TECHNO INDIA UNIVERSITY
WEST BENGAL

Department of Electronics and Communication Engineering

Eight Semester

Program: B.Tech in ECE	**Year, Semester: 4TH year, 8TH sem**
Course Title: CAREER ADVANCEMENT & SKILL DEVELOPMENT-VIII	**SubjectCode:TIU-UEC-S402**
Contact Hours/Week: 0-0-2 (L-T-P)	**Credit: 1**

COURSE OUTCOME:

CO-1	Understand the recruitment process and expectations from a recruiter's perspective to better navigate interviews.	**K2**
CO-2	Apply effective communication strategies and interview techniques to perform confidently in job interviews.	**K3**
CO-3	Identify and analyze job roles relevant to the Electronics and Communication Engineering domain and prepare for specific technical assessments.	**K4**
CO-4	Create professional resumes, cover letters, and statements of purpose tailored to industry and academic requirements.	**K6**
CO-5	Demonstrate an understanding of workplace expectations and professional behavior for a successful transition into corporate life.	**K2**
CO-6	Develop personal strategies for continuous growth and success within a corporate environment through effective goal-setting, adaptability, and upskilling.	**K6**

COURSE CONTENT:

MODULE 1:	i). Interview process from recruiter's perspective, ii). The approach the candidates should adopt during the interview	**6 Hours**
MODULE 2:	i). Discussion on job roles for ECE, ii). Discussion of interview/Written test questions for specific roles	**6 Hours**

MODULE 3:	i). Resume writing, ii). Cover Letter writing, iii). statement of purpose	**6 Hours**
MODULE 4:	: i). expectation from a newly joined employee in a corporate organization, ii). How to succeed in corporate environment.	**6 Hours**
TOTAL LECTURES		**24Hours**

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Nanoelectronics	**Subject Code:** Elective V
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

COB	Objectives
1.	To introduce students to the principles of quantum mechanics, nanomaterials, and nanoscale electronic devices.
2.	To study the working principles, fabrication techniques, and applications of nanoelectronic components like quantum dots, carbon nanotubes, and single-electron transistors.
3.	To equip students with the knowledge and skills required to analyze, design, and develop nanotechnology-based electronic systems for future advancements.

COURSE OUTCOME:

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

COs	Outcomes	Level
1.	Demonstrate knowledge of quantum mechanics, nanomaterials, and the fundamental concepts of nanoelectronics.	K2
2.	Explain the operation of nanoscale transistors, quantum dots, carbon nanotubes, and single-electron devices.	K2
3.	Understand and apply various nanofabrication methods such as lithography, self-assembly, and molecular electronics.	K3
4.	Analyze the behavior of nanoelectronic components in terms of speed, power consumption, and miniaturization advantages.	K3

5.	Study the role of nanotechnology in futuristic applications such as spintronics, molecular electronics, and neuromorphic computing.	K4
6.	Develop problem-solving and research skills to work on cutting-edge advancements in nanoelectronic systems.	K4

COURSE CONTENT:

MODULE 1:		**12 Hours**
Introduction to nanotechnology, mesostructures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.		
MODULE 2:		**12 Hours**
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).		
MODULE 3:		**15 Hours**
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation		
TOTAL LECTURES		**39Hours**

Books:

Text Books:

1. **Hanson, G. W.** (2008). *Fundamentals of Nanoelectronics*. Pearson Education.
2. **Lundstrom, M.** (2006). *Nanoelectronics: The Fundamentals*. World Scientific Publishing.
3. **Streetman, B. G., & Banerjee, S.** (2015). *Solid State Electronic Devices* (7th ed.). Pearson Education.
4. **Waser, R.** (2003). *Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices*. Wiley-VCH.
5. **Datta, S.** (2005). *Quantum Transport: Atom to Transistor*. Cambridge University Press.
6. **Ferry, D. K., &Goodnick, S. M.** (2009). *Transport in Nanostructures*. Cambridge University Press

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.

Course Title: Biomedical Electronics	**Subject Code:TIU-UEC-E410B**
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

COB	Objectives
1.	To introduce students to the fundamentals of human physiology and bioelectric signals relevant to biomedical instrumentation.
2.	To study various transducers used for measuring physiological parameters such as displacement, velocity, force, temperature, and bio-potentials.
3.	To understand the working principles of bio-electrodes and amplifiers used in ECG, EMG, EEG, and other medical signal acquisitions.
4.	To familiarize students with methods for measuring blood pressure, temperature, and flow, as well as advanced imaging techniques like X-ray, ultrasound, and nuclear imaging.
5.	To explore the working of life-supporting devices such as pacemakers, defibrillators, artificial kidneys, and assistive devices for the handicapped.
6.	To develop awareness of electrical safety, patient protection, and regulatory standards in biomedical device design and application.

