THE MAHATMA GANDHI UNIVERSITY UNDERGRADUATE PROGRAMMES (HONOURS) SYLLABUS

MGU-UGP (Honours)

(2024 Admission Onwards)

Faculty: Technology and Applied Sciences

BoS: Electronics

Programme: Bachelor of Science (Honours) Electronics with Computer Technology

Mahatma Gandhi University
Priyadarshini Hills Kottayam – 686560,
Kerala, India

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Preface

According to the guidelines outlined in the Mahatma Gandhi University Four Year Undergraduate Programme (FYUGP) Regulations for the year 2024, a dedicated ExpertCommittee was tasked with the responsibility of structuring the curriculum for the program Electronics with Computer Technology. The envisioned outcome-based program and its corresponding course contents are structured for implementation from the academic year 2024-2025.

To ensure thoroughness and relevance, the committee examined the curricula of various universities and national institutes. Valuable input provided by stakeholders was duly incorporated during the structuring process. Following the directives of the FYUGP Implementation Committee, Mahatma Gandhi University, a comprehensive five-day curriculum workshop was convened in November 2023. This workshop brought together a master trainer appointed by the university, esteemed members of the expert committee, and relevant faculty members. A dedicated FYUGP Syllabus Scrutiny and Vetting Committee was constituted. This committee evaluated the syllabus and proposed invaluable modifications to enhance its efficacy

The Undergraduate (Honours) program in Electronics is an eight-semester full-time programme. With advancements in technology and increasing demand for electronic productsglobally, there is a growing need for skilled professionals in this field. Our program is designedto equip students with the knowledge and skills necessary to excel in various roles within the electronics industry. Our curriculum covers a wide range of topics, including electronic circuitdesign, embedded systems, digital signal processing, communication systems, semiconductor technology, IoT, AI in electronics, mobile and computer technologies. Through hands-on projects and practical experience, students will develop proficiency in designing, testing, and troubleshooting electronic systems.

Graduates of this program will have numerous career opportunities available to them, including roles in electronic product design, research and development, manufacturing, quality assurance, project management, and technical sales. Additionally, the program emphasizes entrepreneurial skills, preparing students to launch their own electronic startups or consultancyfirms. Whether students aspire to work for leading electronics companies, contribute to cutting- edge research or become entrepreneurs in the field, our program provides the foundation and expertise needed to succeed in the dynamic and rapidly evolving field of electronics.

Board of Studies

Sl. No:	Name	Position
1	Ms. Mary Jaya V J Associate Professor and Head Department of Electronics Assumption College, Changanassery	Chairperson
2	Dr. Suresh S Associate Professor Department of Electronics Sree Ayyappa College, Eramallikkara Chengannur	Member
3	Dr. Prakash K C Associate Professor Department of Electronics Sree Ayyappa College, Eramallikkara Chengannur	Member
4	Dr. Reji A P Associate Professor Department of Electronics N.S.S College, Rajakumari, Idukki Dt.	Member
5	Dr. Saritha M Associate Professor Department of Electronics N.S.S College, Rajakumari, Idukki Dt.	Member
6	Dr. Anju P mathews Assistant Professor Department of Electronics St. Joseph's College, Moolamattom	Member
7	Dr. Rekha T K Associate Professor Department of Electronics N.S.S College, Rajakumari, Idukki Dt.	Member
8	Dr. Premlal P D Associate Professor Department of Electronics N.S.S College, Rajakumari, Idukki Dt.	Member
9	Dr. Vinu T P Assistant Professor Department of Physics N.S.S Hindu College, Changanassery	Member

10	Dr. Sindhu Jones Assistant Professor Department of Physics Baselius College, Kottayam	Member
11	Dr. Mary Joseph Associate Professor Department of Electronics M.A College of Engineering, Kothamangalam	Member

Vetting Committee Members

01	Ms Mary Jaya V J Associate Professor, Assumption College, Changanassery	Chairperson BoS
02	Dr. Manjesh Mathew Assistant Professor St Thomas College,Pala	Trainer
03	Dr. Nobert Thomas Pallath Associate Professor WMO Arts and Science College, Muttil P O Wayanad-673122	External Expert
04	Mr. Abhilash V Pandiankal Assistant Professor, Department of Electronics, Mar Augusthinose College, Ramapuram.	Course Parameter Expert
05	Dr. Vijo M Joy Assistant Professor Department of Electronics Aquinas College Edakochi	Internal Expert
06	Mr. Lijo Thomas Assistant Professor, Department of Electronics, Union Christian College, Aluva.	Internal Expert
07	Dr. Reji A P Associate Professor NSS College, Rajakumary	Member BoS

Syllabus Index

Name of the Major: **Electronics with Computer Technology**

L — Lecture, T — Tutorial, P — Practical/Practicum, O — Others

SEMESTER 1

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG1DSCECT100	Emerging Electronics	DSC A	4	5	3		2	
MG1DSCECT101	Computer Fundamentals and Basics of PC Hardware (Electronics Minor*)	DSC B	4	5	3		2	
MG1MDCECT100	Home Appliances and Troubleshooting	MDC	3	4	2		2	
MG1MDCECT101	Foundation of AI automation							
MG1MDCECT102	Data Analytics							
MG1MDCECT103	Audio Electronics							
MG1MDCECT104	Creative Robotics							

***Open Minor**

SEMESTER 2

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG2DSCECT100	Essential Concepts in Digital Electronics	DSC A	4	5	3		2	
MG2DSCECT101	Data Communication (Electronics Minor*)	DSC B	4	5	3		2	
MG2MDCECT100	IoT based smart farming	MDC	3	4	2		2	
MG2MDCECT101	Python for Electronics							
MG2MDCECT102	Office Enhancement Tools							

***Open Minor**

SEMESTER 3

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG3DSCECT200	Analog Electronics	DSC A	4	5	3		2	
MG3DSCECT201	Programming in C	DSC A	4	5	3		2	
MG3DSEECT200	Introduction to embedded system (Embedded System Specialization)	DSE	4	4	4			
MG3DSEECT201	Introduction to Mechatronics (Robotics and Automation Specialization)							
MG3DSEECT202	Sensors and Actuators in Industry Automation (Industrial Electronics Specialization)							
MG3DSEECT203	Intelligent Automation (AI and Machine Learning Specialization)							
MG3DSEECT204	Smart Sensors with IoT (IoT & Cloud Computing Specialization)							
MG3DSEECT205	Microcontroller Programming (Electronic systems and Programming Specialization) (For Physics Major Only)	DSE	4	5	3		2	
MG3DSCECT202	Internet of Things *(Minor for Others)*	DSC B	4	5	3		2	
MG3DSCECT203	Integrated Electronics *(Minor for Others)*							
MG3DSCECT204	Digital Fundamentals (Electronics Minor*)	DSC B	4	5	3		2	
MG3MDCECT200	Electronics Incubation	MDC	3	3	3			
MG3MDCECT201	Robotics with Integrated AI							
MG3MDCECT202	Electronics for sustainable development							
MG3VACECT200	Green Electronics	VAC	3	3	3			

***Open Minor**

SEMESTER 4

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG4DSCECT200	Python Programming	DSC A (Any one)	4	5	3		2	
MG4DSCECT201	AI for Smart Electronics		4	5	3		2	
MG4DSCECT202	IoT System Design	DSC A	4	5	3		2	
MG4DSEECT200	ARM based Embedded System (Embedded System Specialization)	DSE	4	4	4			
MG4DSEECT201	3D Printing and its Applications (Industrial Electronics Specialization)							
MG4DSEECT202	Data Science for AI (AI and Machine Learning Specialization)							
MG4DSEECT203	Single Board Computers for IoT (IoT & Cloud Computing Specialization)							
MG4DSEECT204	Robotics (Robotics and Automation Specialization)							
MG4DSEECT205	Continuous and Discrete System (Electronic systems and Programming Specialization) (For Physics Major Only)	DSE	4	5	3		2	
MG4DSCECT203	Wireless Technology *(Minor for Others)*	DSC C	4	5	3		2	
MG4DSCECT204	Computer Organization (Electronics Minor*)	DSC C	4	5	3		2	
MG4SECECT200	Circuit Simulation and PCB design	SEC	3	3	3			
MG4SECECT201	PCB Design and 3D Printing							
MG4SECECT202	Solar Technology and Applications							
MG4SECECT203	User Interface and User Experience for App Development							
MG4SECECT204	Multimedia Electronics							
MG4VACECT200	Environmental monitoring using sensors	VAC	3	3	3			
MG4INTECT200	Internship	INT	2					

***Open Minor**

SEMESTER 5

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG5DSCECT300	Digital Design using Verilog	DSC	4	5	3		2	
MG5DSCECT301	Artificial Intelligence and Machine Learning	DSC	4	5	3		2	
MG5DSEECT300	Cloud Computing (IoT & Cloud Computing Specialization)	DSE	4	4	4			
MG5DSEECT301	Computer Forensic							
MG5DSEECT302	Instrumentation (Industrial Electronics Specialization)		4	4	4			
MG5DSEECT303	Microwave Electronics							
MG5DSEECT304	Smart Industry (Robotics and Automation Specialization)		4	4	4			
MG5DSEECT305	Computer Assembling and Maintenance							
MG5DSEECT306	Industrial Automation (Embedded System Specialization)		4	4	4			
MG5DSEECT307	Cyber Security							
MG5DSEECT308	Advanced Python (AI and Machine Learning Specialization)		4	4	4			
MG5DSEECT309	Analog and Digital Communication							
MG5DSEECT310	Robotics and Industrial Automation (Electronic systems and Programming Specialization) (For Physics Major Only)	DSE	4	5	3		2	
MG5SECECT300	Office Automation and Content Creation	SEC	3	3	3			
MG5SECECT301	Mobile app Development							
MG5SECECT302	Low Voltage system for building management							

SEMESTER 6

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours /	Hour Distribution/ week			
					L	T	P	O
MG6DSCECT300	Cloud Computing and IoT	DSC	4	5	3		2	
MG6DSCECT301	Computer Networking	DSC	4	5	3		2	
MG6DSEECT300	Natural Language Processing (AI and Machine Learning Specialization)	DSE	4	4	4			
MG6DSEECT301	Optoelectronics							
MG6DSEECT302	Biometric Authentication System (Robotics and Automation Specialization)		4	4	4			
MG6DSEECT303	Embedded Computer Vision							
MG6DSEECT304	Automotive Electronics (Embedded System Specialization)		4	4	4			
MG6DSEECT305	Wireless Communication							
MG6DSEECT306	Edge Computing (IoT & Cloud Computing Specialization)		4	4	4			
MG6DSEECT307	Secure Communication							
MG6DSEECT308	Product System Design and Branding for Start-up (Industrial Electronics Specialization)		4	4	4			
MG6DSEECT309	Power Electronics							
MG6DSEECT310	Advanced Power System Design (Electronic systems and Programming Specialization) (For Physics Major Only)		4	4	4			
MG6SECECT300	Linux Programming	SEC	3	4	2		2	
MG6SECECT301	Basics of Android app Development							
MG6SECECT302	CCTV Installation and Maintenance							
MG6VACECT300	Environmental Awareness and Human Rights	VAC	3	3	3			

SEMESTER 7

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG7DCCECT400	Pytorch for Deep Learning	DCC	4	5	3		2	
MG7DCEECT400	Laser and its Applications	DCE	4	4	4			
MG7DCEECT401	Wireless network security	DCE	4	4	4			
MG7DCEECT402	Research Methodology and Statistical Analysis	DCE	4	4	4			
MG7DCEECT403	Deep Learning							
MG7DCEECT404	MEMS and NEMS	DCE	4	4	4			
MG7DCEECT405	RFID and Applications	DCE	4	4	4			

SEMESTER 8

Course Code	Title of the Course	Type of Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution/ week			
					L	T	P	O
MG8DCCECT400	Digital Signal Processing	DCC	4	5	3		2	
MG8DCCECT401	Natural Language Processing with Transformer in Python	DCC	4	5	3		2	
MG8DCEECT400	Java Programming	DCE	4	5	3		2	
MG8DCEECT401	Digital Image Processing	DCE	4	5	3		2	
MG8DCEECT402	Machine Learning from Scratch	DCE	4	5	3		2	
MG8PRJECT400	Research project/Dissertation		12					

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	**Emerging Electronics**					
Type of Course	**DSC A**					
Course Code	MG1DSCECT100					
Course Level	**100-199**					
Course Summary	This course provides foundational understanding in applications of electronics in a technology-driven world fostering critical thinking, problem-solving skills, and ethical considerations. Learners gain hands-on experience through the laboratory sessions for practical applications in the field.					
Semester	1	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Illustrate the concept, significance and impact of electronics	U	1,2
2	Develop the knowledge acquired from component familiarization in analyzing different applications of electronic components.	A	1,2
3	Describe the fundamentals of Special purpose electronic devices and sensors	U	1,2
4	Apply fundamental electronic principles to demonstrate circuit projects and analyze the results	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No:
	1.1	Introduction to Electronics: Definition of electronics, Signals-AC and DC	1	1
	1.2	Importance of Electronic Technologies in Modern Society: Role of electronics in different fields- Internet of Things, Artificial intelligence, Augmented reality, Virtual reality, Robotics, Biometrics.(concept only)	5	1

1	1.3	Passive components: Resistors: Types of resistors, color coding and standard resistor values, resistors in series and parallel. Capacitors: Types of Capacitors, capacitor coding, standard capacitor values. Basic concepts of Inductors and Transformers	4	1
	1.4	Semiconductor components: Introduction to P and N Type Semiconductor, PN Junction Diodes, symbol, Diode Specifications (Forward & Reverse Current, PIV, Operating frequency), Zener diode – symbol - Voltage regulator circuit (Load).	5	1
2	2.1	Active components: BJT- Types (PNP, NPN) - Symbol and terminal identification, Principle of operation	4	2
	2.2	FET-Symbol and Terminal identification, Working Principle MOSFET-Symbol and Terminal identification	4	2
	2.3	Light Emitting Diodes -Working principle. Integrated Circuits (SSI,MSI,VLSI,ULSI)	1	2
	2.4	Applications: Applications- Rectifier-Half wave and Centre Tapped rectifier, Clipper (positive and negative), Clamper (positive, and negative). Transistor applications - switch and amplifier (Block diagram)	6	2
3	3.1	Working principle and applications of LDR, Infrared sensors	4	3
	3.2	Working principle of Thermistor and their applications	4	3
	3.3	Switches - SPST, SPDT, DPST & DPDT Switches. Concept of relays - Mechanical Relay and solid state relays	5	3
	3.4	Short circuit Protection devices - Working principle of fuse, MCB, polyfuse (resettable)	2	3
4	4.1	**Tools, Components and Lab equipment familiarization:** Breadboard, Nose Plier, Wire Cutter, screwdriver set, connectors and insulation materials. Passive and Active Components, Multimeter, CRO, Function generator, Power Supply, Soldering Practice.	4	4
	4.2	**Simple Experiments (Any 4)** Diode Characteristics, Zener Diode Characteristics, LED Characteristics, Rectifier, Clipper, Clamper. **Compulsory Experiment** Familiarization of Domestic wiring (Wiring colour code and Selection of wire gauge), earthing, Switch board wiring, Staircase wiring	10	4
	4.3	**Projects (Any 5)** LED Bulb assembling, LED Star, Light-Activated LED Circuit, Fire alarm circuit using photodiode, Clap Switch, Simple water level indicator using	8	4

		BC547 transistor Contactless power indicator, Rain detector. Making of electrical extension box **(mandatory)**		
	4.4	**Mini Project Development Using Arduino (Any 1)** Introduction to wokwi online simulator and Arduino IDE. LED flashing and chasing circuit. Automatic night light with LDR and Relay. PIR motion sensor-based burglar alarm. LPG Gas leak detector using MQ2 sensor and Arduino.	8	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. End Semester Examination 1. Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report **c.** Demonstration

References

1. Mehta, V. K. Principles of Electronics. S. Chand Publishing.
2. Sedha R.S. (2022). A Textbook of Applied Electronics. S. Chand Publishing.

