

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**COURSE STRUCTURE AND SYLLABUS**

**For**

**B. TECH ELECTRONICS AND INSTRUMENTATION ENGINEERING**

*(Applicable for batches admitted from 2019-2020)*



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**IV Year- I Semester**

S.No.	Subjects	Category	L	T	P	Credits
1	Management and Organizational Behavior	HS	3	0	0	3
2	Biomedical Instrumentation	PC	3	0	0	3
3	Digital Image and video Processing	PC	3	0	0	3
4	Professional Elective (PE-III)	PE	3	0	0	3
5	Professional Elective (PE-IV)	PE	3	0	0	3
6	Instrumentation lab- II	LC	0	0	3	1.5
7	VLSI Lab	LC	0	0	3	1.5
8	Project - Part I	PR	0	0	6	3
	Total Credits					<b>21</b>

**IV Year - II Semester**

S.No.	Subjects	Category	L	T	P	Credits
1	Professional Elective (PE-V)	PE	3	0	0	3
2	Open Elective (OE2)	OE	3	0	0	3
3	Project - Part II	PR	0	0	18	9
	Total Credits					<b>15</b>



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>INDUSTRIAL DATA COMMUNICATION (PROFESSIONAL ELECTIVE –V)</b>					

**OBJECTIVES:**

**The main objectives of this course are:**

- To educate on the basic concepts of data networks.
- To introduce the basics of inter-networking and serial communications.
- To provide details on HART and Field buses.
- To educate on MODBUS, PROFIBUS and other communication protocol.
- To introduce industrial Ethernet and wireless communication.

**UNIT-I:**

**DATA NETWORK FUNDAMENTALS:** Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing - CSMA/CD, TCP/IP.

**UNIT-II:**

**INTERNET WORKING and RS 232, RS 485:** Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Device net.

**UNIT-III:**

**HART AND FIELDBUS:** Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications – Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard – Fieldbus topology - Interoperability – Interchangeability - Introduction to OLE for process control (OPC).

**UNIT-IV:**

**MODBUS AND PROFIBUS PA/DP/FMS AND FF:** MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway.

**UNIT-V:**

**INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION:** Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMS-Introduction to wireless HART and ISA100.

**TEXTBOOKS:**

1. Practical Industrial Data by Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004
2. Computer Buses, William Buchanan, CRC Press, 2000.
3. Data Communications & Networking, A. Behrouz Forouzan, 3RD edition, Tata Mc Graw



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

2006.

**REFERENCES:**

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> Edition. 2011.
2. Theodore S Rappaport, Prentice Hall of India 2nd Edition, 2001.
3. Wireless Communication: Principles and Practice, William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Identify network on the basis of various network parameters.
- Assign IP address to the network and network component as per the networks.
- Install various types of network devices and other network hardware for Field and ProfiBUS.
- Troubleshoot problems in hardware/software employed in data communication circuit.



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>POWER PLANT INSTRUMENTATION (PROFESSIONAL ELECTIVE –V)</b>					

**OBJECTIVES:**

**The main objectives of this course are:**

- Understand the working model of powerplant.
- Understand the necessity of an instrumentation engineer in a powerplant
- Understand different components and their control in powerplants.
- Understand various analyzers used in powerplant.

**UNIT-I:**

**AN OVERVIEW OF POWER GENERATION:** Introduction-various sources of Electrical Energy - Non-conventional Energy sources- Wind power, solar power, tidal power, geothermal power, magnetohydrodynamic (MHD) Power, Fuel Cells, Biomass Power, Conventional energy sources- hydropower, nuclear power, gas power, steam power (Thermal Power), comparison of various conventional power plants, Importance of instrumentation and control in power Generation – Classification of Instruments in a power plant, objectives of Instrumentation and control.

**PIPING AND INSTRUMENTATION DIAGRAM (P AND I DIAGRAM):** Examples of ISA Instrumentation diagram symbols, examples of SAMA instrumentation diagram symbols, examples of ISA and SAMA diagram, piping and instrumentation diagramming, Cogeneration of Power-back pressure turbine, pass-out turbine process heat unit, control rooms, thermal or boiler control room, electrical control room, plan of control rooms.