COURSE OUTCOME :

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

COs	Outcomes	Level
1.	Demonstrate knowledge of basic human physiology and the characteristics of bioelectric signals used in medical instrumentation.	K2
2.	Explain the working principles and applications of various biomedical transducers used to measure physiological parameters.	K2
3.	Analyze the function and importance of bio-electrodes and amplifiers in recording signals like ECG, EMG, and EEG.	K3
4.	Demonstrate the ability to measure blood pressure, temperature, and flow, and understand the principles of impedance plethysmography.	K3
5.	Explain the operation of medical imaging techniques (Ultrasound, X-ray, Nuclear Imaging) and life-supporting prosthetic devices like pacemakers and artificial kidneys.	K4
6.	Identify potential safety hazards in biomedical devices and apply safety standards and regulations to ensure patient protection.	K4

COURSE CONTENT:

MODULE 1:	Fundamentals of Biomedical Electronics	15Hours

- **Introduction to Biomedical Electronics**
  - Overview of human physiology relevant to biomedical instrumentation.
  - Bioelectric signals and their characteristics.
  - Role of biomedical electronics in healthcare.
- **Biomedical Transducers**
  - Working principles and applications of transducers used in physiological measurements:
    - Displacement, Velocity, and Force Sensors
    - Acceleration and Flow Sensors
    - Temperature Sensors
    - Potential Measurement Transducers
    - Dissolved Ions and Gas Sensors
- **Bio-Electrodes and Biopotential Amplifiers**
  - Types of bio-electrodes (Surface, Needle, and Microelectrodes).
  - Biopotential amplifiers for biomedical signals:
    - Electrocardiogram (ECG)
    - Electromyogram (EMG)
    - Electroencephalogram (EEG)
  - Noise reduction and signal conditioning.

MODULE 2:	Physiological Measurements and Biomedical Imaging	14 Hours

- **Measurement of Physiological Parameters**
  - Blood Temperature Measurement
  - Blood Pressure Measurement (Direct & Indirect Methods)
  - Blood Flow Measurement (Doppler Ultrasound, Electromagnetic Flowmeters)
  - Impedance Plethysmography: Principles and Applications
- **Biomedical Imaging Techniques**
  - Ultrasonic Imaging: Working principle, transducers, and medical applications.
  - X-ray Imaging: Radiography, fluoroscopy, and contrast techniques.
  - Nuclear Imaging:
    - Positron Emission Tomography (PET)
    - Single-Photon Emission Computed Tomography (SPECT)

MODULE 3:	Biomedical Devices, Prostheses, and Safety Aspects	12 Hours

• **Prosthetic Devices and Biomedical Aids**
  ○ Pacemakers: Types, working principle, and applications.
  ○ Defibrillators: Types, function, and emergency usage.
  ○ Heart-Lung Machine: Working principle and applications in surgery.
  ○ Artificial Kidney (Dialysis Machine): Hemodialysis and peritoneal dialysis.
  ○ Aids for the Handicapped: Hearing aids, artificial limbs, mobility assistance devices.
• **Safety Aspects in Biomedical Instrumentation**
  ○ Electrical safety standards in medical devices.
  ○ Patient safety measures and guidelines.
  ○ Hazards and precautions while using biomedical equipment.

TOTAL LECTURES	**41Hours**

Books:

Text Books:

1. **Khandpur, R. S.** (2003). *Handbook of Biomedical Instrumentation* (2nd ed.). Tata McGraw-Hill.
2. **Cromwell, L., Weibell, F. J., & Pfeiffer, E. A.** (1980). *Biomedical Instrumentation and Measurements* (2nd ed.). Prentice Hall.
3. **John G. Webster (Ed.).** (2009). *Medical Instrumentation: Application and Design* (4th ed.). Wiley.
4. **Joseph J. Carr & John M. Brown.** (2001). *Introduction to Biomedical Equipment Technology* (4th ed.). Pearson Education.
5. **Arumugam, M.** (2007). *Biomedical Instrumentation*. Anuradha Publications.
6. **Rangaraj M. Rangayyan.** (2015). *Biomedical Signal Analysis: A Case-Study Approach* (2nd ed.). Wiley-IEEE Press.

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Wavelets	**Subject Code:** Elective V
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

COB	Objectives

1.	To introduce students to the mathematical foundations and basic principles of wavelets, including time-frequency analysis.
2.	To explore different types of wavelet transforms (CWT, DWT, MRA) and their applications in signal and image processing.
3.	To enable students to implement wavelet algorithms for data compression, noise reduction, and feature extraction using computational tools.