Suggested Readings

1. Navas. K.A (2018). Electronics Lab Manual. PHI Learning Pvt. Ltd.
2. B L Theraja. (2007). Basic Electronics. S. Chand Publishing.
3. Floyd, T. L., & Pearson. (2018). Electronic devices: conventional current version. Pearson Education Limited.
4. Boylestad, R. L. (2015, July 2). Introductory Circuit Analysis, Global Edition. Pearson Higher Ed.

5. Bhargava, N. N., D. C. Kulshreshtha, and S. C. Gupta. Basic Electronics and Linear Circuits. Jaypee University of Information Technology, Solan, HP, 2003.
6. Satheesh Kumar, Electrical Wiring: An Introduction, 2nd ed.

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Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Computer Fundamentals and Basics of PC Hardware					
Type of Course	DSC B					
Course Code	MG1DSCECT101					
Course Level	**100-199**					
Course Summary and Justification	This course covers the evolution, classification, and fundamental components of computers, exploring input and output devices, memory types, assembly procedures, and providing a comprehensive understanding of computer hardware. Students will gain practical insights into computer systems, preparing them for advanced studies in computer science.					
Semester	1	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Demonstrate understanding of computer fundamentals	U	1
2	Describe computer hardware components and their respective roles in system functionality.	U	1,2
3	Compare SSD/HDD, GPU, CPU, memory, VR/AR, green computing, future trends	An	1,2
4	Designing and assembling PCs, OS installation, troubleshooting, networking, BIOS/UEFI, benchmarking, security	C	1,2,3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No:
1	1.1	Overview of Computing: Evolution and History, Components of a Computer System: CPU, Memory, Input/ Output Devices	5	1
	1.2	Operating Systems: Types, Functions, and Features	2	1

	1.3	Data Representation: Binary, Hexadecimal, ASCII	3	1
	1.4	Software vs Hardware: Understanding the Difference, Introduction to Networking: LAN, WAN, Internet	5	1
2	2.1	Motherboard and CPU: Architecture, Socket Types, and Compatibility, Memory (RAM): Types, Speed, Capacity	4	2
	2.2	Upgrading, Storage Devices: HDD, SSD, Flash Drives - Characteristics and Differences	3	2
	2.3	Input Devices: Keyboard, Mouse, Touchpad, and Other Peripheral Devices, Output Devices: Monitor, Printer, Speaker - Types and Functions	4	2
	2.4	Power Supply Unit (PSU) and Cooling Systems: Importance and Components, Understanding Ports and Expansion Slots: USB, HDMI, PCI, PCIe	4	2
3	3.1	Solid State Drives (SSD) vs Hard Disk Drives (HDD): Advantages and Disadvantages, Graphics Processing Unit (GPU): Integrated vs Dedicated Graphics Cards	3	3
	3.2	Latest CPU Architectures: Multi-Core Processors, Cache, and Clock Speed, Emerging Trends in Memory Technology: DDR4, DDR5, and Beyond	4	3
	3.3	Introduction to Virtual Reality (VR) and Augmented Reality (AR) Hardware Requirements	3	3
	3.4	Green Computing: Energy-Efficient Components and Practices, Future of PC Hardware: Quantum Computing, Neuromorphic Computing, and Beyond	5	3
4	4.1	• Assembling a PC: Step-by-Step Guide to Building a Computer • Installing Operating Systems: Windows, Linux, macOS - Hands-On Installation • Troubleshooting Common Hardware Issues: Diagnosing and Fixing Problems • Basic Networking Setup: Configuring LAN, Wi-Fi, and Internet Connection • Introduction to BIOS/UEFI: Understanding Firmware and Basic Configuration • Benchmarking and Performance Testing: Tools and Techniques • Security Best Practices: Antivirus, Firewall, Data Encryption	30	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Use of ICT tools in conjunction with traditional classroom teaching methods, Interactive sessions • Class discussions and Lab exercises
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **Theory: - 25 Marks**

	Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study
	A. End Semester Examination 1. Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report **c.** Demonstration

REFERENCES

1. John Smith (2023). Computer Fundamentals and PC Hardware: A Comprehensive Guide (1st Edition). TechBooks Publishing.

SUGGESTED READINGS

1. Randal E. Bryant and David R. O'Hallaron (2016). Computer Systems: A Programmer's Perspective (3rd Edition). Pearson Education.
2. Scott Mueller (2017). Upgrading and Repairing PCs (22nd Edition). Que Publishing.
3. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne (2018). Operating System Concepts (10th Edition). John Wiley & Sons.

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Programme						
Course Name	Home Appliances and Troubleshooting					
Type of Course	MDC					
Course Code	MG1MDCECT100					
Course Level	**100-199**					
Course Summary	This course aims to build an ability to identify the root causes of problems associated with consumer electronics and find the right solution for it. This involves a systematic approach to identifying, analyzing and solving problems with hands-on training approach and also inspires the students to explore opportunities for self-employment					
Semester	**1**	**Credits**			**3**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Describe the basic concept of electricity and electrical safety	U	1,2
2	Explain the tools and equipment for troubleshooting	U	1,2,10
3	Develop practical skill for troubleshooting	C	1,2,10
4	Develop ability to interpret technical documentation, diagrams relevant to electronics and electrical equipment maintenance	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No:
1	1.1	Concept of Voltage, Current, Resistance, Power and its measurement, Single phase vs three-phase system, Earthing procedure, Testing of line faults	5	1
	1.2	Wiring Colour code for domestic and industry, selection of proper wire gauge, Cabling accessories, cable management and wiring harness, wire puller, Familiarization of FUSE, MCB, RCCB,ELCB	5	1
	1.3	Basic Electrical safety rules, Equipment and component level inspection, Overload and short circuit identification	3	1

	1.4	Prevention of fire, First aid and basic awareness on CPR procedure	2	1
2	2.1	Knowledge of basic tools - screwdriver set, wire cutter, wire stripper, piler, tweezers, allen keys, opening piler	3	2
	2.2	Power tools - Hammer, driller, hack saw blade, jig saw machine, chisels, bench vice, center punch, mallet, try square, wrenches, scribers, spanners, electric screwdriver	6	2
	2.3	Electrical Measurement tools:- Voltmeter, Ammeter, Multimeter (Digital and Analog), Clamp meter	2	2
	2.4	Checking of Fuse, Resistor, Potentiometer, Capacitor, Inductor, Transformer, Diode, BJT and MOSFET with digital multimeter	4	2
3	3.1	Basic soldering tools - soldering iron, lead, soldering paste. Desoldering tools - desoldering pump, desoldering wick. Common PCB soldering and desoldering practice	7	3
	3.2	Fault finding procedure for low power home appliances - Power supply unit of LCD/LED TV, Home Theatre, LED Bulbs, FAN	7	3
	3.3	Fault finding procedure for high power home appliances - Mixer Grinder, Iron Box, Water Heater	8	3,4
	3.4	Preventive maintenance of electronics and electrical equipments - dry solder prevention, cleaning of PCB, protective coating, shielding and proper earthing	8	3,4
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester Examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. Thyagarajan, T. Engineering Basics: Electrical, Electronics and Computer Engineering. New Age International, 2007.
2. Raffiel Ken,The basics of testing electronic components

Suggested Readings

1. Dr. Shirish Bhagwat Patil, Dr ,Dr. Shailesh Shivram D Dr. Vimal Sagar Electronics Components and Testing,

2. Powell, Richard F. Testing Active and Passive Electronic Components. Routledge, 1987.
3. Khandpur, R. Troubleshooting electronic equipment. McGraw-Hill, Inc., 2006.
4. Bali, S. P. Consumer Electronics. Pearson Education India, 2007.
5. Sinclair, Ian Robertson, and John Dunton. Electronic and Electrical Servicing: Consumer and commercial electronics. Routledge, 2007.
6. Linsley, Trevor. Electronic servicing and repairs. Routledge, 2014.
7. JJohn Cadick, P. E., et al. Electrical safety handbook. McGraw-Hill Education, 2012.

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Programme	
Course Name	Foundation of AI Automation
Type of Course	MDC
Course Code	MG1MDCECT101
Course Level	**100-199**
Course Summary & Justification	This course provides learners with a comprehensive understanding of intelligent systems, applications of AI, hands-on utilization of AI tools, and the ability to critically assess the opportunities, challenges, and ethical considerations in the field. Through a multidisciplinary approach, the course cultivates analytical reasoning, communication skills, and social responsibility, preparing learners to contribute ethically and effectively in evolving landscape of AI technologies.

Semester	1	**Credits**		3		**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Explain the fundamentals of AI, its history and diverse applications	U	1,2
2	Apply AI techniques to real world problems	A	1,2
3	Evaluate and analyze ethical concerns related to AI systems	E	1,2,10
4	Design and develop a project based on AI	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	History and Evolution of AI, Human brain working, Biological neuron, Introduction to AI. Types of AI: Narrow AI, General AI, Generative AI. Machine Learning and Neural Networks	3	1
	1.2	History and Evolution of AI, Human brain working, Biological neuron, Introduction to AI. Types of AI: Narrow AI, General AI, Generative AI. Machine Learning and Neural Networks	3	1
	1.3	Types of AI: Narrow AI, General AI, Generative AI. Machine Learning and Neural Networks	4	1

	1.4	AI Applications**:** Healthcare, Finance, Entertainment, Transportation	4	2
2	2.1	Language Processing and Multimedia Content Creation, Office Automation, Criteria for Selecting the Right AI Tools	4	2
	2.2	Introduction to ChatGPT, Common Rules and Regulations, Creating Effective Prompts with ChatGPT, Program Code Generation with ChatGPT	3	2
	2.3	Generating Unique Images with Playground AI, DALL-E, and Midjourny Tool , Demonstrating How to Fine-Tune Parameters in Image Editing Tools (DALL-E and Midjourny), Evaluating the Outputs Generated by AI Applications	5	2
	2.4	Machine Learning Techniques for AI: Supervised Learning, Unsupervised Learning, and Reinforcement Learning Ethical Considerations in AI: Societal Impact, Biases, and Consequences Ethical Implications of AI in Social Media Platforms Ethical Decision-Making in AI Applications: Role of Developers, Policymakers, and Users for Ensuring Ethical Considerations, Privacy, Security, Accountability, and Responsibility	8	3
3	3.1	**Practical Training on Latest AI Tools** 1. Introduce students to a variety of contemporary AI tools used in industry and research. (Google Colab, scikit-learn). 2. Provide step-by-step instructions for installing and setting up the selected AI tools. Discuss compatibility, system requirements, and potential challenges during the installation process. 3. Conduct hands-on exercises covering basic operations within the chosen tools. This may include loading datasets, implementing simple algorithms, and visualizing results.	5	3,4
	3.2	**Familiarize common machine learning tasks(Case study only)** 1. Classification: Image Recognition: Showcase a classification example, such as building an image recognition model to classify images into different categories. 2. Regression: House Price Prediction: Walk through a regression example, such as predicting house prices based on features like square footage, number of bedrooms, and location.	10	4

		3. Clustering: Customer Segmentation: Demonstrate clustering by segmenting customers based on purchasing behavior, using a retail dataset.		
	3.3	An AI based project or case study based on specific major disciplines of each student.	15	5
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester Examination 1.Written Test (35 marks) Time :1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. Russell, S., & Norvig, P. (2016). Artificial Intelligence: A Modern Approach (3rd ed.). Prentice Hall.
2. Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems. O'Reilly Media.

Suggested Readings

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
2. Aurélien Géron ,Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (O'Reilly Media, 2019).
3. Floridi, L., & Sanders, J. W. (2004). On the morality of artificial agents. Minds and Machines, 14(3), 349-379.
4. Bryson, J. J. (2018). Patiency is not a virtue: The design of intelligent systems and systems of ethics. Ethics and Information Technology, 20(1), 15-26.
5. Chollet, F. (2018). Deep Learning with Python. Manning Publications.
6. Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer.
7. Create Accurate Models, and Work Projects End-To-End. Machine Learning Mastery.
8. Yao, Mariya, Adelyn Zhou, and Marlene Jia. Applied artificial intelligence: A handbook for business leaders. Topbots Inc., 2018

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Programme						
Course Name	Data Analytics					
Type of Course	MDC					
Course Code	MG1MDCECT102					
Course Level	**100-199**					
Course Summary and Justification	Data analytics is relevant across a wide range of industries, contributing to improved decision-making, operational efficiency, and innovation. As technology continues to advance, the importance of data analytics is likely to grow, shaping the way businesses and organizations operate in the future.					
Semester	1	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites	``					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate Basics of Data Analytics	U	1,2
2	Apply Data collection and manipulation	A	1,2
3	Apply Tools and techniques for data analytics	A	1,2
4	Develop Application fields and future trends	C	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	An introduction to data analytics and its history	2	1
	1.2	Need for data analytics in modern society	3	1
	1.3	Types of data and its significance	3	1
	1.4	Introduction to excel, importing and exporting functions	4	2
2	2.1	Techniques used for data collection	4	2
	2.2	Data collection and pre-processing, data cleaning and extraction	5	2
	2.3	Conditional Formatting and Important Functions in data analytics	5	2
	2.4	Data visualization techniques – different types of charts and plots	5	2
	3.1	Practical MS Excel tools and functions – data sorting, conditional formatting, formulas, Navigation in excel	3	3
	3.2	Slicer function in excel, statistical analysis and data visualization in excel with interactive charts and plots, pivot table	4	3

3	3.3	Introduction to Google forms – data collection with Google form, linking with Google sheets, data validation techniques	4	3
	3.4	Probability distributions, Hypothesis testing, Confidence intervals, Regression analysis	4	3
	3.5	Data analytics in business, industry and social media, add industry	4	4
	3.6	Weather prediction, cricket score prediction, disease prediction with data analytics	3	4
	3.7	Integrating data mining and AI with data analytics	2	4
	3.8	Mini project- Making of a survey form and interactive chart generation with Google tools	6	4
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester Examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019.
2. Simon, Jinjer L. "Excel Data Analysis: Your Visual Blueprint for Creating and Analyzing Data, Charts, and PivotTables." Visual, 2003.