**UNIT-II:**

**INSTRUMENTATION AND CONTROL IN WATER CIRCUIT:** Water circuit, boiler feed water circulation- natural circulation, forced circulation, combined circulation, Measurements in Water Circuit- Water Flow Measurement Differential pressure transmitter (DPT), steam flow measurement, water and steam pressure measurements, water and steam temperature measurements, drum water level measurement.

**CONTROLS IN WATER CIRCUIT:** Boiler drum level control, superheated steam temperature control, steam pressure control, impurities in water and steam- impurities in Raw Water, Effects of Impurities, Measurement of Impurities, feed water treatment.

**UNIT-III:**

**INSTRUMENTATION AND CONTROL IN AIR-FUEL CIRCUIT:** Air-Fuel Circuit – Fuels, combustion air, flue gases, waste gases, Measurements in Air- Fuel Circuit – Measurement of flow/quantity, Measurement of Pressures, Measurement of Temperatures, Measurement of level.

**CONTROLS IN AIR-FUEL CIRCUIT:** Combustion control, furnace Draft Control, Analytical Measurement – Oxygen Measurement in Flue Gas, Measurement of carbon dioxide in flue gas,



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combustibles analyzer (CO+H<sub>2</sub>), Infrared flue gas analyzer, smoke detector, dust monitor, closed circuit television, fuel analyzers, chromatography, pollution monitoring instruments.

**UNIT-IV:**

**TURBINE MONITORING AND CONTROL:** Introduction – Classification, instrumentation control points of View, Principal parts of steam turbines, Turbine Steam Inlet System – Inlet valve arrangements, inlet measurements, Governors, Turbine Measurements – Process Parameters, mechanical parameters, electrical parameters, Turbine control system – safety control systems, process control systems, Lubrication for turbo-alternator – Lubrication system, Controls in Lubrication system, Turbo- Alternator Cooling System – Lube Oil cooling system, Alternator/Generator cooling system.

**UNIT-V:**

**NUCLEAR POWER PLANT INSTRUMENTATION:** Introduction – Instrumentation and Control for Nuclear Power Plant - Important Components of I&C System - Evolution of I&C in NPP – Reactor Control – Methods of Control, Control loops, Functions of control system, Pressurized water reactor (PWR) controls, boiler water reactor (BWR) controls, Liquid metal cooled reactor (LMCR) Control, role of reactor controls during start-up, normal operation and shutdown.

**DIGITAL ARCHITECTURES IN NUCLEAR POWER PLANTS-** System-level Instrumentation and control architecture, safety related systems, non-safety-related systems, man machine interface system (MMIS), Instrumentation and controls architecture platform.

**RADIATION PROTECTION AND MONITORING** – Accident at three-mile Island, USA, disaster at Chernobyl nuclear power plant, Ukraine, calamity at Fukushima, Daiichi nuclear power plant, Japan, Radiation Units, Biological Effects of Radiation, Radiation Monitoring, Nuclear Reactor Safety - Reactor protection system, Reactor Tripping, Engineered Safety Features, Surveillance, Diagnostics and Prognostics – Surveillance, Diagnosis, Prognosis.

**TEXTBOOKS:**

1. Modern Power Station Practice, Volume.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
2. Power Plant Technology, Wakil M.M., McGraw-Hill.

**REFERENCES:**

1. Standard Boiler Operations-Questions and Answers. Elonka S.M and Kohal A.L., – Tata McGraw Hill, New Delhi,1994.
2. Power Plant Instrumentation by Prof. K. Krishna Swamy, Newage International Publisher.
3. Standard Boiler Operations - Questions and Answers – by Elonka S.M., andKohal A.L., TMH, New Delhi,1994



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Analyze the power generation technique used in different types of powerplants.
- Analyze different parameters and their control in the powerplant.
- Apply various concepts of Nuclear powerplants.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>INSTRUMENTATION PRACTICES IN INDUSTRIES (PROFESSIONAL ELECTIVE –V)</b>					

**OBJECTIVES:**

**The main objectives of this course are:**

- Identify and quantitatively estimate different materials required for the manufacturing of Cement, Pulp, Paper, food, Power and pharmacy.
- Understand the principles of different manufacturing processes.
- Recognize these principles written in form of mathematical & chemical equations.
- Apply these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical industrial problems.

