters. 4) Derive transfer function of the given electrical circuits. 5) Use block diagram reduction rules to determine optimize transfer function of the given system.	1. **Control system:** Basics of control system block diagram and practical examples 2. **Classification of control systems:** Open. loop and closed loop systems- block diagram, practical example and comparison, Linear and non -linear systems, Time varying and Time In-varying systems- practical example and comparison, servo system 3. **Transfer function:** Close loop and open loop system RC, LC and RLC Circuits- Differential equations and transfer functions and analysis using Laplace transform **4. Block diagram reduction technique:** Need, reduction rules,

Unit –II Time domain stability analysis	1) Compare the parameter of given standard test inputs. 2) Identify poles, zeros, type and order for the given transfer function 3) Sketch pole zero plot for The given transfer function. 4) Determine output of the given order system for the step input. 5) Calculate time response specifications of the given transfer function. 6) Calculate error constants of the given type of control	1. **Time Response:** Transient and steady state response. 2. **Standard test inputs:** Step, ramp, parabolic, impulse and their corresponding Laplace transform **3. Analysis of first and second order control system:** i. **Poles and zeros -** S-plane representation, Order of system (0, 1, 2)- standard equations, examples and numerical problems ii. **First order System-**Analysis for unit step input, concept of time constant. iii. **Second order system-** Analysis

	system. 7) Determine stability of the given control system using Routh's stability criteria.	for unit step input (no derivation), concept, definition and effect of damping iv. **Time response specifications** (no derivations) - Tp, Ts, Tr, Td, Mp, Ess, numerical problems 4. **Steady state analysis:** Type 0, 1, 2 systems steady state error and error constants, numerical problems 5. **Stability:** Concept of stability, root locations in S-plane and analysis- stable system, unstable system, critically stable systems, conditionally stable system, relative stability 6. **Routh's stability criterion:** Steps and procedures to find stability by Routh' s stability criteria,
Unit-III Process controllers	1) Explain with sketch the given process control system. 2) Describe with sketch the given control action. 3) Compare different. electronic controllers on the basis of the given parameters. 4) Sketch the response of the given controller with respect to error.	1. **Process Control System:** Block diagram, functions of each block **2. Control actions:** 2.1. **Discontinuous mode**- ON-OFF controllers- equation, neutral zone 2.2. **Continuous modes:** Proportional Controller - offset, proportional band. Propo11ional, Integral and Derivative controllers -o/p equation, response, characteristics, 3. **Composite controllers:** PI, PD, PID controllers- o/p equation, response
Unit-IV Fundamentals of PLC	1) Explain with sketch PLC based automation system. 2) Describe with sketch the given PLC module. 3) Identify different devices interfaced with PLC. 4) Explain the steps for PLC installation.	1. **PLC**-Block diagram, classification, (fixed and modular PLCs), need and benefits of PLC in automation 2. **Description of different parts of PLC:** CPU-function, scanning cycle, speed of execution, Power supply- block diagram and function of each block Memory - function and organization of ROM and RAM Input and output modules- function, different input and output devices of PLC (only name and their uses). **3. PLC Installation**
Unit-V PLC hardware and programming	1) Identify and describe the given module of PLC. 2) Describe the given addressing of PLC. 3) Use instruction set to perform the given operation. 4) Develop ladder logic	1. **Discrete input modules:** Block diagram, specifications of AC input modules and DC input module. Sinking and sourcing concept in DC input modules 2. **Discrete output modules:** Block diagram, description, specifications of AC output module and DC output

	programs for the given application.	modules. 3. **Analog input and output modules:** Block diagram, specifications 4. **I/O addressing of PLC:** Addressing data files, format addressing of logical address, different addressing types 5. **PLC Instruction set:** Relay instructions, timer and counter instruction s, data movement instructions, logical and comparison instructions 6. **PLC Programs:** using Ladder programming language.

