DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

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

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	IC MANUFACTURING	I05	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	7564	501	SAFETY PROTOCOLS FOR IC FOUNDRY	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
2	7565	502	VACUUM TECHNOLOGY	3	3	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	5	150
3	7468	511	INDUSTRIAL AUTOMATION OR	3	3	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	4	150
4	7469	512	CONTROL SYSTEM AND PLC															
5	7471	521	SEMICONDUCTOR PACKAGING AND TESTING OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7566	522	SENSORS AND ACTUATORS															
6	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															
7			PRINTED CIRCUIT BOARD DESIGN LAB	0	0	0	0	0	0	0	0	6	3	20	30	03 Hrs.	3	50
8			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
9			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
10			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
TOTAL				16	16				150	350		20	9	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

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

SEMESTER V

COURSE TITLE	:	SAFETY PROTOCOLS FOR IC FOUNDRY
PAPER CODE	:	7564
SUBJECT CODE	:	501
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

Course Contents:

1. Introduction to various types of safety hazards in a fab, e.g. general, chemical, gas, , and radiation. NFPA 704 diamond, signage.
2. Basics of cleanroom, layout, and operation from the perspective of safety. Balance of air intake, pressure, & exhaust.
3. General safety: Basics of fire safety; extinguishers; emergency response plan; high-voltage safety; PPE; incident reporting; management of change; If possible, demonstration/practical of fire extinguisher.
4. Chemical safety: Classification of hazards; Practical aspects like segregation, spill-control & responsible disposal; Mixing of acids and solvents; Toxicity of effluents; Case study of fluorides in cleanroom; If possible, demonstration/practical of RCA clean.
5. Gas safety: Type of gasses; PEL and TEL; Practical handling of gases, including storage, usage and transport; Toxic gas system components like sensors, coaxial lines, gas cabinets, valve-manifold and standard-operating procedures for cylinder change; Case study of H2 usage; If possible, demonstration/practical of SCBA.
6. Radiation safety: Lasers; UV sources;
7. Structured qualitative risk analysis techniques like bowtie; Definition of concepts like Hazards, Top Events, Threats and Consequences; Understand prevention and mitigation strategies; Case studies of SiH4 hazard
8. Quantification of hazards; Blast radius calculation of gases like SiH4; case studies; Six sigma.
9. Discussion of one industry safety standards from CGA, SEMI, or ASTM.

Text Book/References:

1. Introduction to Mechatronic Design by J. Edward Carryer, Matthew Ohline, Thomas Kenny. Pearson
2. A User's Guide to Vacuum Technology by John F. O'Hanlon. Wiley
3. Handbook of Vacuum Technology, edited by Karl Jousten, Wiley
4. SEMI S2/S8 guidelines.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

SEMESTER V

COURSE TITLE	:	VACUUM TECHNOLOGY
PAPER CODE	:	7565
SUBJECT CODE	:	502
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	02

Unit 1
Basic Theory: Gas kinetic theory, pressure, conductance, gas flow regimes, vapour pressure, pumping speed, throughput. Gas surface interactions: physisorption, chemi-sorption, condensation.

Unit 2
Vacuum Pumps: Mechanical, diffusion, molecular drag, turbo molecular, cryopumps, ion pumps - general working principles, operating regimes.
Vacuum Instrumentation: Vacuum gauges, gas regulators, flow meters, residual gas analyzers, interpretation of data.

Unit 3
Design Concepts: Materials, chambers, components, joins, seals, valves. Overall system design and integration.

Unit 4
Problem Solving: Leak detection and detectors, gas signatures.

Unit 5
Vacuum Applications: Micro fabrication Chemical vapour deposition, physical vapour deposition, sputtering, reactive ion etching, implantation, packaging, Display technologies, X-ray tubes, cryogenic insulation, space simulation.