Suggested Readings

1. Matt Taddy Data Science for Business: Excel for Data Analysis
2. Provost, Foster, and Tom Fawcett. "Data science for business." Mach. Learn (2011).
3. Peng, Roger D., and Elizabeth Matsui. The art of data science: A guide for anyone who works with data. Skybrude Consulting, LLC, 2015.

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Programme						
Course Name	Audio Electronics					
Type of Course	MDC					
Course Code	MG1MDCECT103					
Course Level	**100-199**					
Course Summary and Justification	This course aims to provide learners with a comprehensive understanding of the fundamentals of acoustics, electronics for audio systems, microphone and loudspeaker technologies, and audio processing equipment. It equips learners with technical knowledge but also cultivates problem-solving skills and a multidisciplinary approach.					
Semester	1	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the Basics of Acoustics for Audio Systems	U	1,2
2	Create awareness in Electronic Audio Systems	U	1,2
3	Describe microphone and Loudspeaker Technologies and hands on practice	S	1,2
4	Develop an audio Processing Equipment	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Understanding Basics of Acoustics for Audio Systems: Characteristics and properties of sound	2	1
	1.2	Concepts of amplitude, frequency, pitch, Interval, octaves and harmonics	3	1
	1.3	Properties of the Human ear, frequency response	3	1
	1.4	Concepts of resonance and music scale	3	1
2	2.1	Electronics for Audio Systems: Amplifier- concept of pre amplifier and power amplifier (Block diagram approach only)	4	2

	2.2	Introduction to digital amplifier	2	2
	2.3	Types of audio connectors RCA, TRS, XLR, MIDI, SPDIF, HDMI	5	2
	2.4	Balanced vs unbalanced cable wiring. Block Diagram of mixer.	3	2
3	3.1	Mastery in Audio Transducers & Processing Equipments: Characteristics of microphone Moving coil microphone, ribbon microphone, Bluetooth wireless mic	5	3
	3.2	Characteristics of loudspeaker- types of loudspeakers - moving coil, Horn, Piezoelectric loudspeakers, vibration speaker, headphones, Subwoofer and crossover networks	5	3
	3.3	Concept of tone control circuit, graphic equalizer and basic DJ mixer console	4	3,4
	3.4	Making of simple microphone amplifier, Audio bell with NE555 IC, Making of simple audio mixer circuit using UA741	4	3,4
	3.5	Making of UM66 Melody Circuit Making of electronic piano with NE555	4	3,4
4		Teachers Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester Examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Viva , Lab report , Demonstration Time : 1½ hours

References

1. Audio and video systems RG Gupta 7th edition
2. Sinclair, Ian Robertson. "Audio electronics reference book." (1989).

Suggested Readings

1. Alten, Stanley R. "Audio in media." (2011).
2. Owsinski, Bobby. The recording engineer's handbook. Hal Leonard Corporation, 2005.
3. Stewart, Peter, and Ray Alexander. Broadcast journalism: Techniques of radio and television news. Routledge, 2016.

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Programme						
Course Name	Creative Robotics					
Type of Course	MDC					
Course Code	MG1MDCECT104					
Course Level	**100-199**					
Course Summary & Justification	This course aims to empower learners with practical skills in prototyping and constructing robotic systems. Through engaging hands-on projects, the course cultivates critical thinking and analytical reasoning, aiming to spark a genuine interest in robotics. By the end of the course, learners will have developed practical proficiency in implementing robotic projects.					
Semester	1	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Explain the Arduino ecosystem	U	1,2
2	Compare various sensors and actuators	U	1,2
3	Expertise in prototyping and building simple robotic systems	A	1,10
4	Demonstrate robotics experiments	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No:
1	1.1	Overview of Arduino Microcontroller board, Pin configuration and Ports, Basics of Arduino Programming environment, Void setup and Void loop	3	1
	1.2	Learn how to download and install the desktop-based Arduino IDE.	4	1
	1.3	Basic functions: Pin Mode, Digital Write, Analog Write and PWM, Voltage divider, Analog Voltage Read, Serial monitor(Serial. begin, Serial. print functions)	4	2
	1.4	FOR loop and WHILE loop: syntax and uses. Connecting an LED to Arduino, Initialization, Adding delay in programs. Repeated blinking of LED using FOR and WHILE loops	4	1
	2.1	Overview of ultrasonic sensor, Distance measurement using ultrasonic sensor	4	2

2	2.2	Introduction to IR flame sensor and MQ2 smoke sensor. Familiarization of LDR	4	2
	2.3	Familiarize with servo motor, Working of a simple robotic arm using servo motor	4	2
	2.4	Familiarize with geared DC motor, DC motor driver module	3	2
		Practical (any 4)		
	3.1	Write a program to turn ON and OFF LED		1
	3.2	Write a program to create an SOS signal using LED		1
	3.3	Controlling of LED with LDR		1,2
	3.4	Set up a Light controlled buzzer operation system		1,2
	3.5	Design a parking indicator using ultrasonic sensor		1,2,4
	3.6	Create a smoke and fire alarm system		1,2,4
	3.7	Assemble a robocar using geared DC motors and a driver module		1,2,3
	3.8	Design a line follower robot project		1,2,3
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester Examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. Monk, Simon, and Michael McCabe. Programming Arduino: getting started with sketches. Vol. 176. New York: McGraw-Hill Education, 2016.
2. Boxall, John. Arduino workshop: A Hands-On introduction with 65 projects. No starch press, 2021.

Suggested Reading

3. Richardd. Klafter," Robotic Engineering"'phi,1996
4. Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu:
5. Arduino Cookbook by Michael Margolis, O'reilly

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Department	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Essential Concepts in Digital Electronics					
Type of Course	DSC A					
Course Code	MG2DSCECT100					
Course Level	**100-199**					
Course Summary and Justification	This course provides a foundational understanding of key principles and practices in digital electronics. Learners will explore fundamental topics, including number systems, Boolean algebra, logic gates, combinational and sequential circuits, and practical applications using simulation tools and hands-on projects.					
Semester	**2**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites	**Open to all plus two level streams**					

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domain*	PO No:
1	Solve arithmetic of basic number systems	A	1,2
2	Explain logic gates, basics of boolean algebra and implement logic gates from boolean expressions	U	1,2
3	Design combinational logic circuits and understand Arduino board	C	1,2,10
4	Develop logic circuits and simulating different projects using trainer kit and simulating software	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Overview of Digital Electronics, Definition and significance of digital electronics, Distinction between digital and analog signals	4	1
	1.2	Introduction to Number Systems, Positional and non-positional number systems, Binary, decimal, octal, and hexadecimal systems overview	4	1

	1.3	Binary Arithmetic, Rules for binary addition, subtraction, multiplication, and division, 1's and 2's complements, conversion techniques	4	1
	1.4	Signed Numbers: Sign-Magnitude, 1's complement, and 2's complement forms, signed arithmetic	3	1
2	2.1	Boolean Algebra, Commutative, associative and distributive laws, De-Morgan's Theorem	4	2
	2.2	Introduction to Logic Gates, AND, OR, NOT, NAND, NOR, XOR, XNOR, Truth tables and logic gate symbols	3	2
	2.3	Boolean expressions and its simplification, Standard forms of Boolean Expressions: SOP and POS, K-Map simplification	5	2
	2.4	Building logic circuits from Boolean expressions, Universal property of NAND and NOR gates	3	2
3	3.1	Combinational logic circuits, Half Adders and Full Adders, Multiplexers and De-Multiplexers (4 to 1 & 1 to 4)	4	3
	3.2	Sequential logic circuits, SR Latch and SR Flip-flop, JK and D Flip-flops	5	3
	3.3	(Detail Study not required) Registers: Serial in Serial out Shift registers , Serial in Parallel out Shift Registers	2	3
	3.4	(Detail Study not required) Counters : Ring counter, 2 bit Synchronous counter	4	3
4	4.1	**Lab Experiment using Trainer Kit:** (Any Seven) ● Familiarization of Logic Gates ● SR Flip Flop ● JK Flip-flops ● D Flip-flops ● Half Adder ● Full adder ● Multiplexer ● Demultiplexer ● Serial in Serial out Shift registers ● Serial in Parallel out Shift Registers ● 2 bit synchronous counter Familiarize simulation tool.(Tinkercard/ any open source) Introduction, Setting up, Component and tool familiarization, Building and verifying AND, OR, NOT gates, Building a binary-to-decimal converter.(Not Mandatory)	30	4
5		**Teacher specific content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)**

	3. Theory: - 25 Marks Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **4. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. End Semester Examination 1. Written Test (50 marks)- 1½ hours (Duration of Examination) d. MCQ - 10 Marks (Answer all - 10x1=10 Marks) e. Short answer questions (4 out of 6 questions)-4x5=20 marks f. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 1½ hours (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.

Suggested Readings

1. Malvino, A. P., & Leach, D. P. (2017). "Digital Principles and Applications." Tata McGraw-Hill Education.
2. .Kumar, A. (2019). "Digital Electronics: Principles, Devices and Applications." Pearson.
3. Digital Design and Computer Architecture" by David Harris and Sarah L. Harris

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Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Data Communication					
Type of Course	DSC B					
Course Code	MG2DSCECT101					
Course Level	**100-199**					
Course Summary	This course covers fundamental concepts in data communication and networks, including data representation, signal conversion, modulation techniques, switching, and practical applications, providing students with a strong foundation in the field.					
Semester	2	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Describe the foundational elements of data communications	U	1
2	Illustrate guided and unguided media used in data transmission	U	1
3	Illustrate understanding of digital communication and modulation techniques	U	1
4	Develop practical skills in signal quality measurement, delta modulation, and applying modulation techniques using microcontrollers in a lab	A	2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	1.1	Data Communications , Components, Data Representation, Data Flow-Simplex, Half Duplex, Full Duplex	5	1
	1.2	Analog and Digital Data, Analog and Digital Signals, Periodic and Non-periodic, composite Signals, Bandwidth, Bit Rate	5	1

	1.3	Transmission Impairment, Attenuation, Distortion, Noise, Noiseless Channel: Nyquist Bit Rate, Noisy Channel: Shannon Capacity	5	1
2	2.1	Guided Media, Twisted Pair cable-UTP, STP, connectors, Coaxial cable, connectors, Fiber Optic Cable	5	2
	2.2	Unguided Media, Wireless Transmission, Terrestrial microwave, Satellite Microwave, Radio wave, Infrared	5	2
3	3.1	Analog to Digital Conversion: Block diagram of Digital Communication System, Parallel and Serial Port	5	3
	3.2	Pulse Code Modulation, Sampling, Quantization, Delta Modulation, Transmission Modes, Asynchronous and Synchronous Transmission	5	3
	3.3	Digital to Analog Conversion, Modulation of Digital Data, Bit rate, Baud Rate, Carrier Signal, ASK, FSK, PSK, QAM	5	3
	3.4	Analog to Analog Modulation, Amplitude Modulation, Frequency Modulation and Phase Modulation, Bandwidth Utilization: Multiplexing and Spread Spectrum, Multiplexing: FDM, WDM, TDM, Synchronous TDM, Statistical TDM, Spread spectrum: FHSS,DSSS	5	3
4	4.1	Experiments: 1. Measure and compare the quality of the received signals, observing factors like attenuation and interference in different guided medias 2. Implement a simple delta modulation circuit using a microcontroller. 3. Use a microcontroller to generate digital data and Convert the digital data to analog using a Digital to Analog Converter (DAC). 4. Connect the DAC output to an oscilloscope or an audio speaker to visualize or hear the analog signal generated from the digital data. 5. Implement an ASK, FSK and PSK modulation circuit using the microcontroller and required components. 6. Implement Spread Spectrum techniques such as Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS).	30	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ● Use of ICT tools in conjunction with traditional classroom teaching method. ● Interactive sessions ● Class discussions ● Lab exercises
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks**

	1. Written test 2. Assignments **CCA for Practical: 15 Marks** 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. End Semester Examination **ESE for Theory: 50 Marks** **Written Test(50 Marks)** Time : 1½ hours Part A: MCQ (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) **ESE for Practical: 35 Marks** Time : 1½ hours 1. Viva - 15 Marks 2. Demonstration - 10 Marks 3. Record - 10 Marks

REFERENCES

1. Behrouz A Forouzan. Data Communications and Networking(Fifth Edition).TATA McGraw Hill Education

SUGGESTED READINGS

1. William Stallings. (2006). Data and Computer Communications (8th Edition). Pearson.
2. William L. Schweber. (2012). Data Communications (5th Edition). Tata McGraw-Hill Publishing Company Ltd.