**UNIT-I:**

**CEMENT INDUSTRIES:** Corrosion Analysers Porosimeter Compressive strength measurement, Blast Furnace Temperature Measurement using Radiation Pyrometers.

**UNIT-II:**

**PULP AND PAPER INDUSTRIES:**

**MANUFACTURE OF PULP:** Raw materials, Pulping processes, Craft pulping, Soda pulping, Sulfite pulping, Semi chemical pulping, Mechanical and Thermo mechanical Pulping

**MANUFACTURE OF PAPER:** Wet Processing, Fourdrinier Machine, Coated Papers, Special Papers. Wet-end Instrumentation: Pressure: Force Balanced, Bell and Limp or Slack type systems, Temperature: Liquid in Glass, Thermal bulbs, Resistance Bulbs, Liquid Density and Specific Gravity: Fixed Volume, Differential Pressure, Nuclear Radiation Level: Liquid Level- Continuous Purge Instrument, Diaphragm box, Float and Cable, Capacitive, Solid Level- Diaphragm solids, Flow: Tapered tube & float type meter, Cylinder & Piston type meter, Weir and Flumes Consistency: Atmospheric with Driven and Atmospheric with Stationary Sensors, pH: pH Electrode system, types of electrodes, Oxidation Reduction Potential (ORP): ORP Electrode system, electrode holders. Freeness: Continuous Sample and Intermittent Sample Systems. Dry-end Instrumentation: Moisture: Conductivity, Resistance, Capacitance, Hygroscopic, And Infrared Absorption type systems, Basis Weight: Transmission type, On-Machine type, Off-Machine type and Backscatter, type systems, Caliper or Thickness: Contacting type- Electrical, Mechanical and Electro Mechanical, Non- Contacting type

**UNIT-III:**

**PETROLEUM INDUSTRIES:** Unit Operations: Distillation, Drying Separation Measurements in refineries petrochemical industries –Differential pressure transmitter, Thermocouples Infrared Pyrometer, Mass flow meters, Potentiometric level Transmitter, Vacuum Measurement, Near Infrared Analyzer, Hydro Carbon Dew point meter IR Spectrometry, Mass Spectrometry, Flame Ionization Detectors, Chromatography.



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-IV:**

**NUCLEAR POWER PLANT:** Introduction, The power plant scheme, Pressure, flow and level measurement, Vibration and expansion measurements, Analysis of impurities in cooling water, Flue Gas analysis, Ultrasonic Thermometry, Radiation Pyrometry, Emittance measurement.

**UNIT-V:**

**FOOD PROCESSING AND ALLIED INDUSTRIES:** Chromatography, Spectrometry – Mass Spectrometer, Toxicity meter

**TEXT BOOKS:**

1. Chemical Process Industries, Austin G.T. Shreeves, McGraw-Hill International student edition, Singapore, 1985
2. Pulp and Paper Industry Technology & Instrumentation, Sankar Narayana, P.E., Kothari's Desk book.

**REFERENCES:**

1. An Introduction to Paper Industry Instrumentation, John R Lavigne, Miller Freeman Publications, California, 1985 Series.
2. Process measurement and analysis, Liptak B.G., Third edition, Chilton book Company, 1996.
3. Measurement and Control in Papermaking, Robert J. McGill, Adam Hilger Limited, Bristol, 1980.
4. Process/ industrial instruments and controls hand book, Gregory K. McMillan, Douglas M. Considine.
5. Instrumentation in process industries, Liptak B.G., Chilton book Company, 1994.