COURSE OUTCOME :

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

COs	Outcomes	Level
1.	Explain the need for time-frequency analysis and the fundamental concepts of wavelet transforms, including Short-Time Fourier Transform (STFT) and Wigner-Ville Transform.	K2
2.	Demonstrate an understanding of Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT) and their role in time-frequency representation.	K2
3.	Study the construction of wavelets, wave packet analysis, and the concept of multiresolution analysis for signal decomposition.	K3
4.	Implement multirate signal processing techniques and analyze filter bank theory for efficient signal transformation.	K3
5.	Apply wavelet-based methods for signal denoising, image compression, video processing, and transient detection.	K4
6.	Evaluate the role of wavelets in multi-tone digital communication and explore emerging applications in modern engineering fields.	K4

COURSE CONTENT :

MODULE 1:	**Fundamentals of Time-Frequency Analysis and Wavelets**	**13 Hours**
• Introduction to time-frequency analysis (2) • The how, what, and why of wavelets (2) • Short-Time Fourier Transform (STFT) and its limitations (3) • Wigner-Ville Transform (2) • Continuous-Time Wavelet Transform (CWT) (2) • Discrete Wavelet Transform (DWT) – Basics (2).		
MODULE 2:	**Wavelet Construction and Multiresolution Analysis (MRA)**	**13 Hours**

• Tiling of the time-frequency plane and wave packet analysis (3) • Construction of wavelets (3) • Multiresolution Analysis (MRA) – Concept and Implementation (3) • Introduction to Frames and Bi-Orthogonal Wavelets (2) • Multirate Signal Processing (2)		
MODULE 3:	**Applications of Wavelets in Engineering**	**13 Hours**
• Filter Bank Theory and its significance (3) • Application of wavelet theory in signal denoising (3) • Image and Video Compression using Wavelets (3) • Multi-Tone Digital Communication and Wavelets (2) • Transient Detection using Wavelets (2)		
TOTAL LECTURES		**39Hours**

Books:
Text Books:

1. **Mallat, S.** – *A Wavelet Tour of Signal Processing: The Sparse Way* (3rd Edition), Elsevier, 2009.
2. **Daubechies, I.** – *Ten Lectures on Wavelets*, Society for Industrial and Applied Mathematics (SIAM), 1992.
3. **Strang, G., & Nguyen, T.** – *Wavelets and Filter Banks*, Wellesley-Cambridge Press, 1996.
4. **Graps, A.** – *An Introduction to Wavelets*, IEEE Computational Science and Engineering, 1995.
5. **Vetterli, M., Kovacevic, J., & Goyal, V. K.** – *Foundations of Signal Processing*, Cambridge University Press, 2014.
6. **Misiti, M., Misiti, Y., Oppenheim, G., & Poggi, J. M.** – *Wavelet Toolbox for Use with MATLAB*, The MathWorks Inc., 1996.

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Satellite Communications	**Subject Code:TIU-UEC-E410**
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

COB	Objectives
1.	To introduce students to the basic principles of satellite orbits, link design, and communication systems.
2.	To equip students with knowledge of satellite link budget calculations, signal propagation effects, and multiple access techniques like FDMA, TDMA, and CDMA.

3.	To familiarize students with modern satellite applications, including remote sensing, GPS, and broadband satellite networks, along with advancements in satellite communication technology.

COURSE OUTCOME:

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

COs	Outcomes	Level
1.	Describe the principles of satellite orbits, launch mechanisms, and satellite subsystems.	K2
2.	Perform satellite link budget calculations, considering path loss, atmospheric effects, and system design constraints.	K2
3.	Explain and compare multiple access techniques such as FDMA, TDMA, and CDMA for efficient bandwidth utilization.	K3
4.	Analyze applications of satellites in broadcasting, remote sensing, GPS, and global communication networks.	K3
5.	Investigate advancements in satellite technologies, including high-throughput satellites, LEO & MEO constellations, and inter-satellite links.	K4
6.	Develop basic models for satellite link design and evaluate system performance using simulation tools.	K4

COURSE CONTENT:

MODULE 1:		**6Hours**
Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.		
MODULE 2:		**6 Hours**
Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.		
MODULE 3:		**6Hours**
Satellite subsystems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication subsystem, power sub-systems etc.		
MODULE 4:		**6Hours**
Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.		

MODULE 5:		**6Hours**
Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.		
MODULE 6:		**6Hours**
Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.		
TOTAL LECTURES		**42Hours**

Books:

Text Books:

1. **Pratt, T., Bostian, C. W., & Allnutt, J.** – *Satellite Communications* (2nd Edition), Wiley, 2003.
2. **Roddy, D.** – *Satellite Communications* (4th Edition), McGraw Hill Education, 2006.
3. **Richharia, M., & Westbrook, L.** – *Satellite Systems for Personal Applications: Concepts and Technology*, Wiley, 2010.
4. **Pritchard, W. L., Sacks, H. G., & Nelson, J.** – *Satellite Communications Systems Engineering*, Pearson, 1992.
5. **Maral, G., & Bousquet, M.** – *Satellite Communications Systems: Systems, Techniques and Technology* (5th Edition), Wiley, 2009.
6. **Elbert, B. R.** – *Introduction to Satellite Communication* (3rd Edition), Artech House, 2008.

