EMERGING TRENDS IN ELECTRONICS   **Course Code : 316337**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ ET/ EX/ IE/ TE**
Semester	**: Sixth**
Course Title	**: EMERGING TRENDS IN ELECTRONICS**
Course Code	**: 316337**

I. RATIONALE

The rapid advancement in electronics is driven by innovations in computing, communication, automation ,technologies such as AI, ML, IoT, quantum computing. Modern manufacturing techniques, including surface mount technology and automated assembly improves production quality and sustainability. Next-generation telecom networks enable faster and more reliable data exchange. This course will help student to acquire knowledge in Emerging trends in electronics.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences: "Acquire knowledge of Emerging Trends in Electronics fields."

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select the appropriate processor for a specific type of application.
- CO2 - Suggest the relevant techniques in the electronic system manufacturing process.
- CO3 - Suggest a different telecom network for the given application.
- CO4 - Connect IoT Devices to cloud platforms for data storage and analysis.
- CO5 - Interpret drone component functions, government guidelines, and application areas.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH	Credits	Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
316337	EMERGING TRENDS IN ELECTRONICS	ETE	DSC	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

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Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the architecture of given specific modern processors. TLO 1.2 Compare the salient features of ESP32 and ESP8266. TLO 1.3 Establish the relationship between Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL). TLO 1.4 Differentiate between Single Agent and Multi-Agent with examples. TLO 1.5 Compare classical computing with quantum computing with a suitable example.	**Unit - I Advanced Processors and Technology** 1.1 Graphical Processing Unit (GPU): Introduction, features, Overview of processor architecture, superscalar concept, advantages and applications 1.2 ESP 32: features, pin out, Interfacing board, Comparison with ESP 8266 and Arduino Uno, simple programs and applications 1.3 Artificial Intelligence/Machine Learning [AI/ML]: Definitions, applications and advantages of AI, Definition and Types of ML(Machine Learning) such as Supervised, Unsupervised and Reinforcement. Relationship between DL (Deep Learning), ML and AI. Agents in AI: Single Agent and Multi-Agent 1.4 Quantum Computing: Introduction, qubit (quantum bit), comparison of classical versus Quantum systems, Applications of Quantum Computing	Video Demonstrations Presentations Collaborative learning Flipped Classroom

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Compare SMD technology over traditional (through-hole components) technology in terms of size, performance, and manufacturing efficiency. TLO 2.2 Explain the Human-Machine Interface (HMI) concept in smart manufacturing. TLO 2.3 Analyze the role of robotics in smart manufacturing. TLO 2.4 Suggest modern machines of the given specifications for electronic system assembly and manufacturing. TLO 2.5 Evaluate the significance of environmental standards such as EPEAT and RoHS in electronic manufacturing and their impact on sustainability. TLO 2.6 Explain the concept of Open Source Assembly and Testing.	**Unit - II Smart Manufacturing Processes and Tools** 2.1 Surface Mount Technology (SMT): Introduction, characteristics, advantages, applications 2.2 HMI and Robotics in Smart Manufacturing Process : Introduction, functionality, types, benefits, Robotics in Smart Manufacturing: Functionality, benefits, types of Robots: Articulated Robots, Selective Compliance Articulated Robot Arm (SCARA),Autonomous Mobile Robots (AMRs), Cobots. 2.3 Modern Electronic Assembly and Manufacturing Process: Introduction, classification of machines used in electronic assembly, role, features, and specifications of different machines. Pick-and-Place Machine: Working principle and operation, specifications, Automatic Component Insertion Machine: Functionality and working mechanism, advantages over manual component placement. Reflow soldering Method :Overview of soldering techniques in PCB assembly, working principle, stages of the reflow soldering process (Preheating, Soaking, Reflow, Cooling) 2.4 Environmental standards for electronic manufacturing such as: Electronic Product Environmental Assessment Tool (EPEAT) and Restriction of Hazardous Substances (RoHS) standards 2.5 Introduction to Open Source Assembly and Testing (OSAT)	Video Demonstrations Presentations Site/Industry Visit Flipped Classroom