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Apply fundamental knowledge of chemistry & instrumentation to modeling and analysis of different Industrial engineering.
- Understand disasters caused by an incorrect analysis/design in different Industrial engineering system.
- Students will demonstrate a working knowledge of the basic principles of measuring techniques.
- Demonstrate technical knowledge and skills in the calibration and use of equipment used in different industrial process measurement and control.
- Students will demonstrate a working knowledge of safety practices and skills in trouble-shooting

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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<b>VLSI TESTING &amp; TESTABILITY (PROFESSIONAL ELECTIVE –V)</b>					

**OBJECTIVES:**

**The main objectives of this course are:**

- To impart knowledge on the basic faults that occur in digital systems
- To describe fault detection techniques in combinational circuits.
- To outline procedures to generate test patterns for detecting single stuck faults in combinational and sequential circuits.
- To explain design for testability techniques with improved fault coverage.
- To introduce BIST concepts and specific architectures.
- To give exposure to approaches for introducing BIST into logic circuits, memories and embedded cores.

**UNIT-I:**

Introduction to Test and Design for Testability (DFT) Fundamentals, Modelling: Modelling digital circuits at logic level, register level and structural models, Levels of modelling, Logic Simulation: Types of simulation, Delay models, Element evaluation, Hazard detection, Gate level event driven simulation.

**UNIT-II:**

Fault Modelling – Logic fault models, Fault detection and redundancy, Fault equivalence and fault location. Single stuck and multiple stuck – Fault models. Fault simulation applications, General techniques for Combinational circuits.

**UNIT-III:**

Testing for single stuck faults (SSF), Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits, Functional testing with specific fault models, Vector simulation – ATPG vectors, formats, Compaction and compression, Selecting ATPG Tool.

**UNIT-IV:**

Design for testability – testability trade-offs, techniques. Scan architectures and testing – controllability and Observability, generic boundary scan, full integrated scan, storage cells for scan design. Board level and system level DFT approaches. Boundary scan standards, Compression techniques – different techniques, syndrome test and signature analysis.

**UNIT-V:**

Built-in self-test (BIST): BIST Concepts and test pattern generation. Specific BIST Architectures – CSBL, BEST, RTS, LOCST, STUMPS, CBIST, CEBS, RTD, SST, CATS, CSTP, BILBO. Brief ideas on some advanced BIST concepts and design for self-test at board level. Memory BIST (MBIST): Memory test architectures and techniques – Introduction to memory test, Types of memories and



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

integration, Embedded memory testing model. Memory test requirements for MBIST. Brief ideas on embedded core testing.

**TEXTBOOKS:**

1. Digital Systems Testing and Testable Design, Miron Abramovici, Melvin A. Breur, Arthur D. Friedman, Jaico Publishing House, 2001.
2. Design for Test for Digital ICs & Embedded Core Systems, Alfred Crouch, Prentice Hall.

**REFERENCES:**

1. Introduction to VLSI Testing, Robert J. Feugate, Jr., Steven M. Mentyn, Prentice Hall, Englewood Cliffs, 1998.
2. Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits, Bushnell, M., and Agrawal, Vishwani D, Kluwer Academic Publishers, 2002

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Model digital circuits at logic and RTL levels.
- Simulate digital ICs in the presence of faults and evaluate the given test set for fault coverage.
- Generate test patterns for detecting single stuck faults in combinational and sequential circuits.
- Identify schemes for introducing testability into digital circuits with improved fault coverage.
- Compare different approaches for introducing BIST into logic circuits, memories and embedded cores.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>3D PRINTING</b> <b>(OPEN ELECTIVE-II)</b>				

**OBJECTIVES:**

**The main objectives of this course are:**

- The course aims at the importance of Additive Manufacturing, classifications, models, specifications of various Additive Manufacturing Techniques.
- Principles and operation of 3Dp, Various types of 3DP
- Techniques of printing electronics
- To learn the data formats and soft-wares required
- The applications of RP

**UNIT-I**

**INTRODUCTION TO PROTOTYPING:** Traditional Prototyping Vs Rapid Prototyping (RP), Need for time compression in product development, Distinction between RP and CNC and other related technologies, Classification of RP, commonly used terms, advantages and limitations of rapid prototyping.

