Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PC-ECS601	**Category: Program core**
Course Name: Industrial Automation	**Semester: 6th**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 38	

Course Objectives:

O1. To make the learner understand the benefits of using industrial automation systems
O2. To make the learner acquainted with the features of PLC, DCS, SCADA and HMI
O3. To make the learner able to program a PLC

Module No.	Description of Topics	Contact Hrs.
1	**Industrial Automation**: The Industrial Control System, Automation and Process Control, Purpose of Industrial Automation, Industrial Automation Circuits, Computer-Based Industrial Control and Automation.	**6**
2	**Introduction to Programmable Logic Controllers (PLCs)**: Basic Architecture and Functions, Analog Input/Output Modules, Digital Input/Output Modules, CPU and Memory; Relays, Timers, Counters and their uses, Ladder diagram Programming: Programming with Boolean Logic and Activation Instructions, Programming with Timers and Counters, Applications of PLC Programming.	**8**
3	**Industrial Networks of PLCs**: Topology of a Network, Communication Protocols, Implementation of Industrial Networks.	**6**
4	**DCS and HMI**: Computer based control, History and overview of DCS, Concept of centralized and distributed control systems, system architecture, brief view on operator station, engineering station, field control station. HMI – operator & engineering interface, functions and requirements.	**6**
5	**SCADA**: SCADA SYSTEMS HARDWARE & FIRMWARE Introduction, History of SCADA, Fundamental Principles of Modern SCADA Systems, the components of a SCADA system, SCADA Hardware and Software, Comparison of the terms SCADA, DCS, PLC and smart instrument, Considerations and benefits of SCADA system, Remote Terminal unit(RTU), Application Programs, PLCs used as RTUs, The Master Station, Master Terminal unit (MTU), Configuration of MTU.	**6**

6	**Industrial Applications:** A) Cyclic Operation of Traffic Lights B) Automated Filling of Two Milk Tanks C) Combined Operation of Two Conveyor Belts D) Driving a Step Motor Through a PLC	**6**

A. **Text books**:

1. Industrial Automation Using PLC, SCADA, and DCS, R. G. Jamkar, Global Education Ltd., 2nd Edition, 2018.

2. PLCs & SCADA – Theory and Practice, R. Mehra and V. Vij, Laxmi Publications Pvt. Ltd., 2nd Edition, 2017.

3. Programmable Logic Controllers: Principles and Applications, John W. Webb and Ronald A. Reis, Pearson Education, 5th Edition, 2003.

4. Programmable Logic Controllers: An Introduction, Frank D. Petruzella, McGraw-Hill Education, 5th Edition, 2016.

B. **Reference Books**:

1. Modern Distributed Control Systems, M. Elshafei, CreateSpace (Amazon Digital Services), 1st Edition, 2016.

2. Instrument Engineers' Handbook (Vol. 2: Process Control and Optimization), B. G. Lipták (Ed.), CRC Press, 4th Edition, 2005.

3. Process Control: Modeling, Design, and Simulation, B. Wayne Bequette, Prentice Hall, 1st Edition, 2003.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PC-ECS602	**Category: Program core**
Course Name: Machine Learning	**Semester: 6**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 38	
Pre-Requisite: Basic knowledge of probability and statistics, linear algebra (vectors, matrices, eigenvalues), calculus (gradients), and introductory programming (preferably Python). Prior exposure to Artificial Intelligence and data handling is desirable.	

Objectives:

1. To introduce the foundational concepts of machine learning and different learning paradigms.
2. To enable students to understand, apply, and evaluate supervised, unsupervised, and reinforcement learning algorithms.
3. To expose students to artificial neural networks, deep learning basics, and ensemble methods.
4. To develop the ability to select appropriate ML models and assess their performance using suitable evaluation techniques.

Module No.	Description of Topics	Contact Hrs.
1.	Introduction to Machine Learning - What is machine learning; Types of learning: Supervised, Unsupervised, Semi-supervised, Reinforcement; Hypothesis space, target function; Feature representation; Training vs. test data; Regression vs. classification	6
2.	Supervised Learning - Linear models, gradient descent; Decision Trees, Information gain; Random Forests; Naïve Bayes Classifier; k-Nearest Neighbours; Strengths and limitations of supervised learning algorithms	8
3.	Unsupervised Learning - Clustering: k-Means, EM algorithm; Hierarchical clustering; Density-based and model-based methods; Association patterns and correlation measures; Applications of unsupervised learning	6

4.	Neural Learning & Deep Learning Basics - Artificial Neural Networks; Perceptron, Multilayer Perceptron; Backpropagation algorithm; Activation functions (Sigmoid, ReLU, Tanh); Introduction to Deep Learning; Capabilities and limitations of neural models	6
5.	Ensemble Methods & Model Design - Ensemble learning concepts; Bagging, boosting (AdaBoost); Model selection procedures; Bias-variance trade-off; Overfitting vs underfitting; Hyperparameter tuning	6
6.	Evaluation Metrics & Performance Analysis - Performance measures: Accuracy, Precision, Recall, F1-Score; ROC curve, AUC; Confusion matrix; Error analysis; Strengths and limitations of evaluation metrics	6

Course Outcomes:

After completion of this course, students will be able to

1. Explain the fundamentals of machine learning and differentiate among various learning paradigms.
2. Apply and analyze common supervised and unsupervised machine learning algorithms.
3. Explain and evaluate neural networks and summarize the basics of deep learning.
4. Design and develop ensemble-based machine learning systems for real-world applications.
5. Use and interpret performance metrics to evaluate ML models and implement suitable model selection strategies.