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Programme						
Course Name	IoT based smart farming					
Type of Course	MDC					
Course Code	MG2MDCECT100					
Course Level	**100-199**					
Course Summary and Justification	This course equips learners with a deep understanding of IoT principles in agriculture, basic farming techniques, and the practical skills to integrate and apply IoT for sustainable farming. The course fosters critical thinking, problem-solving, and a multidisciplinary approach, preparing students for real-world challenges in sustainable agriculture.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Summarize the concept of Internet of Things (IoT)	U	1,2
2	Explain basic farming techniques	U	1,2
3	Apply skills to Integrate IoT technology in farming	A	1,2,10
4	Design and implement a cloud based smart farm	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Introduction to IoT: Definition, history, and key concepts, IoT in farming	3	1
	1.2	IoT Components: Microcontrollers and their role in IoT, Sensors for data collection (soil moisture sensors, temperature sensors, and humidity sensors)	4	1,3
	1.3	Actuators for automation (irrigation systems, robotic arms)	4	1,3
	1.4	IoT Networks: Overview of communication protocols (Zigbee and LoRa)	4	1,3
2	2.1	Fundamentals of Plant Growth: Plant life cycles and growth stages, Factors influencing plant health and yield	4	2

	2.2	Challenges in Traditional Farming: Water usage and irrigation challenges, Pesticide usage and environmental impact, Weather and climate-related challenges	5	2
	2.3	Introduction to Modern Farming Technique, Vertical farms, Hydroponics, Aquaponics	3	2
	2.4	Data in Farming: Importance of data in precision agriculture, Methods of data collection, Data storage, retrieval, and analytics overview	3	2
3		**IoT for farming- Practical (Any one case study + Any one field visit)** 1. Vertical farms / Hydroponics / Aquaponics. (Case study/Field visit) 2. Smart regulation of soil moisture using integration of soil moisture sensors and irrigation Pump, mediated by ESP32.(Case study/Field visit) 3. Concept of agriculture drone (Case study/Field visit) 4. Visit any smart farm and prepare a report.(Case study/Field visit) 5. UV Bug trap using IOT for farming. (Case study/Field visit)	30	2 2,3 3,4 3,4 3,4
4		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. R. Bassi, "IoT: Building Arduino-Based Projects," Packt Publishing, 2016.
2. P. Dutta, "Building Arduino Projects for the Internet of Things:

Suggested Readings

1. M. Y. Chowdhury et al., "Internet of Things (IoT) in Agriculture: A Comprehensive Survey," Journal of King Saud University - Computer and Information Sciences, 2021.
2. J. Gubbi et al., "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Generation Computer Systems, 2013.
3. Experiments with Real-World Applications," Apress, 2016.

Mahatma Gandhi University Kottayam

Programme						
Course Name	Python for Electronics					
Type of Course	MDC					
Course Code	MG2MDCECT101					
Course Level	**100-199**					
Course Summary and Justification	This course will equip the learners with fundamental programming skills using Python and Raspberry Pi. The course emphasizes hands-on learning, providing them with the essential knowledge to write Python programs and utilize the Raspberry Pi platform for real-world applications especially in the field of electronics.					
Semester	2	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		2		1		60
Pre-requisites	**Open to all plus two level streams**					

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Demonstrate the fundamentals of Python programming and Raspberry pi	U	1,2
2	Explain the concept of control structures in python and GPIO programming	U	1,2
3	Create GUI with Tkinter	C	1,2
4	Develop up problem-solving skills and creativity through hands-on projects and practical applications	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

Module	Unit	Course description	Hours	CO No:
1	1.1	Introduction to Python programming language, Syntax rules and conventions in Python, Structure of a Python program	4	1
	1.2	Variables & Data types in python: Numeric data types: int, float, complex, String data types: str, Sequence types: list, tuple, range	5	1
	1.3	Operators in Python: arithmetic, logical, assignment, comparison and bitwise operators	3	1
	1.4	Introduction to Raspberry pi, Raspberry Pi models, Port layout of Raspberry pi 4, Installation and configuration of Raspberry pi 4,Introduction to Beagle board	3	1

2	2.1	Control statements**:** if, if-else, while loop, For loop, switch. Basic string operations -- Len, lower, upper, split, substrings, String slices - String formatting for number system applications, Converting strings to numerical values and vice versa	4	2
	2.2	Multimedia -Importing multimedia to python (picture & sound). GPIO Programming and Interfacing**:** How the GPIOs work – pin numbering- Initializing I/O pins. Introduction to I/O functions - Importing functions or system libraries (GPIO libraries),digital read, digital write functions	4	2
	2.3	Introduction to GUI programming - Overview of Tkinter. Creating a basic Tkinter window - widgets: labels, buttons, entry widgets, check box – customizing widget properties	4	2
	2.4	Tkinter geometry managers: pack, grid, and place geometry manager	3	2
3		**Practical (any five)** **Getting started with Raspberry pi, Setting up the Raspberry pi computer, Thonny installation in Raspberry pi** 1. Program to print Hello World! 2. Program to add two numbers with user input 3. Program to perform basic logic operations 4. Program to find the sum of a given data set 5. String Input in Python 6. for string operations 7. Program to find largest and smallest number in an array 8. Program to display even numbers from 1-10 9. Program to display a string with number input 10. Blinking LED 11. Controlling LED with a push button 12. Blinking LEDs in a pattern 13. Traffic light controller design 14. Controlling LED with motion sensor 15. Intruder Alert System using motion sensor & buzzer **Title: Basic GUI applications development using Tkinter (Any 2)** 1.Data entry application 2.Basic login with GUI 3.Colour picker app 4.Capturing an image using Raspberry pi camera	30	
4		**Teacher specific content**		

Hardware & Software requirements for hands-on session: Raspberry pi 4, Thonni IDE

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)**

	Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA) Time : 1½ hours Viva , Lab report , Demonstration

References

1. The Fundamentals of Python: First Programs, 2011, Kenneth A. Lambert,
2. Mark Summer field, Programming in python 3: second edition.

Suggested Readings

1. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley, 2015
2. R Nageswara Rao, Python Programming

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Programme						
Course Name	Office Enhancement Tools					
Type of Course	MDC					
Course Code	MG2MDCECT102					
Course Level	100-199					
Course Summary and Justification	This course enhances learners' abilities to apply and create word documents, spreadsheets, presentations, and projects using various office suite tools. Emphasizing communication skills and fostering lifelong learning the course prepares students with practical skills for effective professional engagement.					
Semester	2	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Workshop from expert**	**Practical**	**Others**	
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Illustrate Word Processing Document	U	1,2
2	Build different Excel Sheet Skills	A	1,2
3	Develop Effective PowerPoint Presentation	C	1,2,10
4	Develop and Manage different Office Suite Tools	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Basic components of a Word window - Creating and Editing New Documents -Insert, Delete, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Saving and Printing a Document	3	1
	1.2	Formatting page-Page Orientation - Viewing Documents - Setting Tabs - Page Margins – Indents – Ruler - Formatting Techniques - Font Formatting - Paragraph Formatting - Page Setup - Headers & Footers - Bullets and	3	1

		Numbered List - Borders and Shading - Find and Replace - Page Break, Page Numbers ,Case settings, Highlighting, Special symbols, Alignments, Line Space, Converting files to different formats, Importing & Exporting documents, Sending files to others		
	1.3	Creating Tables- Table settings, Borders, Alignments,Insertion, deletion, Merging, Splitting, Sorting, and Formula, Drawing - Inserting ClipArts, Pictures/Files ,Tables Side – By - Side and Nested Tables	2	1
	1.4	Mail Merging -Spelling and Grammar Checking – Thesaurus – Macros,Drawing options, Inserting images, url, autoshapes, word art	2	1
2	2.1	Spread Sheet & its Applications, Opening Spreadsheet, Formatting toolbar	3	2
	2.2	Working With Cell and Cell Addresses - Selecting a Range, Moving, Cutting, Copy, Paste - Insert and Delete Cells - Freezing Cells	3	2
	2.3	Formatting worksheet-Adding, Deleting and Copying Worksheet within a Workbook - Renaming a Worksheet - Formatting Fonts-Aligning-Wrapping and Rotating Text - Using Borders - Boxes and Colors, Mathematical functions, Arrange data in ascending or descending order	3	2
	2.4	Centering a Heading, Changing Row/Column Height / Width -Formatting a Worksheet Automatically - Insert Comments, Insert picture or clipart in excel sheet.	3	2
3		**Practical** 1. Creating Presentation - Advantages of Presentation,Inserting and Deleting Slides 2. Formatting Slides - Slide Layout Views in Presentation, Insert new slides with different layout 3. Editing a slide, Inserting picture to a slide, Inserting Sounds and Videos , Colour Scheme , Background Action Buttons - Slide Transition - Custom Animation 4. Creating Master Slides - Managing Slide Shows - Using Pen Setting Slide Intervals 5. Creating a simple LaTeX document,Understanding the	23	3,4

		preamble,Document classes and styles,Font styles,Special characters, 6. Creating bullet and numbered lists,Creating tables,Writing mathematical expressions,Including Graphics and images,Bibliographies and Citations,Apply learned skills to create a complete LaTeX document and word document		
4		**Teacher specific content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1.Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. End Semester examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) (CCA Time : 1½ hours Viva , Lab report , Demonstration

References

1. Gini, Courter & Annette Marquis, Ms-Office 2013, BPB Publications.
2. Patrick Blattner, Louie Utrich. Ken Cook & Timothy Dyck, Special Edition Ms Excel 2013, Prentice Hall India Pvt. Ltd
3. Kopka, Helmut, and Patrick W. Daly. *Guide to LATEX*. Pearson Education, 2003.

Suggested Readings

1. Building a Foundation with Microsoft Office 2013
2. Grätzer, G. *Math into LaTeX*. Birkhäuser
3. Walkenbach, John. *Ms Office Excel 2007 Formulas (With Cd)*. John Wiley & Sons, 2007.
4. Mittelbach, Frank, et al. The LATEX companion. Addison-Wesley Professional, 2004.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Analog Electronics					
Type of Course	**DSC A**					
Course Code	MG3DSCECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides essential understanding of analog and digital electronic circuits.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites						

COURSE OUTCOME (CO)

CO No:	Expected course outcome	Learning Domain*	PO No:
1	Illustrate the concept of BJT, FET amplifier configurations.	U	1,2
2	Summarize the design and operation of Op amp	U	1,2
3	Analyze the properties and applications of operational amplifiers	An	1,2
4	Develop hands-on projects that involve the design, implementation, and testing	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Bipolar Junction Transistor, Operating point of BJT ,Modes of Operation, Voltage divider biasing, RC Coupled Amplifier	7	1
	1.2	Principle of Sinusoidal Oscillators - Barkhausen Criteria, RC Phase Shift Oscillator	5	1
	1.3	RC Differentiator and Integrator.	1	1
	1.4	Concept of FET Amplifier	2	1
2	2.1	Integrated Circuits, Types of ICs, Development of ICs – SSI, MSI, LSI, VLSI packages	4	2
	2.2	Block diagram representation of a typical op-amp – schematic symbol , A general purpose IC Op amp – IC 741, pin diagram	4	2

	2.3	Op-Amp parameters - input offset voltage and offset current, common mode rejection ratio (CMMR), slew rate.	3	2
	2.4	Equivalent circuit of an op-amp, Open-loop op-amp configurations, Closed-loop non-inverting and inverting amplifiers.	4	2,3
3	3.1	Analog Integrated Circuits: Integrator, Differentiator, Basic comparator, Zero-crossing detector, Schmitt trigger.	3	3
	3.2	RC Phase shift oscillator using op amp, Frequency response characteristics of major active filters (High pass, Low pass)	4	3
	3.3	Voltage controller oscillator - IC 566	4	3
	3.4	Non-linear Applications – Comparator, Introduction to NE555, Astable multivibrator using 555	4	3
4	4.1	Practical using simulation software 1. RC Coupled Amplifier 2. RC phase shift Oscillator 3. Zero-crossing detector 4. Triangular Waveform generator	30	4
	4.2	**Practical using Components and ICs** 1. RC Differentiator 2. RC Integrator 3. Low pass Filter 4. High pass filter 5. Comparator 6. Astable multivibrator using 555 7. Inverting amplifier 8. Non Inverting amplifier 9. Schmitt Triger 10. Square wave Generator		
	4.3	Mini project using simulation software **(Not Mandatory)**		
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **C. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments , Performance ,Case Study.

	D. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours g. MCQ - 10 Marks (Answer all - 10x1=10 Marks) h. Short answer questions (4 out of 6 questions)-4x5=20 marks i. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – Time 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Mottershead, Allen. Electronic devices and circuits. Goodyear Publishing Company, 1973.
2. Gayakwad, Ramakant A. "Op-amps and linear integrated circuit." (2012).
3. Donald E. Neaman, “Electronic Circuit, Analysis and Design”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2002.
4. Roy Choudhury and Shail Jain, “Linear Integrated Circuits”, 2nd Edition, New Age International Publishers, 2003.

Suggested Readings

1. Millman, Jacob. Electronic Devices and Circuits [by] Jacob Millman [and] Christos C. Halkias. McGraw-Hill, 1967.
2. Adel S. Sedra, Kenneth C. Smith, “Microelectronic Circuits”, Oxford University Press, Fifth Edition, 2004.
3. Sergio Franco,?Design with operational amplifiers and Analog Integrated circuits?, Tata McGraw Hill 3rd Edition 2002.
4. Ron Manchini, “Op-Amps for Everyone“, Design Reference-Texas Instruments, August 2002.
5. S.Salivahanan and V.S. Kanchana Bhaaskaran, “Linear Integrated Circuits”, 6th Edition, Tata McGraw-Hill, 2011.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Programming in C					
Type of Course	**DSC A**					
Course Code	MG3DSCEC T201					
Course Level	**200-299**					
Course Summary and Justification	This course equips the learner to understand C programming .Familiarization with programming techniques and C language helps learners to imbibe the ability to plan and solve problems using computer programs. .					
Semester	3	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites						

COURSE OUTCOME (CO)

CO No:	Expected course outcome	Learning Domain*	PO No:
1	Understand the concepts of programming concept and basics of C	U	1,10
2	Apply different techniques and functions in a program.	A	2
3	Understand the concept of pointers and user defined data types	U	2
4	Develop programs in C using programming Concepts	A	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Introduction to programming, Problem definition, Problem analysis, Algorithms, Flow chart, Compilation, Debugging	2	1
	1.2	C tokens - keywords, identifiers, constants, Data types, Variables- Variable declaration, Input and output Statement, Storage classes, C operators, Operator precedence	3	1
	1.3	C Program Structure, writing the simple C Program, Compilation and Execution of C Program	3	1
	1.4	Control flow statements: simple if, if-else, else-if ladder, nested if, switch case statement. Loops: while loop, for loop, do while, break and continue, goto.	7	1

2	2.1	Arrays*:* Definition and declaration of array, Types of Arrays-One Dimensional Array, Two-Dimensional Array, Multidimensional arrays. Initialization of One Dimensional array, Memory representation of array	4	2
	2.2	Multidimensional arrays: Two-Dimensional Array, Declaring and Initializing 2D arrays, matrix data	3	2
	2.3	Strings*:* Characters arrays and strings, Declaration, Initialization, String handling functions	4	2
	2.4	Functions*:* Definition, Declaration, Local and global variable, User defined functions, Recursive function	4	2
3	3.1	Pointers: Declaration of pointer variables, Initialization	3	3
	3.2	Pointers to Functions: Call by value versus Call by reference.	4	3
	3.3	Advantages and disadvantages of using pointers.	4	3,4
	3.4	User defined data types: Structure Definition, Declaring structure variables, Initialization, Accessing structure members.	4	3,4
4		**Practical(Any 15 from the list)** 1. Find greatest of two numbers 2. Check odd or even 3. Sum of numbers less than N 4. Generation of Fibonacci series 5. Checking of a prime 6. Prime number series generation 7. Temperature conversion 8. Reversing a given number 9. Checking whether a number is Armstrong or not 10. Addition of all the digits of a given number 11. Roots of quadratic equation 12. Calculator program using switch statement 13. Finding the largest and smallest among a list of numbers 14. Linear searching 15. Sorting a set of numbers in ascending order 16. Sorting in descending order 17.Matrix addition and subtraction 18. Process student's record using a structure to find division of pass. 19. Finding factorial using recursive function 20. Find the binary equivalent of a given decimal and vice versa 21. Find the number of vowels of a given string 22. Checking the palindrome. 23. Greatest of three numbers using pointers. 24. Swapping (call by value & call by reference) 25. Menu Program using pointers to calculate the area and circumference of a circle	30	4
5		**Teacher Specific Content**		

		15. Sorting a set of numbers in ascending order 16. Sorting in descending order 17. Matrix addition and subtraction 18. Process student's record using a structure to find division of pass. 19. Finding factorial using recursive function 20. Find the binary equivalent of a given decimal and vice versa 21. Find the number of vowels of a given string 22. Checking the palindrome. 23. Greatest of three numbers using pointers. 24. Swapping (call by value & call by reference) 25. Menu Program using pointers to calculate the area and circumference of a circle		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes(Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Balagurusamy, E. "Programming In Ansi C." (2016).
2. Kanetkar, Yashavant. Let us C. BPB publications, 2018.