**UNIT-II**

**THREE-DIMENSIONAL PRINTING (3DP):** Overview of 3DP, 3D Printer, 3D Systems, and Z Corporation, ExOne - Metal and Molding Sand Printer, Metal Line: Direct Metal Printer, Molding Sand Line: Direct Core and Mold-Making Machine, Soligen - Direct Shell Production Casting (DSPC), Voxel jet- 3D Printing System, Optomec - Maskless Mesoscale Material Deposition (M3D),

**UNIT-III**

**TECHNIQUES FOR PRINTING ELECTRONICS:** printing electronics, 2D-printing technologies- Flexographic, Offset, Gravure, screen printing, Processes in 3D-printing electronics - Improved building process for 3D devices, Functionalization of 3D surfaces, Current trends in 3D-printed electronics- antennas, flexible electronics, batteries, The market for 3D-printed electronics And integrated machines

**UNIT – IV**

**RAPID PROTOTYPING DATA FORMATS:** STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, Newly Proposed Formats.

**RAPID PROTOTYPING SOFTWARE'S:** Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, STL View 3 Data Expert and 3 D doctor.

**UNIT –V**

**RP APPLICATIONS:** Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of biomolecular.

**TEXT BOOKS:**

1. Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.
2. Andreas Gebhardt Jan-Steffen Hotter, Additive Manufacturing: 3D Printing for prototyping and Manufacturing, Hanser Publications, 6915 Valley Avenue, Cincinnati, Ohio.
3. Ian Gibson., David W Rosen., Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.

**REFERENCE BOOKS:**

1. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
2. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
4. Rapid Prototyping / Chua & Liou

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Identify the importance of RP in present scenario.
- Gain the knowledge on 3DP
- Application of 3DP in electronics.
- Minimize various errors that are occurring during conversion of CAD models.
- Applications of RP.



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

<b>IV Year- II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>BLOCKCHAIN TECHNOLOGIES</b>					
<b>(OPEN ELECTIVE-II)</b>					

**OBJECTIVES:**

**The main objectives of this course are:**

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them,
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

**UNIT-I:**

**INTRODUCTION:** Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain.

Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

**UNIT-II:**

**BLOCKCHAIN CONCEPTS:** Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

**UNIT-III:**

**ARCHITECTING BLOCKCHAIN SOLUTIONS:** Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications, Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

**UNIT-IV:**

**ETHEREUM BLOCKCHAIN IMPLEMENTATION:** Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Meta mask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts

**UNIT-V:**

**HYPERLEDGER BLOCKCHAIN IMPLEMENTATION:** Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, Fab Car Use Case Implementation, Invoking Chain code Functions Using Client Application.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**  
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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero-Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

**TEXT BOOKS:**

1. “Blockchain for Enterprise Application Developers”, Ambadas, Arshad Sarfarz Ariff, Sham - Wiley
2. “Mastering Bitcoin: Programming the Open Blockchain”, Andreas M. Antonopoulos, O’Reilly

**REFERENCES:**

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly

**E-RESOURCES:**

<https://github.com/blockchainedindia/resources>

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
- Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Crypto currency markets
- Examine how to profit from trading crypto currencies.

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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>CYBER SECURITY &amp; CRYPTOGRAPHY</b>					
<b>(OPEN ELECTIVE-II)</b>					

**OBJECTIVES:**

The main objectives of this course are given below:

- Able to identify security risks and take preventive steps
- To understand the forensics fundamentals.
- To understand the evidence capturing process.
- To understand the preservation of digital evidence.

**UNIT- I:**

**INTRODUCTION TO CYBERCRIME:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

**UNIT-II:**

**TOOLS AND METHODS:** Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

**UNIT-III**

**CYBER CRIME INVESTIGATION:** Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

**UNIT-IV:**

**COMPUTER FORENSICS AND INVESTIGATIONS:** Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

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**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-V:**

**CYBER CRIME LEGAL PERSPECTIVES:** Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.

**TEXT BOOKS:**

1. SunitBelapure Nina Godbole “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, WILEY, 2011.
2. Nelson Phillips and EnfingerSteuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.