Text / References:

1. T. M. Mitchell, *Machine Learning*, McGraw-Hill, 1997.
2. E. Alpaydin, *Introduction to Machine Learning*, PHI, 2006.
3. P. Flach, *Machine Learning*, Cambridge University Press, 2012.
4. I. Goodfellow, Y. Bengio, A. Courville, *Deep Learning*, MIT Press, 2016.
5. C. M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
6. R. O. Duda, P. E. Hart, D. Stork, *Pattern Classification*, Wiley, 2001.
7. V. Vapnik, *Statistical Learning Theory*, Wiley, 1998.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PC-ECS603	Category: Program core
Course Name: Internet of Things (IoT)	Semester: 6
L-T-P: 3-0-0	Credit: 3
Total Lectures: 36	
Pre-Requisite: Knowledge of computer networking, microcontroller, python programming, Embedded Systems.	

Module No.	Description of Topics	Contact Hrs
1	**Introduction to IoT** Definition, Evolution & Characteristics of IoT, IoT vs Cyber-Physical Systems vs M2M, IoT Functional Blocks, Applications: Smart Home, Smart Agriculture, Healthcare, Industry 4.0, IoT Reference Architectures (IETF, ITU, 5-layer architecture).	6
2	**IoT Hardware & Sensors** Types of Sensor Outputs: Analog, Digital, PWM, Serial, Temperature Sensors: LM35, DS18B20, TMP36 – specification & operation, Humidity Sensors: DHT11, DHT22 : working principle (capacitive humidity detection), Light Sensors: LDR, Photodiode ,luminance-based resistance change, Pressure Sensors: BMP180/BMP280 : barometric pressure measurement, Motion Sensors: PIR sensor – infrared radiation detection, Proximity Sensors: Ultrasonic (HC-SR04), IR Proximity Modules, Capacitive/Inductive Proximity Sensors	6
3	**IoT Networking & Communication Protocols** Communication Models: Request-Response, Publish-Subscribe, Wired Communication: UART, SPI, I2C, Wireless Technologies: Wi-Fi, Bluetooth/BLE, ZigBee, LoRa, RFID, NFC, IoT Protocols: MQTT, CoAP, AMQP, HTTP/HTTPS, Cloud Connectivity Basics	6
4	**IoT Platforms and Cloud** Introduction to IoT Cloud Platforms: Thingspeak, AWS IoT, Google IoT Core, Azure IoT, Data Acquisition & Visualization, Edge Computing & Fog Computing Concepts, IoT Operating Systems	6

	(Contiki, RIOTOS, TinyOS) – Basic Overview	
5	**IoT Security & Privacy** Security Challenges in IoT,Authentication, Encryption, Key Management, Common Attacks: Spoofing, DoS, Replay, Man-in-the-Middle, Secure Boot & Firmware Updates .	6
6	**Case Studies & Recent Trends** IoT Solutions for Healthcare, Home Automation and Agriculture	6

Textbook and Reference books:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press, Edition 2021
2. Internet of Things: Architecture and design principles , Raj Kamal, 2nd Edition, McGrawHill education.
3. Hanes David ,Salgueiro Gonzalo, Grossetete Patrick, Barton Rob ,"IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things" , PearsonEducation

Reference Books

1. Raj Kamal, "Internet of Things: Architecture and Design Principles".
2. Dieter Uckelmann et al., "Architecting the Internet of Things".

Course Outcomes:

After completion of this course, students will be able to

CO1: Understand the fundamental concepts, architecture, and applications of IoT.
CO2: Explain communication models, protocols, and networking technologies used in IoT.
CO3: Demonstrate the integration of sensors, microcontrollers, and communication modules.
CO4: Apply IoT platforms/tools to build simple IoT applications.

Special Remarks:
The outcomes mentioned above are not limited. Institutes may redefine outcomes based on their program educational objective.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS601A	**Category: Professional Elective I**
Course Name: Microelectronics and VLSI	**Semester: 6th**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 38	
Pre-Requisite: Basics of Semiconductor Devices (specifically p-n junction), Digital Electronics	

Module No.	Description of Topics	Contact Hrs
1.	Overview of Microelectronics and VLSI; MOS transistor basics: structure, operation; Threshold voltage, body effect; I–V characteristics (linear & saturation regions); MOS capacitor & C–V characteristics; Parasitic effect.	5
2.	MOSFET operation: cut-off, linear, saturation; I–V characteristics & parameters; Small-signal models; Second-order effects (Channel length modulation, Subthreshold conduction, Mobility degradation, DIBL); Scaling of MOSFETs (Constant-field and constant-voltage scaling, Short-channel effects); Modern transistor technologies: SOI MOSFET, FD-SOI, FinFET, GAAFET Introduction	6
3.	Silicon wafer preparation; Oxidation, diffusion, ion implantation; Deposition (CVD, PVD, ALD); Photolithography and mask preparation; Etching (dry & wet); Metallization, CMP; CMOS process flow (n-well/p-well/twin-tub process)	5
4.	CMOS inverter: voltage transfer characteristics; Noise margin, delay, dynamic behaviour; Power dissipation (static & dynamic); Basic logic gates: NAND, NOR, XOR; Complex logic & transmission gates; Sequential circuits: latches, flip-flops; Memory basics: SRAM cell design, DRAM concepts	7
5.	Current mirrors (simple, cascade, Wilson); Differential amplifiers & common-mode analysis; CS, CG, CD amplifiers; Frequency response of MOS amplifiers; Operational amplifier design basics; Bandgap reference & biasing techniques; Noise in analog circuits.	7