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the function of the given network component. TLO 3.2 Interpret the spectrum used in the present Telecom sector. TLO 3.3 Compare the mobile generations. TLO 3.4 Explain the Multi Protocol Label Switching in NGN core. TLO 3.5 Analyze Fiber to the Home (FTTH) technology, its architecture, and components of Optical Line Termination (OLT) and Optical Network Unit (ONU). TLO 3.6 Assess the effect of Optical Transport Network(OTN) on data transmission.	**Unit - III Next Generation Telecom Network** 3.1 NGN architecture: Features, Functional block diagram, Network components: Media Gateway, Media Gateway Controller, and Application Server 3.2 NGN Wireless Technology: Telecom network Spectrum: Licensed and unlicensed radio bands, Mobile network evolution (3G to 5.5G) and comparative features 3.3 NGN Core: Concepts, features and advantages 3.4 Fiber to the Home (FTTH): Features, architecture and components: Optical Line Termination (OLT) ,Optical Network Unit (ONU) 3.5 Synchronous Digital Hierarchy (SDH), Optical Transport Network(OTN): Introduction, features and applications	Lecture Using Chalk-Board Presentations Video Demonstrations Site/Industry Visit Flipped Classroom
4	TLO 4.1 Describe different IoT architectures and their role in data processing. TLO 4.2 Compare different cloud service providers based on their capabilities and applications. TLO 4.3 Explain how IoT enhances efficiency and automation in different industrial sectors. TLO 4.4 Explain the applications and benefits of Industry 5.0 in smart manufacturing. TLO 4.5 Differentiate between Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), along with their applications across various domains.	**Unit - IV IIoT and Immersive Technologies** 4.1 Internet of Things (IoT): Introduction, functions of Cyber physical system components, architectures, IoT sensor to cloud data routes 4.2 Introduction to Cloud computing, Cloud service providers (AWS, AZURE, GOOGLE Cloud, ThingSpeak), ThingSpeak: Features, collecting and retrieving data from ThingSpeak, applications 4.3 Applications of IoT in Industries: Automotive, Discrete Manufacturing, Telecom and Agro- industries 4.4 Industry 5.0 and Industrial IoT (IIoT): Introduction, evolution from I1.0 to I5.0, applications and benefits of I5.0, Compare I3.0, I4.0 and I5.0, Architecture of I5.0 4.5 Introduction to Immersive Technologies: Overview of Virtual reality (VR), Augmented Reality (AR), Mixed reality (MR) and Extended reality (XR)	Lecture Using Chalk-Board Hands-on Collaborative learning Flipped Classroom

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Classify drones based on structural configuration. TLO 5.2 Describe the functions of different drone components. TLO 5.3 Interpret relevant government drone regulations. TLO 5.4 Identify the utility of drones in the given application.	**Unit - V Drone Systems and Applications** 5.1 Overview of Drone Technologies, Types of Drones: Multi-Rotor, Single-Rotor, Fixed-Wing, Hybrid 5.2 Hardware Components of drones: Frame, Propellers, Motors, Electronic speed controller, Flight controllers, Gimbal, Radio transmitter and receiver, GPS, Camera, Power distribution panel, Landing gears, Sensors: accelerometer, gyroscope and magnetometers, Batteries: lithium polymer and lithium-ion 5.3 Regulations and safety considerations: Category of zones: Red zone, Inner yellow zone, Outer yellow zone, Green zone, DGCA rules and regulations for registration, operation and pilot license of drones 5.4 Drone Applications: Photography, Logistics, Medical, Agriculture, Defence, Surveillance, Disaster management	Presentations Video Demonstrations Model Demonstration Flipped Classroom

VI.   LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII.   SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop a simple ESP32-based sensor data logging system and explain the interfacing process.
- Implement a basic IoT-based LED control program using ESP32 and document the code.
- Develop a smart home automation system using an ESP32 microcontroller, allowing users to control home appliances (lights, fans, etc.) via a smartphone using Wi-Fi and a web-based dashboard or mobile app.
- Collect temperature and humidity data using DHT11/DHT22 sensors and send it to an IoT platform like ThingSpeak.
- Use networking tools like Cisco Packet Tracer to simulate MPLS functionality.
- Detect gas leaks using an MQ-6 sensor and send alerts to users via SMS or an IoT platform.
- Use an ultrasonic sensor in dustbins to detect the garbage level and send notifications to the waste collection department.
- Assemble a simple quadcopter using a frame, motors, electronic speed controllers, and a flight controller.