Suggested Readings

1. Thareja, Reema. "Data structures using C." (2014).

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Introduction to Embedded System					
Type of Course	**DSE**					
Course Code	MG3DSEECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides a comprehensive understanding of AVR based Embedded System, depth knowledge on AVR microcontroller, AVR based Embedded C programming and assembly language programming.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites						

COURSE OUTCOME (CO)

CO No:	Expected course outcome	Learning Domain*	PO No.
1	Illustrate the definition and the concepts of embedded systems	U	1,2
2	Demonstrate the pin diagram, registers, ports and basic instructions of AVR microcontrollers	U	1,2
3	Apply the concept of AVR microcontroller programming	A	1,2
4	Develop the embedded system projects using AVR.	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Introduction to Embedded Systems. Definition, Purpose of embedded systems.	2	1
	1.2	Processors in Embedded Systems: Microprocessors v/s Microcontrollers, Role of controllers in Embedded System, Distinguish CISC and RISC. Features of RISC processors.	3	1
	1.3	Microprocessor architecture, Harvard, Von Neumann architecture	2	1
	1.4	Memory organization in Microcontroller, Program memory, data memory	3	1

2	2.1	Overview of AVR Microcontroller ATMEGA32, Classification of AVR family. General purpose registers, Special function registers, and Flag register.	2	2
	2.2	ATMEGA32 pin configuration, I/O ports, AVR data types, Structure of assembly language (Instruction), Addressing modes.	2	2
	2.3	Instruction set:- Data transfer (MOV, LDI,LDS & STS, LD & ST, LDD, IN, OUT). Branching instruction(RJMP, JMP, BREQ, BRNE, BRCC, BRCS)	3	2
	2.4	Bit manipulation instruction (SEC, CLC, ROL, ROR, SBI, CBI). Arithmetic and Logic instructions(ADD, SUB, MUL, AND , OR, EOR, INC, DEC, CLR)	3	2
3	3.1	Relevance of Embedded C, Data types	2	3
	3.2	Basic structure of AVR Embedded C program Sample programs.	2	3
	3.3	Time delay using pre-defined delay function (Sample programs)	3	3
	3.4	I/O programming, Concept of interrupts, Timer/Counter	3	3
4	4.1	**Hands on training using AVR studio/Atmel Assembly language Programs (Any 4)** 1. 8-bit addition, subtraction 2. 16- bit addition, subtraction, multiplication. 3. Multiplication using repeated addition 4. Number of ones in a byte 5. Check weather a number is even or odd 6. Memory swapping	30	4
	4.3	**Embedded C (Any 2)** 1. LED interfacing. 2. Buzzer interfacing. 3. LED Chaser. 4. Relay interfacing. 5. LCD /seven segment LED.		
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)(Internal)** Theory: - 30 Marks Internal Test , Seminar Presentation ,Case Studies/Projects/Site visit/others

	B. Semester End examination Written Test (70 marks)-2 Hour (Duration of Examination) MCQ - 20 Marks Short answer questions (6 out of 8 questions)-6x5=30 marks Essay questions -2 out of 4 - 2x10=20 marks

References

1. Mazidi, Muhammad Ali, Sepehr Naimi, and Sarmad Naimi. The AVR microcontroller and embedded systems: using Assembly and C. MicroDigitalEd. com, 2017 .
2. Shibu, K. V. Introduction to embedded systems. Tata McGraw-Hill Education, 2009.

Suggested Readings

1. Gadre, Dhananjay V. Programming and customizing the AVR microcontroller. 2001.
2. Barnett, Richard H., Sarah Cox, and Larry O'Cull. Embedded C programming and the Atmel AVR. Thomson Delmar Learning, 2006.
3. PandiankalAbhilash V, A Key to Program Microcontroller System:- S Chand Publishing

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Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Introduction to Mechatronics					
Type of Course	DSE					
Course code	MG3DSEECT201					
Course Level	**200-299**					
Course Summary and Justification	This course provides a comprehensive understanding of the integration of mechanical components, electronics, and computer control in the design and manufacturing of automated systems.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites						

COURSE OUTCOME(CO)

CO No:	Expected course outcome	Learning Domain*	PO No:
1	Illustrate the Principles of Mechatronics	U	1,2
2	Analyze and design mechanical components and systems for mechatronic applications	An	1,2,10
3	Demonstrate the concept of signals, systems and actuating Devices	U	1,2,10
4	Apply the concept of programming languages commonly used in mechatronics	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Definition and concept of Mechatronics, Applications of mechatronics in real-world systems, Conventional system vs. mechatronic system	2	1
	1.2	Need and Role of Mechatronics in Manufacturing and industrial Automation, Hardware components for Mechatronics	3	1
	1.3	Concept of ADC - Successive Approximation Register. Concept of DAC - R -2R ladder DAC (Detailed analysis not needed)	5	1

	1.4	Sensors and Transducers: Introduction to sensors and Transducers, Requirements and selection of sensors in mechatronics	5	1
2	2.1	Introduction to Mechanical components (gears, bearings, belts)	3	2
	2.2	Actuators for mechanical systems. Relays and solenoids, Concept of DC motor, stepper motor, servo motor, linear actuators	5	2
	2.3	Sensors for mechanical systems - potentiometer, LVDT, inductive and capacitive proximity sensors	2	2
	2.4	Hydraulic systems: flow, pressure and direction control valves, actuators, Concept of pneumatics	5	2
3	3.1	Introduction to signals, systems and control systems	3	3
	3.2	Analog and digital signal processing :-Pre-amplification, Scaling , Signal Conditioning	4	3
	3.3	Digital filtering concept (an overview about FIR and IIR Filters), Real-time data processing (sampling, quantization, and operations on signals)	3	3
	3.4	Basic concept of Serial communication (RS232, I2C, SPI), Networking basics- (Ethernet, CAN), Wireless communication (ZigBee), LoRa	5	3
4	4.1	**Hands on Experience** Introduction to hardware and software development for mechatronics applications (Embedded C or Python)	5	4
	4.2	Interfacing potentiometer and proximity sensors with Arduino Real-time monitoring and control	4	4
	4.3	Controlling of mechanical robotic arm with servo motor and potentiometer, Basic concept of PID control system	4	4
	4.4	Industrial Robotics-Case study	2	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)(Internal)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks)- 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Bolton.W,Mechatronics: Principles and Applications 2005.
2. Craig, John J. Introduction to Robotics: Mechanics and Control: Solutions Manual. Addison-Wesley, 1990

Suggested Readings

1. Groover, M. P. (2017). Introduction to Mechatronics and Measurement Systems.
2. Bishop, Robert H, ed. Mechatronics: an introduction. CRC Press, 2017.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Sensors and Actuators in Industry Automation					
Type of Course	**DSE**					
Course Code	MG3DSEECT202					
Course Level	**200-299**					
Course Summary and Justification	This course is designed to educate learners in electronics to make use of sensors and actuators in industry automation. The learners will have an exposure to sensors, actuators, stepper motors and its importance in the industry.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites						

COURSE OUTCOME (CO)

CO No	Expected course outcome	Learning Domain*	PO No
1	Demonstrate the concept of sensors and transducers	U	1,2
2	Illustrate the operation and application of transducers and A-D and D-A	U	1,2
3	Analyze the basic components needed to interface a linear actuator, solenoid, relay, DC motor, servo motor, stepper motor	An	1,2,10
4	Summarize the concept of industry automation	U	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Introduction to Sensors and Transducers**,** Need of sensors and transducers in industry.	3	1
	1.2	Types of sensors - Voltage sensor, Current sensor, Potentiometer, IR Sensor, Hall effect sensors, Piezoelectric sensors, Temperature sensor, Pressure sensor, Ultrasonic distance sensor, Motion sensor, proximity sensor	7	1

	1.3	Signal conditioning Using Instrumentation Amplifiers for sensors and transducers	2	1
	1.4	Applications of IR Sensor, Piezoelectric sensors, Temperature sensor, Pressure sensor, Proximity sensor	3	1
2	2.1	Introduction to Transducers and different types: Passive and Active transducer, Selection Criteria for transducer	2	2
	2.2	Displacement transducers - Resistive (Potentiometric, Strain Gauges, LVDT) , Wheatstone bridge circuits, Semiconductor strain gauge), Magnetostrictive transducers, Microphone	7	2
	2.3	Interfacing of transducers: Touch Switch, Photo Diode, LDR. (familiarization of LM 358)	2	2
	2.4	A-D and D-A Conversion: D-A Conversion: Circuit of R-2R ladder. A-D Conversion: successive approximation registers working	4	2
3	3.1	Introduction to Actuators	2	3
	3.2	Types of actuator: Servo Motor, Stepper Motor, Relay, Solenoid, Linear actuator	7	3
	3.3	Interfacing of actuators, Driver Circuit	3	3
	3.4	Applications of Linear actuators in the industrial sector.	3	3
4	4.1	Introduction to Industrial Automation and Control, Architecture, Tools for Industrial Automation	3	4
	4.2	Measurement of Temperature, Pressure, Force, Displacement, Speed	4	4
	4.3	Measurement of Flow, Level, Humidity and proximity sensor.	3	4
	4.4	Applications of Sensors- Case studies	4	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)(Internal)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies /Projects /Site visit/ others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Patranabis D, Sensor and Actuators, Prentice Hall of India (Pvt) Ltd., 2005.

2. Renganathan S, Transducer Engineering, Allied Publishers (P) Ltd., 2003.

Suggested Readings

1. Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, VI Edition, Tata McGraw-Hill Book Company, 2011.
2. Bradley D.A., and Dawson, Burd and Loader, Mechatronics, Thomson Press India Ltd, 2004.
3. Bolton W, Mechatronics, Thomson Press, 2003.

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Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Intelligent Automation					
Type of Course	DSE					
Course Code	MG3DSEECT203					
Course Level	**200-299**					
Course Summary & Justification	This course equips learners with the practical skills to apply AI and machine learning in solving complex electronic engineering problems					
Semester	3	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Explain the concepts of Artificial Intelligence (AI) and Machine Learning	U	1,2
2	Apply Python for machine learning applications	A	1,2
3	Organize hands-on experience in selecting appropriate classification models	A	1,2,10
4	Develop a solid understanding of Unsupervised Learning	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	1.1	Overview of AI and Machine Learning	2	1
	1.2	Concept of Neural networks, Machine Learning	3	1
	1.3	Types of Machine Learning Systems	3	1
	1.4	Main Challenges of Machine Learning: Application of ML: Genetics, medical treatment, Business	3	1
2	2.1	Introduction to Python, How to write code in Jupyter Notebook, Pycharm & IDLE	5	2
	2.2	Import and export data using Python (panda)	4	2
	2.3	Machine learning Lab : Extract data from database using Python	4	2

	2.4	Concept of Gradient descent algorithms	4	2
3	3.1	An overview about Machine learning: supervised, unsupervised, reinforcement learning	4	3
	3.2	Supervised learning Technique : K-Nearest Neighbors (KNN)	5	3
	3.3	Unsupervised learning Techniques	4	3
	3.4	Reinforcement learning	4	3
4	4.1	Linear activation function	2	4
	4.2	Non- linear Activation functions: Sigmoid, ReLu, TanH	5	4
	4.3	Elements of Neural Network – Input, Output and Hidden Layers	4	4
	4.4	Concept of regression analysis	4	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)(Internal** Theory: - 30 Marks Internal Test , Seminar Presentation ,Case Studies/Projects/Site visit/ others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Auelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Second Edition, O'Reilly, 2019
2. Jeremy Watt, Reza Borhani, Aggelos Katsaggelos, Machine Learning Rened, 2nd Ed., Cambridge University Press.

Suggested Readings

1. Ethem Alpaydin, Introduction to Machine Learning, 3rd Ed., MIT Press.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2016.
3. Michael Nielsen, Neural Networks and Deep Learning
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, The MI

Mahatma Gandhi University
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Programme	**BSc (Honours) Electronics with Computer Technology**
Course Name	Smart Sensors with IoT
Type of Course	DSE
Course Code	MG3DSEECT204
Course Level	200-299
Course Summary and Justification	This course is designed to educate learners in electronics to make use of sensors and actuators in industry automation. The learners will have an exposure to sensors, actuators, stepper motors and its importance in the industry.