6.	Full-custom vs. Semi-custom design; Standard cell-based design; Stick diagrams; Layout design rules (λ-based rules); Layout of : MOS transistor, CMOS inverter, NAND/NOR gates; Parasitics: R, C extraction; DRC, LVS, ERC checks; Introduction to VLSI CAD tools; FPGA Design Flow; System on Chip (SoC); Physical Design & Testing; Low Power VLSI Design.	8

Course Objective

1. Provide a strong foundation in semiconductor physics, MOS devices, and microelectronic components.
2. Introduce modern CMOS technologies, device fabrication, and VLSI process flows.
3. Enable students to understand MOSFET modeling and scaling for deep-submicron technologies.
4. Teach principles of CMOS digital and analog circuit design.
5. Familiarize students with VLSI layout, design rules, and CAD tools.

Course Outcome

CO1: Explain semiconductor physics, MOS structure, device operation, and electrical characteristics.
BT Level 2 – Understand
CO2: Analyze MOSFET models, scaling principles, and short-channel effects in modern VLSI devices.
BT Level 4 – Analyze
CO3: Interpret and apply CMOS fabrication steps and process integration techniques.
BT Level 3 – Apply
CO4: Design basic CMOS digital and analog circuits and evaluate performance metrics.
BT Level 5 – Evaluate
CO5: Demonstrate understanding of VLSI design flow, layout rules, and parasitic effects.
BT Level 2 – Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code : **PE-ECS601 B**	Category: Professional Elective I
Course Name : Electronic Measurement & Measuring Instrument	Semester : 6th
L-T-P : 3-0-0	Credit: 3
Total Lectures: 42	
Pre-Requisites: Basic Electrical Engineering	

Module no.	Content	Hours
1	**Characteristics** Significance of Measurement and block diagram of Measurement System, Static characteristics- Accuracy, Precision, Sensitivity, Linearity, Repeatability, Reproducibility, Resolution, Threshold, Drift, Stability, Dead zone, hysteresis Dynamic Characteristics- speed of response, measuring lag, fidelity, dynamic error, Types of Errors – Gross error, systematic errors, Random errors	8
2	**DC and AC Bridges:** Concept of Bridges, Measurement of low resistance by Kelvin Double Bridge Method. A.C. bridges - Maxwell's inductance bridge, Anderson bridge, D-Sauty Bridge, Schering Bridge, Wien bridge Circuit diagram, phasor diagram, derivations of equations for unknown parameter, Q-factor, dissipation factor, advantages and disadvantages for all the bridges.	8
3	**Measuring Instruments:** General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Principle of operation of the Electrostatic instruments, Extension of instrument ranges and multipliers. Principle of operation of Electrodynamic & Induction type wattmeter.	8
4	**Oscilloscopes:** Cathode ray oscilloscope (CRO): Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.	8

5	**Transducers:** Transducer and its classification, Resistive Transducer: Potentiometric type, Strain Gauge type (Gauge factor derivation, SG materials, Bonded and unbounded strain gauges), Capacitive Transducers - Variable gap type, variable area type and variable Dielectric type, Inductive Transducers - LVDT, Thermocouple, Thermistor, Piezo Electric Transducers.	10

Learning Resources:

Text Books:

1. A.K. Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai.
2. E.W Golding, Electrical Measurement and Measuring Instruments; Wheeler Publication
3. J.B.Gupta, Electrical & Electronics Measurements and Instrumentation; S.K. Kataria and Sons.
4. Kalsi, G.C., Electronic Instrumentation, TMH.

Course Outcome:

After completion of this course, the students will be able to

1. explain the terms accuracy, precision, resolution, speed of response, errors in measurement, loading effect
2. describe methods of measurement of power, energy by instruments and resistance, capacitance and inductance by bridges and potentiometer
3. explain the principle of operation of analog meters, instrument transformer, digital multimeter, digital voltmeter, digital frequency meter, signal generator, strain gauge, LVDT and temperature transducers
4. explain the different building block, principle of operation of oscilloscope and measurement techniques of voltage, current, frequency and phase by oscilloscope.
5. solve numerical problems related to analog meters, instrument transformer, measurement of power, energy, resistance, inductance and capacitance.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS601C	Category: Professional Elective I
Course Name: Industry 5.0	Semester: 6
L-T-P: 3-0-0	Credit: 3
Total Lectures: 34	