Student Activity

- Prepare a report on Open Source Assembly and Testing (OSAT).
- Prepare a report on automatic electronic components assembly machine.
- Prepare a PowerPoint presentation on upcoming 5G technology.
- Prepare a report on quantum bits (qubits) and their role in quantum processing using diagrams.
- Prepare a PowerPoint presentation on various Government of India schemes related to drones.
- Prepare a report on the application area of different types of drones.
- Prepare a report on the eligibility criteria for Remote Pilot License and the DGCA approved Remote Pilot Training Organizations near your area.
- Create a PowerPoint presentation on GPU architecture and its role in AI and gaming applications.
- Prepare a PowerPoint presentation on the functions of various sensors and actuators used in drones.
- Prepare internet-based reports on real-world applications of AI and ML in different industries.

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Assignment

- Compare the working of superscalar processors with real-world examples.
- Explore anti-drone technology.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Advanced Processors and Technology	CO1	10	2	6	8	16
2	II	Smart Manufacturing Processes and Tools	CO2	9	4	4	6	14
3	III	Next Generation Telecom Network	CO3	9	4	4	6	14
4	IV	IIoT and Immersive Technologies	CO4	8	2	4	6	12
5	V	Drone Systems and Applications	CO5	9	4	4	6	14
Grand Total				**45**	**16**	**22**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as Microproject/assignment/activities. (60 % weightage to process and 40 % to product)

Summative Assessment (Assessment of Learning)

- Online MCQ type Exam

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	2	3	3	2	3			
CO2	2	1	2	2	2	1	2			
CO3	2	1	2	2	3	1	2			
CO4	2	2	2	3	2	2	3			
CO5	1	1	2	2	2	1	2			

Legends :- High:03, Medium:02, Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII.   SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Sudhir Warier	The ABC of Fiber Optics Communication	Artech House Publishers ISBN: 978-1630814144
2	David Hanes, Salgueiro Gonzalo, et al.	IoT Fundamentals: Networking Technologies, Protocols and use cases for Internet of Things	Pearson Education ISBN: 978-9386873743
3	Saroj Kaushik	Artificial Intelligence	Cengage Learning India Pvt. Ltd. ISBN: 978-9355730428
4	Dharna Nar, Radhika Kotecha	Drone Technology for Beginners- Learn | Build | Fly Drones	Drone School India and Ane Books Pvt Ltd. ISBN: 978-8197222184
5	Garvit Pandya	Basics of Unmanned Aerial Vehicles : Time to start working on Drone Technology	Notion Press Media Pvt Ltd. ISBN: 978-1637453865
6	Bhushan Patil, Manisha Vohra	Introduction to Extended Reality (XR) Technologies	John Wiley & Sons Inc. ISBN: 978-1119857228
7	Guy A. Boy	The Handbook of Human-Machine Interaction A Human-Centered Design Approach	CRC Press ISBN: 9780367111939
8	S K. Saha	Introduction to Robotics	Tata McGraw-Hill Education ISBN: 978-9355326461

XIII .   LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.rohsguide.com/rohs-faq.htm	RoHS Guide
2	http://www.trai.gov.in/	TRAI official website for Next Generation Network

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Sr.No	Link / Portal	Description
3	https://www.tec.gov.in/	Technical Enginnering Centre Technical Reports.
4	https://cfdflowengineering.com/working-principle-and-compone nts-of-drone/	Introduction about drone components
5	https://www.twi-global.com/technical-knowledge/faqs/industry -5-0	Industry 5.0
6	https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.20 12-200609-S!!PDF-E&type=items	Next Generation Networks – Frameworks and functional architecture mode
7	https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/Invent oryList/headerblock/drones/RPAS.html	DGCA Drone rules
8	https://circuitdigest.com/microcontroller-projects/programmi ng-esp32-with-arduino-ide	Programming ESP32 Board with Arduino IDE
9	https://cloud.google.com/learn/artificial-intelligence-vs-ma chine-learning	Artificial intelligence (AI) vs. machine learning (ML)
10	https://www.plugxr.com/augmented-reality/ar-vr-mr-xr/	AR vs VR vs MR vs XR – What is the difference?
11	https://www.electronicsandyou.com/electronics-assembly-equip ment-guide.html	Electronic system assembly and machines
12	https://esp32io.com/	ESP 32 Tutorials
13	https://randomnerdtutorials.com/getting-started-with-esp32/	Getting Started with the ESP32 Development Board
14	https://learnesp32.com/videos/course-introduction/course-int roduction	Learn ESP32

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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