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Value and Ethics	**Subject Code:**TIU-UEC-E40#
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

COB	Objectives
1.	To help students comprehend the core concepts of morality, values, and ethical principles in personal and professional life.

2.	To enable students to analyze ethical dilemmas and make responsible decisions by applying ethical theories and frameworks.
3.	To encourage students to act with honesty, fairness, and social responsibility in various real-life situations, contributing to a just and ethical society.

COURSE OUTCOME :

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

COs	Outcomes	Level
1.	Demonstrate knowledge of fundamental ethical principles, values, and moral reasoning.	K2
2.	Analyze and resolve ethical dilemmas in personal, professional, and social contexts using ethical theories.	K2
3.	Exhibit honesty, accountability, and integrity in decision-making and actions.	K3
4.	Evaluate ethical issues from multiple perspectives and make well-informed decisions.	K3
5.	Recognize ethical responsibilities in professional environments and adhere to ethical standards.	K4
6.	Contribute to society by making ethical choices that support sustainability, human rights, and social justice.	K4

COURSE CONTENT :

MODULE 1:	**Introduction to Values and Ethics**	**10 Hours**
• **Definitions and Concepts**: Values, ethics, morality, and their importance in personal and professional life • **Types of Values**: Personal, cultural, social, professional values • **Theories of Ethics**: Deontology, utilitarianism, virtue ethics, and care ethics • **Distinction Between Ethics and Law**: Legal vs. ethical behavior; role of societal norms • **Case Studies**: Examples illustrating ethical dilemmas and their impact.		
MODULE 2:	**Personal Ethics and Moral Development**	**10 Hours**

• **Moral Development**: Theories of moral development (Kohlberg's stages, Carol Gilligan's perspective) • **Self-Reflection and Awareness**: Personal values, beliefs, and biases; their role in ethical decision-making • **Building Integrity and Character**: Role of honesty, empathy, and respect in personal life • **Ethical Decision-Making Models**: Frameworks for making ethical decisions in challenging situations • **Practical Exercises**: Activities to explore personal values and ethics.

MODULE 3:	**Social Responsibility and Corporate Ethics**	**10 Hours**
• **Corporate Social Responsibility (CSR)**: Definition, importance, and forms of CSR • **Sustainable Development**: Ethics in sustainability, environmental ethics, and impact on society • **Ethics in Business**: Fair trade, transparency, stakeholder theory • **Corporate Governance**: Concepts of transparency, accountability, and fairness in corporate operations • **Case Studies**: Examples of ethical and unethical corporate behavior and their social impact.		
TOTAL LECTURES		**30Hours**

Books:

Text Books:

1. **Gaur, R. R., Sangal, R., &Bagaria, G. P.** (2010). *A Foundation Course in Human Values and Professional Ethics*. Excel Books.
2. **Mandal, S. K.** (2012). *Ethics in Engineering and Corporate Governance*. McGraw Hill Education.
3. **Govindarajan, M., Natarajan, S., & Senthil Kumar, V.** (2013). *Professional Ethics and Human Values*. PHI Learning Pvt. Ltd.
4. **Fleddermann, C. B.** (2011). *Engineering Ethics* (4th ed.). Pearson Education.
5. **Dobrin, A.** (2002). *Ethics for Everyone: How to Improve Your Moral Intelligence*. John Wiley & Sons.

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Program: B. Tech. in ECE	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Project II	**Subject Code:**TIU-UEC-P496
Contact Hours/Week: 0–0–8 (L–T–P)	**Credit:** 8

Course Objectives:

- To develop problem-solving skills through research and practical implementation.
- To enhance technical knowledge in real-world applications.
- To improve project management, teamwork, and communication skills.

- To document and present the project findings effectively.

COURSE OUTCOME :

CO-1	Identify and define an engineering problem through literature survey and industry requirements.	K2
CO-2	Formulate project objectives, methodology, and work plan.	K3
CO-3	Design, develop, and implement innovative solutions using appropriate tools and techniques.	K3
CO-4	Analyze and evaluate project outcomes using experimental results, simulations, or prototypes.	K4
CO-5	Prepare technical documentation, research reports, and project presentations.	K3
CO-6	Demonstrate teamwork, ethical practices, and project management skills.	K2

COURSE CONTENT :

Phase 1: Project Proposal & Planning
Phase 2: System Design & Development
Phase 3: Implementation & Experimentation
Phase 4: Report Writing & Final Presentation