MODULE	DESCRIPTION OF TOPIC	HRS/UNIT
1	INTRODUCTION TO INDUSTRY 5.0 Evolution from Industry 1.0 to 5.0, Introduction to Industry 5.0, Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, Healthcare and Human computer interactions, Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Big Data and Advanced Analysis.	6
2	DIGITAL TRANSFORMATION TO INDUSTRY 5.0 Digital Transformation, Introduction to Digital Transformation, Digital business transformation, Causes of disruption and transformation, Digital transformation myths and realities, Digital transformation across various industries, Retail industry, Urban Development, e-Governance and the public sector, Insurance industry, Healthcare, Food, Manufacturing, Disaster Control, Elements of Society 5.0, Data Driven to Society, Humanity Vs Society 5.0	7
3	SMART WORLD Introduction: Sensing & actuation, Communication, Electronics in Smart city, 5G Technology, Communication protocols, Integration of Sensors in Robots and Artificial Intelligence, Human-Machine Interaction, Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & 207 Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management., Intellectual Property Rights- Case Studies - Milk Processing and Packaging Industries	7

4	CYBER SECURITY IN INDUSTRY 5.0 Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Intellectual Property Rights (IPR)	7
5	AR/VR IN INDUSTRY 5.0 Unity, Basics of Unity, understanding different panels in Unity, Moving, rotating & scaling Gameobjects in Unity, Game Panel in Unity, Physics in Unity, Increasing the light intensity, Adding colors to Gameobject, Adding textures to Gameobject, Parent and child Gameobjects in Unity. Case Studies- Development of AR/VR Models in Unity.	7

TEXT BOOKS:

1. Misra, Sudip, Chandana Roy, and Anandarup Mukherjee. Introduction to industrial internet of things and industry 4.0. CRC Press, 2021.

2. Elangovan, Uthayan. Industry 5.0: The future of the industrial economy. CRC Press, 2021.

REFERENCE BOOKS:

1. Klaus Schwab, “Fourth Industrial Revolution”, Random House USA Inc, New York, USA, 2017.

2. Oliver Grunow, “SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies”, Study lab Publications, 2016.

3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

4. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

5. Saini, Aarti, and Vikas Garg, eds. Transformation for Sustainable Business and Management Practices: Exploring the Spectrum of Industry 5.0. Emerald Publishing Limited, 2023.

Course Objectives:

This course will enable students:

1. To acquaint with the digital transformation of Industry 5.0
2. To recognize the power of industry to achieve societal goals beyond jobs and growth
3. To understand the design of personalized electronics products
4. To focus on methods of interaction between humans and machines in virtual reality
5. To develop the concept of augmented reality in electronics manufacturing beyond automation and optimization

Course Outcomes:

Course Outcome	Description	Bloom's Taxonomy Level
CO-1	Identify the digital transformation power of Industry 5.0 to achieve societal goals beyond jobs and growth	BT2
CO-2	Analyze enhanced new production models in electronics	BT3
CO-3	Implement various electronics manufacturing technologies of augmented reality beyond automation and optimization	BT4
CO-4	Design suitable sensors for smart world real time applications with virtual reality experience	BT4
CO-5	Evaluate the performance of various cyber physical systems	BT5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS602A	Category: Professional Elective-II
Course Name: Robotics	Semester: 6
L-T-P: 3-0-0	Credit: 3
Total Lectures: 36	

Module No.	Description of Topics	Contact Hrs
1	**Introduction to Robotics** Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.	7
2	**Robot Anatomy and Motion Analysis** Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.	7
3	**Robot Drives and End Effectors** Robot drive systems, Hydraulic, Pneumatic and Electric drive systems, classification of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper, gripper force analysis and gripper design, 1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors, Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.	7
4	**Path Planning** Definition-Joint space technique, Use of P-degree polynomial-Cubic, polynomial- Cartesian	8

	space technique, parametric descriptions, straight line and circular paths, position and orientation planning.	
5	**Robotics Applications** Material Handling: pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots	7

Textbook and Reference books:

1. Robotics Technology and flexible automation, S.R. Deb, Tata McGraw-Hill Education, 1st Edition, 2009.

2. Industrial Robots - Technology, Programming and Applications Mikell P. Groover et. al., McGraw Hill, Special Edition, 2012.

3. A textbook on Industrial Robotics, Ganesh S Hegde, University science press, 3rd Edition, 2017.

4. Robotics: Fundamental Concepts and Analysis, Ghosal A, Oxford University Press, 2nd Edition, 2006

5. Introduction to Robotics, S. K. Saha, Tata McGraw Hill Education Pvt. Ltd., 2nd Edition, 2020.

6. Robotics and Control, R. K. Mittal, I. J. Nagrath, Tata McGraw-Hill Publishing Company Ltd., 5th Edition, 2018

Course Outcomes:

After completion of this course, students will be able to

CO1 Understand the significance, social impact and future prospects of robotics and automation

in various engineering applications

CO2 Identify and describe the components and anatomy of robotic system.

CO3 Know about various path planning techniques and analyze different motions of robotics system

CO4 Use the suitable drives and end-effectors for a given robotics application.

CO5 Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios.