Semester	3	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOME(CO)

CO No.	Expected course outcome	Learning Domain*	PO No.
1	Demonstrate the concept of sensors and transducers	U	1,2
2	Illustrate the operation and application of transducers and A-D and D-A	U	1,2
3	Analyze the basic components needed to interface a linear actuator, solenoid, relay, DC motor, servo motor, stepper motor	An	1,2,10
4	Summarize the concept of smart sensors and industry automation	U	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to Sensors and Transducers, Need of sensors and transducers in industry	3	1
	1.2	Types of sensors - Voltage sensor, Current sensor, Potentiometer, IR Sensor, Hall effect sensors, Piezoelectric sensors, Temperature sensor, Pressure sensor, Ultrasonic distance sensor, Motion sensor, proximity sensor	7	1
	1.3	Signal conditioning Using Instrumentation Amplifiers for sensors and transducers	2	1
	1.4	Applications of IR Sensor, Piezoelectric sensors, Temperature sensor, Pressure sensor, Proximity sensor.	3	1

2	2.1	Introduction to Transducers and different types: Passive and Active transducer, Selection Criteria for transducer	2	2
	2.2	Displacement transducers - Resistive (Potentiometric, Strain Gauges, LVDT), Wheatstone bridge circuits, Semiconductor strain gauge), Magnetostrictive transducers, Microphone	7	2
	2.3	Interfacing of transducers. Touch Switch, Photo Diode, LDR. (familiarization of LM 358)	2	2
	2.4	A-D and D-A Conversion: D-A Conversion, Circuit of R-2R ladder. A-D Conversion, successive approximation register working	4	2
3	3.1	Introduction to Actuators	2	3
	3.2	Types of actuator: Servo Motor, Stepper Motor, Relay, Solenoid, Linear actuator	7	3
	3.3	Interfacing of actuators, Driver Circuit	3	3
	3.4	Applications of Linear actuators in the industrial sector	3	3
4	4.1	Concept of Smart Sensors with IoT –Steps for Uploading Sensor Data With Cloud Server (Thing Speak API)	3	4
	4.2	Measurement of light intensity and temperature with Thing Speak	4	4
	4.3	Automatic fan control, water pump control with IoT tools and smart sensors (Using ESP32 & Thing Speak)	4	4
	4.4	Introduction to Industrial Automation and Control, Architecture, Tools for Industrial Automation. Concept of Industry 2.0	4	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)(Internal)** Theory: - 30 Marks Internal Test , Seminar Presentation ,Case Studies/Projects/Site visit/ others
	B. Semester End examination 1.Written Test (70 marks)- 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Patranabis D, Sensor and Actuators, Prentice Hall of India (Pvt) Ltd., 2005.
2. Renganathan S, Transducer Engineering, Allied Publishers (P) Ltd., 2003.

Suggested Readings

1. Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, VI Edition, Tata McGraw-Hill Book Company, 2011.
2. Bradley D.A., and Dawson, Burd and Loader, Mechatronics, Thomson Press India Ltd, 2004.
3. Bolton W, Mechatronics, Thomson Press, 2003.
4. Veena S. Chakravarthi - Internet of Things and M2M Communication Technologies

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Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Microcontroller Programming					
Type of Course	DSE					
Course Code	MG3DSEECT205					
Course Level	**200-299**					
Course Summary and Justification	The syllabus covers Python basics, Raspberry Pi fundamentals, GPIO programming, and GUI development using Tkinter. It includes topics like data types, operators, control statements, hardware setup, and practical projects such as LED control and integration of motion sensor.					
Semester	3	**Credits**			4	**Total Hours**
Course details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Understand the basics of Python programming and Raspberry pi microcontroller board	U	2
2	Demonstrate proficiency in Control Structures in python and GPIO programming	U	1,2
3	Acquire expertise in GUI Programming with Tkinter	C	1,2,10
4	Develop problem-solving skills and ignite creativity through hands-on projects and practical applications, employing Python for electronic systems	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Fundamental of Python programming- Syntax rules and conventions in Python, Structure of a Python program	3	1
	1.2	Fundamental data types - Numerical data types, string. Sequence types: list, tuple, range	3	1
	1.3	Arithmetic, Logical, Assignment, Comparison and bitwise operators	3	1
	1.4	Fundamental of Raspberry pi microcontroller board - Raspberry Pi models. Port layout of Raspberry pi 4 Installation and configuration of Raspberry pi 4	6	1
2	2.1	Control statements in Python: if, if-else, while loop, for loop, switch	3	2

	2.2	Basic string operations -- Len, lower, upper, split, substrings, String slices - String formatting for number system applications, Converting strings to numerical values and vice versa	4	2
	2.3	Multimedia -Importing multimedia to python (picture & sound)	4	2
	2.4	Programming and Interfacing of GPIO: How the GPIOs work – pin numbering- Initializing I/O pins. Introduction to I/O functions - Importing functions or system libraries (GPIO libraries). Digital read, Digital write functions	4	2
3	3.1	Basics of GUI programming - Overview of Tkinter	4	3
	3.2	Creating a basic Tkinter window - widgets: labels, buttons, entry widgets, check box – customizing widget properties	4	3,4
	3.3	Tkinter geometry managers: pack, grid, and place geometry manager	7	3,4
4	4.1	**Practicals.-** Hardware & Software requirements for hands-on session: Raspberry pi 4, Thonni IDE **Part A** 1. Program to perform basic logic operations 2. Program for toggling the bits of Port B 3. Program to find the sum of a given data set 4. Program for string operations 5. Program to find largest and smallest number in an array 6. Program to display even numbers from 1-10 7. Program to display a string with number input	20	4
	4.2	**Part B** 1. Blinking LED 2. Controlling LED with a push button 3. Blinking LEDs in a pattern 4. Traffic light controller design 5. Controlling LED with motion sensor 6. Intruder Alert System using motion sensor & buzzer	10	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)(Internal)** Theory: - 30 Marks Internal Test , Seminar Presentation ,Case Studies/Projects/Site visit/ others
	B. Semester End examination 1.Written Test (70 marks)- 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Lambert, Kenneth A. Fundamentals of Python: first programs. Cengage Learning, 2018.
2. Summerfield, Mark. Programming in Python 3: a complete introduction to the Python language. Addison-Wesley Professional, 2010.

Suggested Readings

1. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley, 2015
2. R Nageswara Rao, Python Programming

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Internet of Things					
Type of Course	DSC B					
Course Code	MG3DSEECT202					
Course Level	**200-299**					
Course Summary and Justification	This course provides learners with a solid foundation in IoT, specifically focusing on ESP32. Through hands-on experience, learners will understand, apply, and analyze IoT concepts, creating prototypes and enhancing their programming skills.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites						

COURSE OUTCOME(CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Illustrate basics of IoT, ESP32 and programing concepts	U	1,2
2	Develop the knowledge in I/O devices and their Interfacing Techniques	C	1,2
3	Analysis of IoT system Interaction and creation of IoT prototypes with ESP32	An	1,2
4	Build up skill enhancement using IoT programing	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No:
1	1.1	Overview of Internet of Things (IoT) and its key components, Basic IoT block diagram, Characteristics of IoT devices	3	1
	1.2	Relevance of IoT in Modern society, Challenges and problems faced with IoT	3	1
	1.3	Overview of Embedded platforms for prototyping - Arduino,ESP32 Node MCU	4	1
	1.4	Introduction to the ESP32 microcontroller and its features, pin diagram ,APIs, device driver installation, ESP32 board with Arduino IDE	5	1

2	2.1	Understanding the Arduino Programming Language for ESP32, GPIO Pins and Digital Input/ Output examples with LED	4	2
	2.2	Serial communication -UART, serial print, serial Read with examples, Analog read and Analog write	4	2
	2.3	Sensors - Temperature sensor (DHT11), LDR Sensor, PIR sensor, rain sensor, Gas sensors , Ultrasonic sensor	4	2
	2.4	Output devices - Buzzer, LCD, Actuators - Relays, DC Gear motor, servo motors and Solenoids	3	2
3	3.1	BLE mode in ESP32 - Introduction to Bluetooth and BLE	3	3
	3.2	ESP32 Wi-Fi Networking: Wi-Fi Access point - Station mode, access mode	4	3
	3.3	ESP32 HTTP server and HTTP client	3	3
	3.4	Connecting ESP32 to local web server - data collection and reporting with web browser	5	3
4		**Programming skill Development (*Any 4*)** 1. Read a button state with digital input using the ESP32 Arduino 2. Dim an LED with PWM using the ESP32 Arduino 3. Control a traffic light using ESP32 4. Basic Burglar alarm security system with the help of PIR sensor and buzzer. 5. Temperature sensor (DHT11) interfacing 6. Bluetooth Interfacing 7. Motor driver Interfacing 8. Create a simple web server in the ESP32 9. Use ESP32 with ultrasonic sensor HC-SR04 to control servo motor 10. Control LED matrix sign board via web interfacing using ESP32	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.

	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Hakima Chaouchi, — The Internet of Things Connecting Objects to the Web, Wiley Publications
2. Jose, Jeeva. Internet of things. Khanna Publishing House, 2018.
3. Jain, Satish, Shashi Singh, and M. Geetha. BPB COMPUTER COURSE-WIN 10/OFFICE 2016. BPB Publications, 2018.

Suggested Readings

1. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
3. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.
4. Internet of Things- Shriram K Vasudevan, Abhishek Nagarajan, RMD Sundaram, Wiley India
5. IoT and its Applications- Prof. Satish Jain, Shashi Singh, BPB publications
6. Erwin Ouyang, Hands-On IoT: Wi-Fi and Embedded Web Development, Developing with ESP32, Arduino, C/C++, HTML, CSS, and JavaScript by Examples

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Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Integrated Electronics					
Type of Course	**DSC B**					
Course Code	MG3DSCECT203					
Course Level	**200-299**					
Course Summary and Justification	This course provides essential understanding of analog and digital electronic circuits.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites						

COURSE OUTCOME (CO)

CO No.	Expected course outcome	Learning Domain*	PO No.
1	Explain the concept of BJT , Oscillator circuits and negative feedback circuit	U	1,2
2	Illustrate the design and operation of adder, andcounters	U	1,2
3	Analyze the working and applications of operationalamplifiers	An	1,2
4	Develop hands-on projects that involve the design,implementation, and testing	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Bipolar Junction Transistor, Operating point of BJT, Modes of Operation, Voltage divider biasing, RC Coupled Amplifier	6	1
	1.2	Principle of Sinusoidal Oscillators - Barkhausen Criteria, RC Phase Shift Oscillator Oscillators - Barkhausen Criteria, RC phase shift oscillator	5	1
	1.3	Negative feedback circuit- advantage	1	1
	1.4	Emitter follower circuit, Single stage Common Emitter Amplifier with voltage divider biasing	2	1
2	2.1	Shift registers - serial/parallel – data transfers, timing diagrams	3	2
	2.2	Ring counter, Johnson counter and applications	3	2
	2.3	Design of asynchronous/synchronous up/down counter - timing diagram	3	2
	2.4	Design of asynchronous/synchronous up/down decade counter-timing diagram	4	2,3

3	3.1	Block diagram representation of a typical op-amp – schematic symbol , A general purpose IC Op amp – IC 741 , pin diagram, Op-Amp parameters - input offset voltage and offset current, common mode rejection ratio (CMMR), slew rate	5	3
	3.2	Equivalent circuit of an op-amp, Open-loop op-amp configurations, Closed-loop non-inverting and inverting amplifiers	4	3
	3.3	Integrator, Differentiator, Basic comparator, Zero-crossing detector, Schmitt trigger. RC Phase shift oscillator using op amp, Frequency response characteristics of major active filters (High pass, Low pass)	5	3
	3.4	Voltage controller oscillator - IC 566. Non-linear Applications – Comparator, Introduction to NE555, astable multivibrator using 555	4	3
4	4.1	**Practical using simulation software** 1. RC Coupled Amplifier 2. RC phase shift Oscillator 3. Ring counter, Johnson Counter. 4. Decade Counter	30	4
	4.2	**Analog (Any 4)** 1. Zero crossing detector 2. Comparator 3. Astable multivibrator using 555 4. Inverting amplifier 5. Non Inverting amplifier		
	4.3	**Digital (Any 4)** 1. Parallel in serial Out Registers 2. Parallel in Parallel out Registers 3. Ripple counter 4. Ring counter 5. Johnson Counter 6. Decade counter		
	4.4	Mini project using simulation software **(Not Mandatory)**		
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignment, Performance, Case Study.

	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Mottershead, Allen. Electronic devices and circuits. Goodyear Publishing Company, 1973.
2. Gayakwad, Ramakant A. "Op-amps and linear integrated circuit." (2012).
3. Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.

Suggested Readings

1. Malvino, A. P., & Leach, D. P. (2017). "Digital Principles and Applications." Tata McGraw-Hill Education.
2. Millman, Jacob. Electronic Devices and Circuits [by] Jacob Millman [and] Christos C. Halkias. McGraw-Hill, 1967.
3. Pandiankal Abhilash : Filters :ebook – kindle edition:- kindle store

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Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Digital Fundamentals					
Type of Course	**DSC B**					
Course Code	MG3DSCECT204					
Course Level	**200-299**					
Course Summary and Justification	This course covers the fundamentals of digital electronics, including number systems, Boolean algebra, logic gates, combinational logic circuits, and sequential logic circuits. Through theoretical concepts and practical examples, students gain a comprehensive understanding of digital logic design principles and their applications.					
Semester	**3**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites						

COURSE OUTCOME (CO)

CO No.	Expected course outcome	Learning Domain*	PO No.
1	Familiarization of number systems and their importance in computation	U	1
2	Analyse working of logic gates and formation of logic combinational circuits	A	1,2
3	Implementation of sequential logic circuit and Arithmetic Logic Units of a computer	A	1,2
4	Demonstrate the ability to implement and verify basic digital logic circuits, including gates, adders, multiplexers, decoders, flip-flops, counters, and memory systems	A	2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Number Systems, Decimal, Binary, Octal and Hexadecimal), Conversion-From one number system to another	4	1
	1.2	Concept of binary addition and subtraction- 1's Complement , 2's complement, Subtraction using 1's and 2's Complement- BCD numbers- concept and addition	4	1
	1.3	Logic gates- AND, OR, NOT, NAND, NOR, XOR and XNOR. Truth tables - Basic laws of Boolean Algebra, Simplification of Expressions	3	1

2	2.1	De-Morgan's theorems, Simplification of expressions using K-MAP (up to 4 variables)-	3	2
	2.2	Combinational Logic Circuits : Adders-Half adder, Full adder – parity generator- Encoders- Decoders- Multiplexers – Demultiplexers	8	2
	2.3	Sequential - Logic Circuits: Flip flops- Latch, Clocked, RS, JK, T, D, Triggering of flip flops, Master Slave flip flops - Concept of Registers, Shift Registers- SISO, SIPO, PISO, PIPO	5	2
	2.4	Basic Structure of computers – functional units - basic operational concepts - data representation - instruction execution, and memory hierarchy - bus structures- addressing modes	3	2
3	3.1	Memory system: basic concepts – semiconductor RAMs. memory system considerations interfacing memory with CPU-memory map- ROMs, cache memory, mapping Techniques	5	3
	3.2	Arithmetic algorithms: Adder and subtractor units - Booth's multiplication algorithm - access	5	3
	3.3	Control organization – Hardwired control-microprogram control of processor unit – Microprogram sequencer, micro programmed CPU organization - I/O organization: accessing of I/O devices – interrupts, interrupt hardware -Direct memory access	5	3
4	4.1	**Practical** 1. Familiarization of logic gates and verification of truth tables 2. Implementation of a logic equation using gates. 3. Verification of DeMorgan's Theorem 4. Implementation of logic gates using universal gates. 5. Implementation of flip flop using gates 6. Verification of flip flop IC, truth table states. 7. Implementation of Half Adder 8. Implementation of Full Adder 9. Implementation of 3 to 8 decoder 10. Implementation of seven segment display. 11. Implementation of 8:1 multiplexer 12. Implementation of 1:8 demultiplexer 13. Implementation of 3 bit counter 14. Understanding shift operations. 15. Implementation of a 4 bit memory system	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks**

	1. Written test 2. Assignments **CCA for Practical: 15 Marks** 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination **ESE for Theory: 50 Marks** Time : 1½ hours **Written Test(50 Marks)** Part A: MCQ (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) **ESE for Practical: 35 Marks** Time : 1½ hours 1. Viva - 15 Marks 2. Demonstration - 10 Marks d.3. Record - 10 Marks

REFERENCES

1. Thomas L Floyd- Digital Fundamentals, Ninth edition, PEARSON Prentice Hall.
2. Carl Hamachar, ZvoncoVranesic and SafwatZaky(2019).Computer Organization (6th edition). McGraw Hill.