**REFERENCE BOOKS:**

1. Michael T. Simpson, Kent Backman and James E. Corley, “Hands on Ethical Hacking and Network Defence”, Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar “Cyber Security and Cyber Laws”, Cengage, 2018.

**Web References:**

1. CERT-In Guidelines- <http://www.cert-in.org.in/>
2. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> [ Online Course]
3. <https://computersecurity.stanford.edu/free-online-videos> [ Free Online Videos]
4. NickolaiZeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu>. License: [Creative Commons BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/).

**OUTCOMES:**

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

- Explain the computer forensics fundamentals.
- Describe the types of computer forensics technology
- Analyze various computer forensics systems.
- Illustrate the methods for data recovery, evidence collection and data seizure.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

IV Year- II Semester		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>18</b>	<b>9</b>
<b>PROJECT –PART II</b>					



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**OPEN ELECTIVES OFFERED BY EIE**



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**PRINCIPLES OF MEASUREMENT AND INSTRUMENTATION**  
**(OPEN ELECTIVE-1)**

**OBJECTIVES:**

**The main objectives of this course are:**

- Acquire knowledge of Basic functional elements of instrumentation.
- Learn and understand fundamentals of electrical and electronic instruments.
- Compare various measurement techniques.
- Learn and understand various storage and display devices.
- Compare various transducers and the data acquisition systems.

**UNIT-I:**

**INTRODUCTION:** Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

**UNIT-II:**

**ELECTRICAL AND ELECTRONIC INSTRUMENTS:** Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss –Instrument transformers – Instruments for measurement of frequency and phase.

**UNIT-III:**

**COMPARATIVE METHODS OF MEASUREMENTS:**D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

**UNIT-IV:**

**STORAGE AND DISPLAY DEVICES:** Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

**UNIT-V:**

**TRANSDUCERS AND DATA ACQUISITION SYSTEMS:** Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart Sensors-Thermal Imagers.

**TEXTBOOKS:**

1. 'A Course in Electrical & Electronic Measurements & Instrumentation', A.K. Sawhney, Dhanpat Rai and Co, 2010.
2. 'A Course in Electronic and Electrical Measurements', J. B. Gupta, S. K. Kataria& Sons, Delhi, 2013.

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3. Measurement Systems – Applications and Design, Doebelin E.O. and Manik D.N, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

**REFERENCES:**

1. 'Electronic Instrumentation', H.S. Kalsi, McGraw Hill, III Edition 2010.
2. 'Transducers and Instrumentation', D.V.S. Murthy, Prentice Hall of India Pvt Ltd, 2015.
3. 'Electronic Instrumentation & Measurements', David Bell, Oxford University Press, 2013.
4. 'Electrical Measurements', Martin Reissland, New Age International (P) Ltd., Delhi, 2001.
5. Principles of Measurements and Instrumentation, Alan. S. Morris, 2nd Edition, Prentice Hall of India, 2003.

**OUTCOMES:**

**At the end of this course the student will be able to:**

- To acquire knowledge on Basic functional elements of instrumentation.
- To understand the concepts of Fundamentals of electrical and electronic instruments.
- Ability to compare between various measurements techniques.
- To acquire knowledge on various storage and display devices.
- To understand the concepts various transducers and the data acquisition systems.
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**DIGITAL SENSORS**  
**(OPEN ELECTIVE-II)**

**OBJECTIVES:**

**The main objective of this course is:**

- To make student to acquire the knowledge on types of sensors/transducers, working principles, selection procedure, and applications of sensing systems.

**UNIT-I:**

**INTRODUCTION TO MEASUREMENT:** Measurement units, applications, elements, choosing appropriate measuring instruments. Instrument Types and Performance Characteristics: Review of instrument types, Static characteristics and dynamic characteristics.

**ERROR DURING MEASUREMENT PROCESS:** Sources of systematic error, reduction and quantification of systematic errors, random errors, aggregation of measurement system errors.

**CALIBRATION:** Calibration of measuring instruments, Primary calibration, secondary calibration and field calibration. Calibration methods for different parameters (temperature, pressure, humidity, flow...etc.). Automatic Calibration mechanisms.