Special Remarks:

The outcomes mentioned above are not limited. Institutes may redefine outcomes based on their program educational objective.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS602 B		Category: Professional Elective-II
Course name: Information Theory and Coding		Semester
L-T-P: 3-0-0		Credit Points:3
Total No. of lecture hours:		36
Module	Topics	Hours
1	Information Theory Fundamentals: Information measure, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov statistical model for information sources, Entropy and Information rate of Markoff Sources.	8
2	Source Coding: Encoding of the source output, Shannon's encoding algorithm, Shanon Fano Encoding algorithm, Source coding theorem, Prefix code, Kraft McMillam Inequality property-KMI, Huffman codes.	**7**
3	Information Channels: Communication Channels, Discrete Communication channels, Discrete Communication channels, Channel Matrix, Joint Probability Matrix, Binary Symmetric Channel, System Entropies, Mutual information, Channel capacity, channel capacity of Binary Symmetric channel, Binary Erasure channel, Muroga's Theorem	**7**
4	Error Control Coding: Introduction, Example of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of linear Block codes, Single error correction Hamming code, Table lookup Decoding using Standard array. Binary cyclic codes: Algebraic structure of cyclic codes, encoding using an (n-k) Bit shift register,	9

	Syndrome calculation, Error Detection and Correction.	
5	Convolution Codes: Convolution Encoder, Time domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm.	**5**

Course Outcomes

On completion of this course, the student will be able to:

1. **Explain** the fundamental concepts of information theory including entropy, mutual information, and data compression limits.
2. **Apply** source coding techniques such as Huffman, Shannon–Fano, and Lempel-Ziv codes to achieve efficient data representation.
3. **Analyze** discrete memoryless channels and **evaluate** channel capacity and coding limits.
4. **Design and implement** linear block codes, cyclic codes, and convolutional codes for error detection and correction.
5. **Select and compare** appropriate coding schemes for reliable and secure digital communication systems.

Textbooks

1. **Ranjan Bose**, Information Theory, Coding and Cryptography, Tata McGraw-Hill, 2nd Edition, 2008

2. **Simon Haykin**, Communication Systems, Wiley India Pvt. Ltd., 5th Edition

Reference Books

1. **Simon Haykin**, *Digital Communication*, Wiley India Pvt. Ltd., 2nd Edition
2. **Bernard Sklar**, *Digital Communications – Fundamentals and Applications*, Pearson Education, 2nd Edition
3. **Lin, Shu & Daniel J. Costello, Jr.**, *Error Control Coding: Fundamentals and Applications*, Pearson, 2nd Edition
4. **Tomasi**, *Electronic Communication Systems*, Pearson Education

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Outcomes with Bloom's Taxonomy Levels

CO No.	Course Outcome Statement	Bloom's Level
CO1	Explain the concepts of information measure, entropy, mutual information, and data compression fundamentals.	L2 – Understand
CO2	Apply and evaluate source coding algorithms (Huffman, Shannon–Fano, LZ) for optimal data representation.	L3/L4 – Apply/Analyze
CO3	Analyze discrete communication channels and compute channel capacity and limits using Shannon's theorems.	L4 – Analyze
CO4	Design and implement linear block codes for error detection and correction using matrix methods.	L5 – Evaluate/Design
CO5	Select and compare error control coding schemes such as cyclic and convolutional codes for reliable communication.	L4/L5 – Analyze/Evaluate

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS602C	**Category: Professional Elective-II**
Course Name: Web Technology	**Semester: 6th**
L-T-P : 3-0-0	**Credit: 3**
Total Lectures: 30	
Prerequisites: Basic programming concepts, familiarity with HTML**,** CSS**,** and JavaScript, basic understanding of internet including client-server architecture, domain, URLs, IP addresses etc.	

Course Objectives:

The aim of this course is to able the students to:

1. Understand different internet technologies.
2. Learn java-specific web services architecture.
3. Develop web applications using framework.

Syllabus:

Module No.	**Description of Topics**	**Contact Hrs.**
1	**Website Basics, HTML 5, CSS 3, Web 2.0:** Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework.	**7**
2	**Client Side Programming:** Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.	**6**

3	**Server Side Programming:** Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.	**5**
4	**PHP and XML:** An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL and XSLT.	**6**
5	**Introduction to Angular and Web Applications Framework:** Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JSReact- Django- UI & UX.	**6**

Course Outcome:

After this course, student will be able to

- Construct a basic website using HTML and Cascading Style Sheets.
- Build dynamic with validation using Java Script objects and by applying different event handling mechanism.
- Develop server side programs using Servlets and JSP.
- Construct simple web pages in PHP and to represent data in XML format.
- Develop interactive web applications.

Text Book, Reference Book, and Special Resources:

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies a Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition,Packet Publishing.
4. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition,1999.
5. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
6. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
7. UttamK.Roy, “Web Technologies”, Oxford University Press, 2011.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS603A	**Category: Professional Elective III**
Course Name : Power Electronics	**Semester : 6th**
L-T-P : 3-0-0	**Credit: 3**
Total Lectures: 36	
Pre-Requisites: In-depth understanding of Analog Electronics Circuit and Circuit Theory and network	

Objectives: The subject aims to provide the student with:

1. To explain working of different solid-state devices.
2. To analyze and comprehend the various operating modes of configurations of converters.
3. To analyze different configurations of Choppers
4. To study and analyze about three phase Inverter's principle of operation
5. To study and analyze about AC Voltage regulators and cycloconverters