SUGGESTED READINGS

1. Thomas C Bartee- Digital computer Fundamentals, Sixth Edition, TATA McGraw Hill Edition
2. M Morris Mano. Digital Logic and Computer design (4th Edition). Prentice Hall.
3. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier.
4. John P. Hayes, Computer Architecture and Organization, McGraw Hill.
   William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education

Mahatma Gandhi University Kottayam

Programme						
Course Name	Electronics Incubation					
Type of Course	MDC					
Course Code	MG3MDCECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides learners with a comprehensive understanding of prototyping principles and hands-on experience in designing and troubleshooting electronics prototypes.					
Semester	3	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Demonstrate basics entrepreneurship and ethical concern	U	1,2
2	Develop simple analog circuits	A	1,2
3	Develop Custom structures and integrate PCBs into it.	C	1,2
4	Develop and materialize a functional electronics device	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Basics of business planning for electronics startups, Market research and identifying target audiences, Concept of Intellectual property considerations	3	1
	1.2	Importance of collaborative teamwork and effective communication skills	4	1
	1.3	Overview of Electronics -Prototyping, Understanding the product development life cycle	4	1
	1.4	Steps involved in Prototyping an electronic product. Design challenges	4	1
2	2.1	Familiarizing **any one** PCB design software- KiCAD, Easy EDA, Circuit maker	3	2
	2.2	PCB design- Rules. Create the Bill of Materials. Estimation of the component cost	4	2
	2.3	Preparation of homemade PCB with thermal transfer method and ferric chloride solution	4	2

	2.4	Ordering Online PCB boards by uploading Gerber files. Familiarizing manufacturing service providers and customization process-JLCPCB, PCBway or PCBcart	4	2
3	3.1	Familiarization of Autodesk fusion 360 - basic tools and practising simple structures	3	3
	3.2	PCB design of a simple Mobile battery charger using linear power supply with 7805	4	3
	3.3	Visit an industry or Incubation facility such as Maker village.Report of an Industrial visit.Understanding the facilities and services offered by Maker village for prototyping devices	8	4
4		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 marks Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1.Written Test (50 marks) – Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Babu, Dr A. Sathish. "Entrepreneurship And Incubation (Text And Cases).
2. Phan, Phillip H., Sarfraz A. Mian, and Wadid Lamine, eds. Technology entrepreneurship and business incubation: Theory, practice, lessons learned. World Scientific, 2016.

Suggested Readings

1. Owen, Tony. "The Art of Electronics, by Paul Horowitz and Winfield Hill Cambridge University Press, Cambridge, 1990
2. Williams, Tim. The circuit designer's companion. Elsevier, 2004.
3. Dure, Leon. Interconnectedness: A Case Study of Revolutionary War and War of the Regulation Battlefields in North and South Carolina.(2020).
4. Gebhardt, Andreas. Understanding additive manufacturing. (2011).

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Programme						
Course Name	Robotics with integrated AI					
Type of Course	MDC					
Course Code	MG3MDCECT201					
Course Level	**200-299**					
Course Summary and Justification	This course provides an introductory overview of robotic systems, covering fundamental concepts, components, and applications.					
Semester	3	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	45
		3				
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Demonstrate the fundamental principles and concepts of robotics.	U	1,2
2	Explain about modern sensors and actuators	U	1,2
3	Develop the integration of artificial intelligence (AI) techniques in robotics, enabling robots to make intelligent decisions.	C	1,2
4	Apply their knowledge and skills to complete a hands-on robotics project	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Need for robotic systems in daily life, Definition and types of robotic systems, Cylindrical, Spherical Work envelope.	3	1
	1.2	Characteristics of robotic systems - Precision, accuracy, resolution, repeatability.	4	1
	1.3	Different types of joint -Prismatic and Revolute End-effectors-Gripper and Pickup	4	1
	1.4	Linear and non-linear position control, concept of dynamics	4	1
2	2.1	Position sensors - potentiometer sensor, servo mechanism.	2	2
	2.2	proximity sensors - whisker sensor, limit switch, tilt sensor.	2	2
	2.3	IR Obstacle avoidance sensor, ultrasonic distance sensors.	3	2
	2.4	Force sensor and flex sensor, accelerometer and gyroscope, Introduction to computer vision in robotics(Concept only)	3	2
3	3.1	Supervised, Unsupervised and	5	3

		Reinforcement Learning for robotic systems. Teach In, Teach Through techniques		
	3.2	Re-configurable and adaptable with deep learning. Line following method for robotics	5	3
	3.3	**Applications of modern robotics** 1. Robotics in industry- pick and place, die casting, spot welding, spray painting, sorting. 2. Robotics in the Medical field - Robotic surgery, robotic implants for disabled persons.	5	4
	3.4	3. Robotics for military- Automated warfield robots, remote surveillance robot, and the concept of robotic drones.	5	4
4		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 marks Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1.Written Test (50 marks) – Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Schilling, Robert J. Fundamentals of Robotics PHI, 1996
2. Richardd. Klafter, Robotic Engineering phi,1996
3. Siciliano, Bruno, Oussama Khatib, and Torsten Kröger, eds. Springer handbook of robotics. Vol. 200. Berlin: springer, 2008.

Suggested Readings

1. Fu, Gonzalez, and Lee, robotics-control,sensing,vision and intelligence,McGraw hill
2. Groover, Weiss, Nagel and Odrey Industrial robotics technology,programming & amp;applications McGraw hill.
3. Correll, Nikolaus, et al. "Introduction to Autonomous Robots: Mechanisms." Sensors, Actuators, and Algorithms. MIT Press, Cambridge, MA, (2022).
4. Lynch, Kevin M., and Frank C. Park. Modern robotics. Cambridge University Press, 2017.

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Programme						
Course Name	Electronics for sustainable development					
Type of Course	MDC					
Course Code	MG3MDCECT202					
Course Level	**200-299**					
Course Summary and Justification	This course provides a comprehensive overview of sustainable energy resources, energy-efficient devices, electric vehicles, e-waste management techniques, and sustainable electronics design. Students will learn about renewable and non-renewable energy resources, the need for renewable energy, concepts of carbon neutrality and ecological balance.					
Semester	3	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	45
		3				
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Illustrate Concept of Green Electronics and Renewable Energy	U	1,2
2	Develop knowledge in E-Waste Management and Product Recycling	A	1,2
3	Develop awareness of equipment used for sustainable electronics	A	1,2,9
4	Analyze the technologies used for e waste management	An	1,6,8

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Renewable and non-renewable energy resources, Need for Renewable energy, Concept of carbon neutrality and ecological balance	2	1
	1.2	Concept of solar energy - off grid and on grid systems, Extraction of energy from wind, tidal, hydro and geothermal sources, Hydrogen and biogas, concept of nuclear energy and nuclear waste management..	4	1
	1.3	Design of energy efficient devices Understanding the star rating and BIS standards &- Peak time energy management, Energy efficient modern home appliances - smart LED,	5	1

		BLDC fan, BLDC washing machine and inverter AC(Concept only)		
	1.4	Introduction to Electric Vehicles, Benefits of EV over conventional fuels , EV battery monitoring and charging system, Battery technologies - Li-Po, Li-ion and LiFePO 4 battery	4	1
2	2.1	Electronic devices life cycle, Toxic materials of E-Waste, Health Hazards of E-Waste	3	2
	2.2	E-Waste Sorting and Segregation,Reusable components from E-Waste, Refurbishment products, safely disposal methods of E-Waste	3	2
	2.3	Solder fumes and health hazards, preventive measures, Concept of lead free soldering, Biodegradable plastic for electronic products.	4	2
3	3.1	Introduction to IoT, Building blocks of IoT, Overview of the IoT ecosystem, Real life Examples of IoT products	2	3
	3.2	Solar panel - mono crystalline and poly crystalline type installation and maintenance of solar panel	5	3
	3.3	PV System Configurations: On-grid, Off-grid, and Hybrid Systems, Solar plant with smart sensors for maximum energy harvesting	5	3
	3.4	Load estimate calculation, solar panel accessories - battery charger controller, Inverter board	3	3,4
	3.5	Hands on training - Making of solar powered rechargeable toy car	5	3,4
4		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 marks Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1.Written Test (50 marks) – Time : 1½ hours MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Hassan, Masjuki Hj, and Md Abul Kalam. "An overview of biofuel as a renewable energy source: development and challenges." Procedia Engineering 56 (2013): 39-53.

Suggested Readings

1. Prasad, Majeti Narasimha Var, Meththika Vithanage, and Anwesha Borthakur, eds. Handbook of electronic waste management: international best practices and case studies. Butterworth-Heinemann, 2019.

Mahatma Gandhi University Kottayam

Programme						
Course Name	Green Electronics					
Type of Course	VAC					
Course Code	MG3VACECT200					
Course Level	**200-299**					
Course Summary and Justification	This course addresses the imperative for sustainable practices in Electronics. By instilling an understanding of eco- friendly principles, providing hands on experience in E-waste management fostering critical thinking and sustainability consciousness.					
Semester	3	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Explain The threat of E-waste on human health and the environment.	U	1,2
2	Construct knowledge sustainable materials for electronic devices	A	1,2
3	Develop E-waste management practices and strategies for recycling electronic products	C	1,2
4	Apply green electronics principles to real world scenarios and obtain a fundamental understanding of future trends of green Electronics	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Electronic waste (E-waste), sources of E-Waste, categories, Effect of E-waste on ecosystems.	5	1
	1.2	Health hazards of E-waste. Challenges associated with the disposal of E-waste. Benefits of E-waste recycling	6	1,3
	1.3	E-waste compounds and its toxicity chart	4	1,3
2	2.1	Definition and significance of sustainable materials in the context of electronic devices.	2	2
	2.2	Different categories of sustainable materials:(Recycling of copper, aluminum, gold from PCB)	5	2

	2.3	Eco friendly dielectric layers - Paper, Silk, cellulose and cellulose derivatives , Resin, Gelatin, Shellac, Organic semiconductor materials	5	2
	2.4	Performance and durability of sustainable materials compared to traditional ones.	3	2
3	3.1	Mechanical Recycling Methods Introduction to mechanical recycling-Shredding, Magnetic Separation, Air Classification, Gravity Separation	5	3
	3.2	Chemical Processes for Material Recovery-Leaching, Solvent, Extraction, Pyrolysis, Electrochemical Processes	5	3
	3.3	***Case study*** **-** Identification and separation of reusable components inside a PC	3	3,4
4		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory :- 25** Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours 2.MCQ - 35x1= 35 Marks 3.Short Essay Question = 15 Marks (3 out 5)- 3x5

References

1. Bhagat-Ganguly, Varsha. "E-Waste Management: Challenges and Opportunities in India." (2021).
2. .Irimia-Vladu, Mihai, et al., eds. Green materials for electronics. John Wiley & Sons, 2017.

Suggested Readings

1. Prasad, Majeti Narasimha Var, Meththika Vithanage, and Anwesha Borthakur, eds. Handbook of electronic waste management: international best practices and case studies. Butterworth-Heinemann, 2019.
2. Brandt, Stefan L., Frank Mehring, and T. Rapatzikou. "Electronic Wastelands? Information Management, Cultural Memory, and the Challenges of Digitality." (2023).
3. Han, Moon Jong, and Dong Ki Yoon. "Advances in soft materials for sustainable electronics." Engineering 7.5 (2021): 564-580.
4. Simple method for extracting gold from electrical and electronic wastes using hydrometallurgical process (researchgate.net)

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Python Programming					
Type of Course	**DSC**					
Course Code	MG4DSCECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides modern high level programming language with immense applications in various fields					
Semester	**4**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites	**Should have basic knowledge in computer programming.**					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Demonstrate the basics of Python programming	U	1,2,10
2	Demonstrate proficiency in programming concepts specific to Python	U	1,2,10
3	Apply advanced programming techniques in Python, including object-oriented programming	A	1,2,10
4	Analyze and solve complex problems using python	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	**Introduction to Python:** Features, Installation of Python, Basic elements of Python, Python Command Line mode, Python IDE's.- Pycharm	3	1
	1.2	**Python Basics**: Identifiers, Keywords, Variables, Operators, Data Types, Built-in Functions- Input and Output, Type Conversions	3	1
	1.3	**Strings:** Creating and storing Strings, Accessing String Characters, Operations on Strings: Concatenation, Comparison, Slicing and Joining	4	1
	1.4	Concept of list, Tuples, set, dictionaries with examples	5	1
2	2.1	**Python Control Flow:** Types of Control Flow; Control Flow Statements- if, else, elseif	3	2
	2.2	**Program Loops:** while loop, break, continue statements, for loop Statement; range () and exit () functions	4	2

	2.3	**Python Functions:** Types of Functions; Function Definition-Syntax, Function Calling, Passing arguments, the return statement,	5	2
	2.4	**Recursive Functions**; special functions: zip, lambda, map, filter and generator functions	3	2
3	3.1	**Modules and Packages:** Built-in modules, creating modules, import statement, locating modules, Packages in Python, importing modules from a package. Python Libraries: Importing Libraries	4	3
	3.2	**Exception handling in Python**: basic concepts, try-except-else, try finally clause, argument of an exception, raising an exception, built-in exceptions, user-defined exceptions.	3	3
	3.3	**Regular Expressions:** basic concepts, Special characters, groups of characters, Re module, match(), search() methods.	4	3
	3.4	**Introduction to GUI -** Importing tkinter module, basic form window, widgets and its properties	4	3
4		**Practical (Any 5)** 1. Programs based on data types, Input & Output and Control Statements 2. Programs based on Arrays 3. Programs based on Strings 4. Programs based on Functions 5. Programs based on Lists and Tuples 6. Programs based on Dictionaries 7. Programs based on Classes and Objects 8. Programs based on Inheritance 8. Programs based on Polymorphism 9. Programs based on Exceptions 10. Programs based on Regular Expressions 11. Make a login from with tkinter	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **E. Continuous Comprehensive Assessment (CCA)** **Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.