**UNIT-II:**

**TEMPERATURE SENSORS:** Thermo-resistive, Resistance Temperature Detectors, Silicon Resistive, Thermistors, Semiconductor, Optical, Acoustic, Piezoelectric.

**HUMIDITY AND MOISTURE SENSORS:** Capacitive, Electrical Conductivity, Thermal Conductivity, Optical Hygrometer, Time Domain Reflectometer.

**PRESSURE AND FORCE SENSORS:** Mercury Pressure, Bellows, Membranes, and Thin Plates, Piezoresistive, Capacitive, Optoelectronic, Vacuum, Strain Gauges, Tactile, Piezoelectric Force.

**APPLICATIONS:** Case studies in processing industries, indoor environment monitoring in offices, cold storages.

**UNIT-III:**

**OCCUPANCY AND MOTION DETECTORS:** Ultrasonic, Microwave Motion, Capacitive Occupancy, Visible and Near-Infrared Light, Far-Infrared Motion, PIR Motion, Position, Displacement, and Level Sensors: Potentiometric, Gravitational, Capacitive, Inductive and Magnetic, Optical, Ultrasonic, Radar.

**VELOCITY AND ACCELERATION SENSORS:** Capacitive Accelerometers, Piezoresistive Accelerometers, Piezoelectric Accelerometers, Thermal Accelerometers, Heated-Plate Accelerometer, Heated-Gas Accelerometer, Gyroscopes, Piezoelectric Cables.

**APPLICATIONS:** Case studies in manufacturing industries, robotics.



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**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**UNIT-IV:**

**FLOW SENSORS:** Pressure Gradient Technique, Thermal Transport, Ultrasonic, Electromagnetic, and Micro flow, Coriolis Mass Flow, Acoustic Sensors: Resistive Microphones, Fiber-Optic, Piezoelectric, Solid-State microphone, Light & Radiation Sensors: Photodiodes, Phototransistor, Photo resistors, Thermal detectors.

**CHEMICAL SENSORS:** Metal-Oxide Chemical, ChemFET, Electro-chemical, Potentiometric, Conduct metric, Amperometric, Optical Chemical, Mass Detector

**APPLICATIONS:** Case studies in processing industries, oil and gas industries, water SCADA, pharmaceutical industries

**UNIT-V:**

**INTRODUCTION TO WIRELESS SENSOR NETWORKS:** Challenges for wireless sensor networks, Applications for wireless sensor networks, enabling technologies for wireless sensor networks. **SINGLE NODE ARCHITECTURE**– Hardware components, Energy consumption of Sensor nodes (only Operation states with different power consumption, Relationship between computation and communication, Power consumption of sensor and actuators is included), Deployment environments.

**SENSOR NETWORK ARCHITECTURE**- Sensor Network Scenarios, Optimization goals and figures of merit, Design principles of WSN, Service interfaces of WSNs, Gateway-concepts.

**TEXTBOOKS:**

1. Measurement and Instrumentation Principles - Morris, Alan S
2. An Introduction to Error Analysis by John R. Taylor
3. Sensor Technology Handbook, John S. Wilson
4. "Protocols and Architectures for Wireless Sensor Networks" Holger Karl & Andreas Willig, John-Wiley, First-Edition-2014.

**REFERENCE:**

1. Mechanical Measurements – Beckwith, Marangoni, Lienhard
2. Measurement of Systems - Application and design - Earnest O. Doebelin
3. Electronic Instrumentation and Measurement Technique - Albert D Helfrick

**OUTCOMES:**

**At the end of this course the student will be able to:**

- Understand measuring parameters, measuring systems, effects of environment, characteristics and parameters to be considered for designing an instrument.
- Understand different types of sensors/transducers, working principles, selection procedure, applications of sensing systems.
- Understand Challenges and applications of sensors and sensor networks.
- Select a sensor/sensing system for a requirement.
- Test, install and collect the data from a group of sensors.
- Derive sensor-based solution for different applications.