Module No.	Description of Topic	Contact Hrs.
1.	Power Semiconductor Devices: Rectifier diodes, fast recovery diode and Schottky barrier diode. Power BJT and power Darlington transistors, Power MOSFET. The thyristor family: SCR, TRIAC, inverter-grade SCR, asymmetric SCR, reverse-conducting thyristor (RCT) and gate turn-off thyristor (GTO). SCR turn-on and turn-off methods. Insulated gate bipolar transistor (IGBT). Common triggering devices and their applications: UJT, DIAC and PUT.	**8**
2.	Converters 1: (a) Rectifiers: Single phase and three phase uncontrolled bridge rectifiers with inductive load / RL load, free-wheeling diodes, Single phase and three phase controlled bridge rectifiers with	**8**

	inductive load / RL load, free- wheeling diodes (b) DC to DC converters (Choppers): principle of step up and step down converters with R / RL load	
3.	Converters 2: (a) DC to AC converters (inverters): Single phase and three phase inverters (b) Cycloconverters: Single phase and three phase circuits, blocked group operation, circulating current mode	**8**
4.	DC line communication: parallel capacitor turns off, resonant turn off (series), impulse communication	**6**
5.	Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS.	**6**

Course Outcomes (CO): The students will be able to –

1. To analyse the operation and performance of uncontrolled rectifiers with different load conditions,
2. To analyse the operation and performance of controlled half wave rectifiers
3. To apply controlled and uncontrolled rectifiers for various application
4. To analyse various chopper circuits

Text Books:

1. P.C. Sen, Power Electronics, TMH, New Delhi
2. M. H. Rashid, Power Electronics, PHI/Pearson Education
3. C. W. Lander, Power Electronics, Mc Graw Hill
4. B. K. Bose, Modern Power Electronics, Jaico

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PE-ECS603B	**Category: Professional Elective-III**
Course Name: Virtual Instrumentation	**Semester: 6**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 42	
Pre-Requisite: Digital Electronics, Object-Oriented Programming, Embedded Systems.	

Objectives: This course is designed to

1. Familiarize the importance of Virtual Instrumentation (VI) and its architecture
2. Provide various operations of DAQ devices used in VI and LabVIEW
3. Provide the basic programming concepts in LabVIEW
4. Familiarize types of I/O module, Data Acquisition System, and Communication Networks (Bus Systems) using the Standard Protocol
5. Impart the knowledge on applications of VI

Module No.	Description of Topics	Contact Hrs
1	**Concept of Virtual Instrumentation (VI):** Introduction of Instrumentation and Measurements, Historical perspective, Need of VI, Advantages of VI, Define VI, Block diagram & Architecture of VI, Data flow techniques, Comparison with conventional programming and Graphical programming.	8
2	**Graphical Programming:** VIs and sub-VIs, Loops (While Loop and For Loop), Charts, Structures (Case, Formula node, and sequence structures), Arrays, Array Functions, Clusters and Graphs, Strings, String Functions, and file I/O.	8
	Data Acquisition in Virtual Instrumentation: Introduction to data acquisition on PC, Sampling fundamentals,	

3	Input/Output techniques and buses, ADC, DAC, Digital I/O, counters and timers, Direct Memory Access, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.	9
4	**Communication Protocols:** RS232, RS 422, RS 485, and USB standards – IEEE 488 standard – ISO OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.	8
5	**Application of Virtual Instrumentation:** Fourier transform, Power spectrum, Correlation, Windowing and filtering tools, Simple temperature indicator, ON/OFF controller, P-I-D controller, CRO emulation, Simulation of a simple second-order system, Generation of HTML page.	9

Textbook and Reference books:

1. Virtual Instrumentation Using LabVIEW, Jerome, 2nd Edition, PHI publication, 2010.
2. "Virtual Instrumentation using LabVIEW" , S. Gupta and J. John, 2nd Edition, Tata McGraw-
Hill Publishing Company Limited, 2017.
3. LabVIEW Graphical Programming, Gary W. Johnson, Richard Jennings, 4th Edition, TMH
4. J. Travis, J. Kring, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun"
, 3rd Edition, Prentice Hall, 2006.
5. R. H. Bishop, "Learning with LabVIEW" , 1st Edition, Pearson Publishing, 2014.
6. B. Mihura, "LabVIEW for Data Acquisition" , Prentice Hall of India, 2013.
7. R. Bitter, T. Mohiuddin, M. Nawrocki, "LabVIEW: Advanced Programming Techniques" ,
CRC Press, 2007.
8. Practical Data Acquisition for Instrumentation and Control Systems, John Park and Steve

Mackay, 2003, Newnes

9. LabVIEW-based advanced instrumentation system, P. Sumathi, 1st Edition, 2007, Springer Science Elsevier.

Course Outcomes:

After completion of this course, students will be able to

CO1: Identify and explain the components of Virtual instrumentation and use them for PC Based Measurement

CO2: Develop programming skills on application development software

CO3: Simulate with LabVIEW software for instrument control, measurement, data acquisition and data handling

CO4: Differentiate between different data acquisition techniques on virtual instrumentation CO5: Implement different controllers and conduct testing using industry standard software CO6: Differentiate between various Industrial network components and protocols

Special Remarks:

The outcomes mentioned above are not limited. Institutes may redefine outcomes based on their program educational objective.