SUGGESTED LEARNING RESOURCES :

S.No	Author	Title of Book	Publication
1	Process control instrumentation Technology	Johnson, C. D.	Prentice Hall, 8th edition, United States of America,2014 ISBN: 978-0131194571
2	Intro. To Programmable logic control	Dunning, Gary	Cenage Learning, United States of America,2005 ISBN: 9781401884260
3	Control System Engineering	Nagrath, J.J. ; Gopal, M.	Anshan Publishers (2008) ISBN: 9781848290037
4	Modern control Engineering	Ogata, K.	PHI, 5th Edition, NEW DELHI,2010 ISBN: 978812034010
5	Programmable logic controllers and industrial automation an introduction	Mitra. Madhuchhanda ; Gupta, Samaijit Sen	Penram, 1st Edition, Mumbai. 2007 ISBN: 9788 I 87972174
6	Progrnmmable logic controllers	Petruzella, F.D.	Tata- McGraw Hill, 3n Edition, 2010 ISBN: 9780071067386

SOFTWARE/LEARNING WEBSITES

1. www.scilab.org
2. www.openplc.fossee.in
3. www.github.com/FOSSEE/OpenPLC
4. www.youtube.com /plc
5. www.dreamtechpress.com /ebooks
6. www.nptelvideos.com/control_ systems/
7. www.in.mathworks.com/ solutions/ control-systems.html ?s _ tid=srchtitle
8. www.edx.org/course?subject=Engineering&course=all&language=English
9. www.plcs.net
10. www.ab.rockwellautomation.com > Allen-Bradley
11. www.plc-training-rslogix-simulator.soft32.com/free-download/

Course Outcome:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Identify different types of control systems.
2. Determine the stability of the control system.
3. Test the performance of various types of controllers.
4. Maintain various components of PLC based process control system.
5. Maintain PLC based process control systems.

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CONTROL SYSTEM AND PLC LAB

Course Objective:
The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electronic automated systems in processs and manufacturing industries.

SUGGESTED PRACTICALS/ EXERCISES

1. Use potentiometer as error detector.
2. Determine error of angular position of DC servo system.
3. Test the Step response of R-C (first order) circuit.
4. Test the Step response of R-L-C (second order) circuit.
5. Test the functionality of temperature control with on-off controller.
6. Use PI controller to control temperature of the given process.
7. Use PD controller to control temperature of the given process.
8. Use PID controller to control temperature of the given process.
9. Identify and test different parts of PLC.
10. Develop ladder diagram to test the functionality of the logic gates.
11. Develop ladder diagram to test Demorgan's theorem.
12. Develop the ladder diagram for Adder and Subtractor by using PLC.
13. Develop ladder diagram for ON and OFF control of lamp using timer and counter.
14. Develop ladder diagram for traffic light Control system.
15. Develop ladder diagram for stepper motor control.
16. Develop ladder diagram for temperature controller.

SUGGESTED LEARNING RESOURCES :

S.No	Author	Title of Book	Publication
1	Process control instrumentation Technology	Johnson, C. D.	Prentice Hall, 8th edition, United States of America,2014 ISBN: 978-0131194571
2	Intro. To Programmable logic control	Dunning, Gary	Cenage Learning, United States of America,2005 ISBN: 9781401884260
3	Control System Engineering	Nagrath, J.J. ; Gopal, M.	Anshan Publishers (2008) ISBN: 9781848290037

4	Modern control Engineering	Ogata, K.	PHI, 5th Edition, NEW DELHI,2010 ISBN: 978812034010
5	Programmable logic controllers and industrial automation an introduction	Mitra. Madhuchhanda ; Gupta, Samaijit Sen	Penram, 1st Edition, Mumbai. 2007 ISBN: 9788 I 87972174
6	Progrnmmable logic controllers	Petruzella, F.D.	Tata- McGraw Hill, 3n Edition, 2010 ISBN: 9780071067386

SOFTWARE/LEARNING WEBSITES

12. www.scilab.org
13. www.openplc.fossee.in
14. www.github.com/FOSSEE/OpenPLC
15. www.youtube.com /plc
16. www.dreamtechpress.com /ebooks
17. www.nptelvideos.com/control_ systems/
18. www.in.mathworks.com/ solutions/ control-systems.html ?s _ tid=srchtitle
19. www.edx.org/course?subject=Engineering&course=all&language=English
20. www.plcs.net
21. www.ab.rockwellautomation.com > Allen-Bradley
22. www.plc-training-rslogix-simulator.soft32.com/free-download/

Course Outcome:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

6. Identify different types of control systems.
7. Determine the stability of the control system.
8. Test the performance of various types of controllers.
9. Maintain various components of PLC based process control system.
10. Maintain PLC based process control systems.