Text Book

S. No.	Title of Book	Author	Publication
1.	High-vacuum Technology: A Practical Guide	M. H. Hablanian, H. H. Hablanian	2nd Edition, CRC Press, 1997
2.	Ultra High Vacuum Techniques	A.D. Tripathi , A. Gupta	Allied Publishers Private Limited, 2002.
3.	Vacuum Technology	A Roth	Third Edition , Eleciever Science
4.	Vacuum Science, Technology and Applications	Pramod K Naik	CRC Press
5.	Vacuum Science and Technology	V.V. Rao, T.B. Ghosh, K.L. Chopra	Allied Publishers

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VACUUM TECHNOLOGY LAB

List of experiments

1. Familiarization of vacuum pumps in range of 10 ^-2 torr to 10 ^-11 torr
2. Study of vacuum pumps-roots pump, rotary pump, diffusion pump
3. Study of Bayet-Albert guage
4. Study of gas regulators
5. Study of flow meters
6. Study of gas analyzers
7. Study of joints ,seals and valves
8. Study of gas leak detection system

Learning resources

S. No.	Title of Book	Author	Publication
1.	High-vacuum Technology: A Practical Guide	M. H. Hablanian, H. H. Hablanian	2nd Edition, CRC Press, 1997
2.	Ultra High Vacuum Techniques	A.D. Tripathi , A. Gupta	Allied Publishers Private Limited, 2002.
3.	Vacuum Technology	A Roth	Third Edition , Eleciever Science
4.	Vacuum Science, Technology and Applications	Pramod K Naik	CRC Press
5.	Vacuum Science and Technology	V.V. Rao, T.B. Ghosh, K.L. Chopra	Allied Publishers

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

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

List of experiments

1. Study hardware and software platforms for DCS
2. Simulate analog and digital function blocks
3. Study, understand and perform experiments on timers and counters
4. Logic implementation for traffic Control Application
5. Logic implementation for Bottle Filling Application
6. Tune PID controller for heat exchanger using DCS
7. Develop a temperature control scheme for a boiler plant using PID
8. Develop graphical user interface for a typical industrial application

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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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

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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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

SEMESTER V

COURSE TITLE	:	SEMICONDUCTOR PACKAGING AND TESTING
PAPER CODE	:	7471
SUBJECT CODE	:	521
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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DIPLOMA IN IC MANUFACTURING (I05)

SEMESTER V

COURSE TITLE	:	SENSORS AND ACTUATORS
PAPER CODE	:	7566
SUBJECT CODE	:	522
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Contents :

Unit-1
Principles of operation, construction, theory, advantages and disadvantages, applications of-
Resistive Transducers: Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors.

Unit- 2
Principles of operation, construction, theory, advantages and disadvantages, applications of-
Inductive Transducers: LVDT (Linear variable differential transformer).
Capacitive Transducers: various capacitive transducers based upon familiar equation of Capacitance

Unit- 3
Principles of operation, construction, theory, advantages and disadvantages, applications of-
Active Transducers: Thermocouple, Piezo-electric transducer, Hall Effect transducer, Flow meter

Unit- 4
Actuators: Thermal actuators, Electrostatic actuators , Piezoelectric actuators, magnetic actuators

Unit- 5
Understanding of sensor interfacing with microprocessor to build electronic systems. Static and Dynamic characteristic parameters for sensors and actuators, calibration of sensor based electronic systems

TEXT BOOKS

1. Patranabis.D, “Sensors and Transducers”, Wheeler publisher, 1994.
2. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” Fourth edition, Springer, 2010.
3. Sabrie Soloman, Sensors Technology Handbook
4. Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

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 IC MANUFACTURING (I05)

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
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

SEMESTER V

COURSE TITLE	:	PRINTED CIRCUIT BOARD DESIGN LAB
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

List of Experiments

1. Using any Electronic design automation (EDA) software, Practice following PCB Design steps (Open source EDA Tool KiCad/QUCS Preferable)

   Example circuit: Basic RC Circuits

   - Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Netlist generation
   - Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic
   - Create new schematic components
   - Create new component footprints

2. Design PCB (schematic and Layout) for following exercises.

   1. Simple voltage regulator
   2. Opamp circuits
   3. Rectifiers
   4. Multivibrators
   5. Oscillators
   6. Full-Adder using half-adders
   7. 4 bit binary counter using Flip Flops

3. Fabricate single-side/doubleside PCB for simple electronic circuits

Learning resources

S. No.	Title of Book	Author	Publication
1.	Complete PCB Design using orcad capture and pcb editor	Kraig Mitzner	Newpress
2.	PCB design and Layout fundamentals for EMC	Roger Hu	Independently Published

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN IC MANUFACTURING (I05)

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 IC MANUFACTURING (I05)

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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