Course Code: PE-ECS603 C	**Category: Professional Elective-III**

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Name: Digital Signal Processing	**Semester: 6**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 41	

Unit	Content	Hrs
1	**Introduction:** **Discrete-time signals:** Concept of signals and systems, Advantages and application of digital signal processing, Analog signal to digital signal conversion, Sampling theorem, Reconstruction of signal, Concept of Discrete –time signal, Representation of discrete time sequences, Classifications of discrete time sequences, Mathematical operations on sequences. **Discrete-time System:** Classifications of Discrete time systems, LTI systems, Representation of Discrete time signal using Impulse response, Concept and properties of linear convolution, Methods of convolution process between two signals by both graphical and tabular form procedure, circular convolution, stability and causality conditions, recursive and non-recursive systems.	6
2	**Z-Transform:** Definition, concept of unit circle (Fourier transformation from z transformation), stability of a system using z transformation, concept of ROC, Z-transformation of finite and infinite sequences and their ROC, z-transformation of standard sequences, properties of z-transform **Inverse Z-transform:** Direct evaluation of inverse Z-transform -Residue theorem, partial fraction method, long division or power series expansion method, convolution process	7
3	**Discrete Time Fourier Transform (DTFT):** Concept of Fourier series of discrete time signals, difference between continuous time and discrete time Fourier series, frequency spectrum of periodic discrete time signals, properties of discrete time Fourier series and its example, definition of DTFT, frequency spectrum of discrete time signal, properties of DTFT,	8

	DTFT of periodic discrete time signals, analysis of discrete time system using DTFT and its frequency response. **Discrete Fourier Transform:** Concept of DFT/IDFT, relation between DFT and IDFT, Properties of DFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations and computation of DFT in matrix form, multiplication of DFTs or concept of circular convolution, computation of circular convolution by graphical and matrix form, relationship between linear convolution and circular convolution, computation of linear convolution from circular convolution, aliasing error.	
4	**Fast Fourier Transform (FFT):** Complexity analysis of direct computation of DFT, Concept of Fast Fourier transformation, Radix-2 computation of FFT using decimation-in-time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations of FFT in one place using both algorithms, bit reversal process, examples for DIT & DIF FFT Butterfly computations.	6
5	**FIR Filter Design:** Basic concepts of IIR and FIR filters, Gibbs Phenomenon, realization of FIR filters using direct, cascade and linear phase realization. Design of linear phase FIR filters, no. of taps, concept of window technique to design FIR filter, Fourier series method of FIR filter designing, different types of window sequences and their spectrum-rectangular, Bartlett, Hamming, Hanning, Blackman and Kaiser windows, Design of FIR filter using window techniques.	6
6	**IIR Filter Design:** Concept of IIR digital filter, recursive and nonrecursive system, realization of IIR filter using Direct Form I**,** Direct Form II**,** Transposed Direct Form**,** Cascade**,** and Parallel forms. Analog to digital domain transformation- impulse invariant method and bilinear transformation and their properties, limitations of bilinear transformation, warping and prewarping, methods to find out the order of IIR filter, mapping of poles and zeroes of filter in analog domain, computation of	8

	filter transfer function in analog domain, digital filter realization techniques, procedure to design Butterworth digital IIR filters.	

Text books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G. Proakis & D.G. Manolakis, Pearson Ed.

2. Digital Signal processing – A Computer Based Approach, S. K. Mitra, TMH Publishing Co.

3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.

Reference books:

1. Digital Signal Processing, A. NagoorKani, TMH Education

2. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).

3. Digital Signal Processing, S. Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.

Course Outcome:

After this course student will be able to

CO1	Describe the different types of signals and their conversion techniques, criterion for stability of a system. (BT-1)
CO2	Solve the different types of mathematical operation on signals. (BT-3)
CO3	Use of different types of transformation method like DFT, FFT, Z-Transform the digital signals. (BT-3)
CO4	Apply different types of IIR and FIR filters and different window techniques like Bartlett, Hamming, Henning, Blackman, and Kaiser windows (BT-3)

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Code: PC-ECS691	**Category: Program core**
Course Name: Industrial Automation Lab	**Semester: 6th**
L-T-P: 0-0-3	**Credit: 1.5**
Total Days: 10	

Course Objectives:

1. To impart comprehensive knowledge of various industrial processes' principles, operations, and characteristics, enabling students to analyze and optimize these processes effectively.
2. To equip students with the understanding and application of advanced control strategies for industrial processes, fostering their ability to design, implement, and evaluate control systems in real-world scenarios for automation purpose.

Module No.	Description of Topics	Contact Hrs.
1	1.Study of flow, level, pressure processes and construction of the PI diagrams in accordance with ISA guidelines / standards.	**3**
2	2. A. Study of a typical Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller. B. Monitoring and control of Pressure Control Loop using DCS. 3. A. Study of a typical Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller. B. Monitoring and control of Flow Control Loop using DCS. 4. A. Study of a typical Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller.	**9**

	B. Monitoring and control of Level Control Loop using DCS.	
3	5. Programming Logic Gates Function in PLC Ladder Logic. 6. Develop/ test ladder program to blink LED/lamp. 7.Develop /Execute a ladder program for the given application using following: - timer, counter, comparison, logical, arithmetic instruction. 8. Develop Ladder Logic for Traffic Light Control System instruction. 9. Study of PLC field device interface modules (AI, AO, DI, DO modules).	**15**
4	Use various functions of SCADA simulation editors to develop simple project.	**3**

Reference Book And Special Resources:

1. Process Control-Principles and application, S. Bhanot, Oxford University press.
2. Principle of Process control, D. Patranabis, TMH.
3. Automatic Process Control, D.P. Eckman, John Wiley.
4. Instrumentation and Process Control, D.C. Sikdar, Khanna Publishing House. Reference books:
5. Process control, P. Harriott, McGraw Hill.
6. Chemical process control, G. Stephanpoulos, PHI.
7. Process control instrumentation technology, C.D. Johnson, PHI
8. Process Control, S.K. Singh, PHI.