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SEMESTER V

COURSE TITLE	:	MICROWAVE AND RADAR
PAPER CODE	:	7470
SUBJECT CODE	:	521
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Content:

Unit I - Introduction to Microwaves

History and applications of Microwaves

Mathematical Model of Microwave Transmission-Microwave transmission modes, wave- guides and transmission lines, Impedance Matching

Microwave Network Analysis

Unit II - Passive and Active Microwave Devices

Directional Coupler, Power Divider, Attenuator, Resonator.

Microwave active components: Diodes, Transistors, Microwave Tubes

Unit III -Microwave Design Principles- Microwave Filter Design, Microwave Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas

Unit IV - Microwave Measurements, Microwave Systems, Effect of Microwaves on human body.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Microwave Engineering	D.M. Pozar	Wiley; Fourth edition (2013) ISBN 978-8126541904
2	Foundation for Microwave Engineering	R.E. Collins	Wiley; Second edition (2007) ISBN : 978-8126515288

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SEMESTER V

COURSE TITLE	:	SEMICONDUCTOR PACKAGING AND TESTING
PAPER CODE	:	7471
SUBJECT CODE	:	522
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objective:

The course deals with electronics systems packaging – a multidisciplinary area. The course will discuss all the vital features of Electronic packaging at three major levels, namely, chip level, board level and system level. This course covers the technology advancements of microelectronic packaging from design to fabrication; assembly and testing and discuss the Current trends in packaging of electronic systems.

Detailed Content:

Unit-1: Overview of Electronic Systems Packaging

Functions of Electronic Packaging, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends and Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

Unit -2: Electrical Issues in Packaging

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics.

Unit -3: Chip Level Packaging

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded.

Unit -4: PCB, Surface Mount Technology and Thermal Considerations

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements

Unit -5: Testing

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

Textbook/Reference books:

1. Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001.
2. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
3. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
4. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.
5. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
6. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005
7. Recent literature in Electronic Packaging
8. Michael L. Bushnell &Vishwani D. Agrawal," Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwer Academic Publishers.2000.
9. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press,1990

Course Outcomes:

At the end of the course learners will be able to

1. Discuss the various packaging types
2. Design of packages which can withstand higher temperature, vibrations and shock
3. Design of PCBs which minimize the EMI and operate at higher frequency
4. Analyze the concepts of testing methods.
5. Discuss the various packaging types

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SEMESTER V

COURSE TITLE	:	RENEWABLE ENERGY TECHNOLOGIES
PAPER CODE	:	7601
SUBJECT CODE	:	531
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
    - To understand bio energy and its usage in different ways.
    - To identify different available non-conventional energy sources.

Course Content:

UNIT-I: Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achieve-ments / Applications; Economics of renewable energy systems.

Unit-II: Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrat- ing Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals ofSolar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-III: Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Perfor- mance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-IV: Bio-Energy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Etha-nol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-V: Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cy- cles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, BNatarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey &Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course outcomes:

At the end of the course, the student will be able to:

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	INTERNET OF THINGS
PAPER CODE	:	7602
SUBJECT CODE	:	532
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Content:

Unit I - Introduction to Internet of Things

- Define the term "Internet of Things"
- State the technological trends which have led to IoT.
- Describe the impact of IoT on society.

Unit II - Design consideration of IoT

- Enumerate and describe the components of an embedded system.
- Describe the interactions of embedded systems with the physical world.
- Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

- Describe the interaction between software and hardware in an IoT device.
- Explain the use of networking and basic networking hardware.
- Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2	internet of Things: A Hands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

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DIPLOMA WING

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DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	SUMMER INTERNSHIP - II
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

SUMMER INTERNSHIP - II

4-6 weeks summer internship after IVth Semester.

It should be undertaken in an Industry only.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E03) /
DIPLOMA IN ELECTRONICS ENGINEERING (E06)

SEMESTER V

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00 (ONE CREDIT WILL BE CARRIED FORWARD TO THE VI SEM. MAJOR PROJECT EVALUATION)

MAJOR PROJECT

It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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