9. Instrument Engineers Handbook, B.G. Liptak, Chilton Book Co. Philadelphia

10. Elements of Chemical Process Technology, O.P. Gupta, Khanna Publishing House

Course Outcome:

A	Explain the operation of different types of control actions. (BT LEVEL-1)
B	Describe the Control different process variable (flow, pressure, level) using DCS. (BT LEVEL-2)
C	Create ladder logic diagram for various sequential operations. ((BT LEVEL-3)
D	Develop ladder logic for real time applications of Industrial Automation. (BT LEVEL-6)

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Title: Machine Learning Lab	**Code: PC-ECS692**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 2P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Credit Points: 1	

Laboratory Experiments:	
Decision Tree Learning (ID3 / CART)	
1	Implement a Decision Tree classifier (ID3/CART) using a suitable dataset.
2	Study inductive bias and evaluate the effect of attribute selection measures.
Multilayer Perceptron (MLP) – Backpropagation	
1	Train an MLP using Backpropagation.
2	Experiment with number of hidden layers, number of neurons, learning rate, momentum.
3	Compare training and validation performance.
Deep Neural Networks – Activation Function Study	
1	Implement a deep neural network.
2	Compare Sigmoid, ReLU, and Tanh activation functions.
3	Analyze convergence behaviour and accuracy differences.
Naïve Bayes Classifier for Text Classification	
1	Implement Naïve Bayes using a suitable platform (e.g., Python, WEKA).
2	Perform preprocessing steps: tokenization, stop-word removal, TF-IDF.
EM Algorithm for Clustering	
1	Implement Expectation-Maximization for document clustering.
2	Use the same dataset to implement *k*-Means and compare cluster quality.
***k*-Nearest Neighbours (kNN) Classification**	
1	Implement kNN for text or numerical classification.
2	Study the effect of varying *k* on performance.
3	Compare with Naïve Bayes classifier.

Support Vector Machine (SVM) for Image Recognition	
1	Implement SVM for handwritten digit classification using MNIST dataset.
2	Compare kernel choices (linear, RBF, polynomial).
Ensemble Learning – Heterogeneous Ensemble	
1	Build an ensemble using three base classifiers: Naïve Bayes, ANN, SVM.
2	Compare ensemble performance with each individual classifier.

COURSE OUTCOMES (COs)

On completion of the course, students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
CO1	Make use of datasets to implement machine learning algorithms.	Make use of	K3
CO2	Implement ML concepts and algorithms in a suitable programming language (Python).	Implement	K3
CO3	Evaluate the performance of machine learning models using appropriate metrics.	Evaluate	K5
CO4	Compare the performance of different machine learning algorithms.	Compare	K5
CO5	Analyze the effect of model parameters (e.g., *k* in kNN, activation functions, hidden layers) on performance.	Analyze	K4

Reference Books:

1. A. Géron, *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow*, O'Reilly Media, 2019.
2. A. Müller, S. Guido, *Introduction to Machine Learning with Python*, O'Reilly Media, 2016.
3. T. M. Mitchell, *Machine Learning*, McGraw-Hill, 1997.
4. I. Goodfellow, Y. Bengio, A. Courville, *Deep Learning*, MIT Press, 2016.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Title: Internet of Things Lab	**Code: PC-ECS693**
Type of Course: Practical	Course Designation: Compulsory
Semester: 6th	Contact Hours: 3P/week
Continuous Assessment: 40 Marks	Final Exam: 60 Marks
Credit Points: 1.5	

Laboratory Experiments:	
1	Familiarization with Arduino IDE and writing a program using Arduino IDE or LED blinking.
2	Study of LM35 temperature sensors and write programs to monitor them with Arduino with serial monitor.
3	Study of DHT-11 sensors and write programs to monitor them with Arduino with Private cloud/Public cloud.
4	Study of Ultrasonic sensors and write programs to monitor them with Arduino with ThingSpeak.
5	Study of Soil sensor and write programs to monitor them with Arduino with Thing Speak.
6	Study of PIR sensor and write programs to monitor them with Arduino with Thing Speak.
7	Setup Raspbian on the Raspberry Pi and write a program to blink an LED using Python.
8	Interfacing digital sensors and relay boards with Raspberry Pi

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details
CO1	Understand the concept of Internet of Things
CO2	Implement interfacing of various sensors with Arduino/Raspberry Pi.
CO3	Demonstrate the ability to transmit data wirelessly between different devices.
CO4	Show an ability to upload/download sensor data on cloud and server

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of B.Tech in Electronics and Computer Science
Effective from academic session 2023-2024

Course Title: Mini Project	**Code: ECS 681**
Type of Course: Sessional	**Course Designation: Compulsory**
Semester: 6th	
Credit Points: 2	

Broad area	
	Based on the Hardware and software skillset of the students the Mini project may be allocated to the students. The broad area of the project may be as follows: a) Embedded system application b) Building of IoT applications c) Preparation of UI interface d) ML applications and analytics e) Biomedical signal/image processing f) Cutting edge devices modeling simulations g) Utility software development The scopes mentioned above are not limited. Institutes may allocate other projects based on their program educational objective. The institution may allow the 7^{th} and 8^{th} semester Major Project work based on 6^{th} semester Mini Project.