	F. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Gowrishankar, S., and A. Veena. Introduction to Python programming. CRC Press, 2018.
2. Kamthane, Ashok Namdev, and Amit Ashok Kamthane. Programming and Problem Solving with Python. McGraw-Hill Education, 2020.

Suggested Readings

1. Programming and Problem Solving with Python, Ashok Namdev Kamthane, Amit Ashok Kamthane, McGraw Hill Education
2. John V Guttag. "Introduction to Computation and Programming Using Python", 2nd Edition, Prentice Hall of India.
3. Anurag Gupta, G P Biswas, Python Programming – Problem Solving, Packages and Libraries, McGraw Hill

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	AI for smart electronics					
Type of Course	**DSC A**					
Course Code	MG4DSCECT201					
Course Level	**200-299**					
Course Summary and Justification	This course aims to provide beginners with a foundational understanding of artificial intelligence concepts, including machine learning, neural networks, and natural language processing, empowering them to comprehend and appreciate the applications and implications of AI in diverse fields					
Semester	**4**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites	**Should have basic knowledge in computer programming.**					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the basics, types, approaches, and applications of AI	U	1,2
2	Illustrate the basics of neural networks and learning	U	1,2
3	Analyze the real-world applications of AI	An	1,2
4	Develop practical knowledge of AI and its application	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Understanding the basics of AI: definition, history, and Significance of AI in modern society. Ethical considerations	3	1
	1.2	Types of AI: Narrow AI, General AI, Generative AI	4	1
	1.3	Applications of AI in everyday life: Virtual Assistants, Online Shopping Recommendations, Social Media Algorithms, Language Translation Services, Navigation Apps , Smart home automation, AI Upscaling Smart Recommendation Systems (concept level only)	4	1
	1.4	Different Approaches: Modeling human problem solving, formal logics, mathematical optimization, simulating the human brain, statics and probability (concept level only)	4	1
2	2.1	Introduction to Machine Learning (ML)	4	2
	2.2	Supervised, Unsupervised, and Reinforcement Learning techniques (concept level only)	4	2

	2.3	Basics of neural networks: Artificial neuron, different layers of neural network	4	2
	2.4	Introduction to deep learning concept	3	2
3	3.1	Basic Requirement analysis Selection of proper hardware for specific applications , Selection of CPU and GPU	4	3
	3.2	Introduction to Computer vision, Basic Hardware and software requirement for Computer vision (Concept Level only).	4	3
	3.3	Natural language processing, Text to voice and voice to text tools, Expert suggestion systems (concept level only).	5	3
	3.4	Real world applications: Self driving cars, Traffic sign detection, Face-app, Customized object detection (STEMpedia, Concept level only)	2	3
4		**Practical (Any 2)** 1. Content creation with chat GPT, Effective prompt generation, Use AI tools for image creation (Midjourny Dall-E) 2. Design a simple chatbot using online platforms, Integration of Chat GPT with ESP32 3. Build a simple image recognition model using online ML platforms, AI based Object detection, Motion detection, AI Home automation (STEMpedia) 4. Experiment with pre-trained image modes, Online AI tools for training and simulation Gesture based gaming, AIR Draw Self driving car model, Number and pattern recognition (STEMpedia)	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **G. Continuous Comprehensive Assessment (CCA)** **3. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **4. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	H. Semester End examination a. 1.Written Test (50 marks)- Time : 1½ hours b. MCQ - 10 Marks (Answer all - 10x1=10 Marks) c. Short answer questions (4 out of 6 questions)-4x5=20 marks d. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Tegmark, Max. Life 3.0: Being human in the age of artificial intelligence. Vintage, 2018.
2. Nilsson, Nils J. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.

Suggested readings

1. Poole, David L., and Alan K. Mackworth. Artificial Intelligence: foundations of computational agents. Cambridge University Press, 2010.
2. Ng, Andrew. "Machine learning yearning." URL: http://www. mlyearning. org/(96) 139 (2017): 30.
3. Heaton, Jeff. "Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep learning: The MIT Press, 2016, 800 pp, ISBN: 0262035618." Genetic programming and evolvable machines 19.1-2 (2018): 305-307.
4. Nielsen, Michael A. Neural networks and deep learning. Vol. 25. San Francisco, CA, USA: Determination press, 2015.
5. Lee, Kai-Fu. AI superpowers: China, Silicon Valley, and the new world order. Houghton Mifflin, 2018.
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7. Tegmark, Max. Life 3.0: Being human in the age of artificial intelligence. Vintage, 2018.
8. Bishop, Christopher M. Pattern Recognition and Machine Learning by Christopher M. Bishop. Springer Science+ Business Media, LLC, 2006.
9. Tegmark, Max. Life 3.0: Being human in the age of artificial intelligence. Vintage, 2018

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	IOT System Design					
Type of Course	**DSC**					
Course Code	MG4DSCECT202					
Course Level	**200-299**					
Course Summary and Justification	This course focuses on imparting comprehensive knowledge and practical skills required to design, develop, and implement IoT systems.					
Semester	**4**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3			1	**75**
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Summarize the architecture and components of IoT systems	U	1,2
2	Explain the concept of Sensors , Actuators	U	1,2
3	Apply their knowledge of cloud services for IoT	A	1,2
4	Analyze and design IoT systems.	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	IoT- Introduction and definition	3	1
	1.2	Architecture and characteristics of IoT	4	1
	1.3	Things in IoT, Application areas	3	1
	1.4	Familiarization IoT Gadgets in daily life - IP Camera, smart lamp, smart FAN, Automated water pump	5	1
2	2.1	Basic operation and applications of sensors: gas sensor, obstacle sensor, heart beat sensor, gyro sensor, LDR sensor, PIR sensor.	8	2
	2.2	Types of actuators and examples: hydraulic, pneumatic, magnetic and mechanical(Concept level only)	7	2
	2.3	Protocols for IoT: Messaging protocols- MQTT (Activity: subscribe –implementation exercise), CoAP, XMPP and DDS	3	2
	2.4	Transport protocols-BLE, LiFi	2	2
3	3.1	Cloud for IoT: cloud services- AWS, Blynk , ThingSpeak and Firebase	5	3
	3.2	Types of IoT: Consumer IoT, Commercial IoT, Industrial IoT, Infrastructure IoT, Internet of Medical Things, AIoT	2	3

	3.3	Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, IoT using PLC technology	2	3
	3.4	Legal challenges, IoT design Ethics, IoT in Environmental Protection.	1	3
4		**IoT System Design (Practical) (10 experiment out of 20)** 1. Familiarization of development board ESP8266 (NodeMCU)/ESP32 and Blynk 2. Familiarization of IDE- Arduino IDE/ESPIDF 3. Blinking of a LED 4. Control LED using button switch 5. PIR sensor interfacing. 6. Ultrasonic sensor interfacing 7. Obstacle/infrared sensor interfacing 8. LM 35 interfacing: Read temperature and display the measurement in serial monitor 9. Interface DHT 11 sensor and display the output in serial monitor 10. Soil moisture sensor interfacing 11. Rain drop sensor interfacing 12. Bluetooth module interfacing (Serial monitor can be used to observe output 13. Generate PWM signal and observe the output in a CRO 14. Brightness control of LED using PWM 15. servo motor interfacing 16. OLED display interfacing 17. LM 35 interfacing: Read temperature and display the measurement in serial monitor 18. Interface DHT 11 sensor and display the output in serial monitor 19. Soil moisture sensor interfacing 20. Rain drop sensor interfacing **(Any one Experiment is mandatory)** 1. LED/Device control using Blynk server/app 2.LED/Device control using ThingSpeak	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.

	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours e. MCQ - 10 Marks (Answer all - 10x1=10 Marks) f. Short answer questions (4 out of 6 questions)-4x5=20 marks g. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Hakima Chaouchi, — The Internet of Things Connecting Objects to the Web, Wiley Publications
2. Jain, Satish, Shashi Singh, and M. Geetha. BPB COMPUTER COURSE-WIN 10/OFFICE 2016. BPB Publications, 2018.

Suggested Readings

1. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
3. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.
4. Shriram K Vasudevan, Abhishek Nagarajan, RMD Sundaram Internet of Things, Wiley India
5. Prof. Satish Jain, Shashi Singh,IoT and its Applications BPB publication

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	ARM Based Embedded Systems					
Type of Course	**DSE**					
Course Code	MG4DSEECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides a comprehensive understanding of embedded system design using ARM architecture. It covers the fundamental concepts, programming methodologies and practical applications in the development of embedded systems					
Semester	**4**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites	Knowledge in Basic electronic Concepts					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the role of ARM architectures in embedded systems	U	1,2
2	Demonstrate a comprehensive understanding of ARM Architecture	U	1,2
3	Explain the interfacing of ARM microcontrollers with various peripherals effectively	U	1,2,10
4	Develop embedded system projects using ARM	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to Embedded Systems- The RISC and CISC design, ARM design philosophy.	3	1
	1.2	ARM Processor Families and Features -ARM7, ARM9, ARM10, ARM11 Series, Specialized processors.	3	1
	1.3	Introduction to ARM Assembly language Programming, -Basic Instruction set -Data processing, Arithmetic, logical and branching instructions (Detailed analysis not required), Program Development Tools - Simulator, Emulator, Integrated Development Environment (IDE)	5	1

	1.4	Embedded C Programming for ARM- Overview of C Compilers and Optimization, Basic C data types, C Looping Structures, Branching, Register Allocation, Function Calls	4	1
2	2.1	Technical overview of ARM Cortex-M Architecture, Modes of operations of ARM.	3	2
	2.2	Memory System, Memory organization, Register organization	4	2
	2.3	An overview of AMBA Bus Architecture, Status Register,	4	2
	2.4	Exception and Interrupts- ARM processor Exceptions and Modes, Vector Table, Interrupts, Interrupt Latency, IRQ and FIQ Exceptions	4	2
3	3.1	Embedded System Design Principles-Define modules, board support and package and device drivers, Design method using finite state machine.	3	3
	3.2	I/O Interfacing and Peripherals -General purpose I/O interfaces-Toggling LED, reading, masking specific pin of output, ON-OFF control, Understanding Interrupt Operation, Interfacing Sensors-IR, Temperature.	5	3
	3.3	Timers and Counters-Input Capture, Output compare, PWM, Frequency Measurement(With time period calculation)	4	3
	3.4	An overview of Communication Interfaces (UART, SPI, I2C, USB)	3	3
4		**Hands on session- Interfacing with ARM Cortex M** GPIO Control- 1. On Off Control of LEDs and switches, 2. LED blinking using Interrupts. 3. Sensor Interface [Temperature sensor(NTC and LM 35), IR Sensor] 4. Implementing wireless communication using Bluetooth Interface-HC-06 and ESP8266/ESP32. 5. Interactive simulation with proteus **The session should involve writing code in Keil 5 or Arduino IDE with ARM library and simulating the circuits in Proteus Simulator for simulation based experiments. For hardware based session deploy the code onto the actual ARM boards(Cortex M3,ARM 7, STM 32)**	7 8	4
5		Teacher specific content		

Software Requirements for hands-on session*: Keil 5, Arduino IDE with ARM library and PROTEUS Simulator.*

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks 1. Internal Test – One MCQ based and one extended answer type- 10 Marks 2. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks 3. Case Studies/Projects/Site visit/others - 10
	B. Semester End examination 1.Written Test (70 marks) Time : 1½ hours 1. MCQ - 20 Marks 2. Short answer questions (6 out of 8 questions)-6x5=30 marks 3. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Sloss, Andrew, Dominic Symes, and Chris Wright. ARM system developer's guide: designing and optimizing system software. Elsevier, 2004.
2. Yiu, Joseph. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors. Newnes, 2013.

Suggested Reading

1. Valvano, Jonathan W. Embedded systems: introduction to ARM® Cortex (TM)-M microcontrollers. Jonathan W. Valvano, 2014.
2. Mazidi, Muhammad Ali, et al. Freescale ARM Cortex-M Embedded Programming (Volume 3). MicroDigitalEd. com, 2016.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	3D Printing and its Applications					
Type of Course	**DSE**					
Course Code	MG4DSEECT201					
Course Level	**200-299**					
Course Summary and Justification	This course provides a comprehensive exploration of Additive Manufacturing (AM) and 3D Printing					
Semester	**4**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites	This foundational knowledge should include an understanding of geometric concepts, basic electronic principles					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Demonstrate the fundamental principles of 3D printing	U	1,2
2	Explain the process of 3D printing from design to production	U	1,2
3	Analyze and evaluate the diverse applications of 3D printing	An	1,2
4	Adapt practical skills and knowledge for a career in additive manufacturing	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Unit)

Module	Unit	Course description	Hours	CO No.
1	1.1	Evolution of 3D Printing, Basics of 3D printing process	2	1
	1.2	Types of 3D printing or (Navigating the Additive manufacturing(AM) Process Spectrum and materials) - Extrusion, Vat Photo polymerization based printing, Powder-based printing Material Jetting, Binder Jetting , Droplet-based printing, Directed Energy Deposition, Lamination.	4	1
	1.3	Introduction to Additive and subtractive manufacturing, principles for AM, The Additive Manufacturing Workflow	5	1
	1.4	Applications of 3D printing, Industry	4	1
2	2.1	Introduction to AM Software and Computational Design-Principles of Computational Design for AM, Computational Design of a key chain.	4	2

2	2.2	3D model software(Any two)- Generative Design, Auto desk Fusion 360 (students version), FreeCAD, TinkerCad, Soildworks (students version)	4	2
	2.3	Advanced Topology Optimization for AM	4	2
	2.4	Advanced Topics in computational design-Simulation based design optimisation, Integration of AI in design	3	2
3	3.1	Framing the Applications of AM, Prototyping , Tooling, Performance Improvement	4	3
	3.2	Production or Build Preparation Software - Overview of production Software, Data representation in AM	4	3
	3.3	3D printer components and operation, 3D printer calibration, Customization and Personalization, Spare Parts, Maintenance and Repair, The Growing AM Infrastructure	3	3
	3.4	Applications, Current advancements in 3D printing, Bio Printing , The Digitization of Production	4	3
4	4.1	The 3D Printer Kit : Deep Dive	4	4
	4.2	Design for manufacturability, Wall thickness, Support structures, Infill	4	4
	4.3	Common 3D printing problems	3	4
	4.4	Troubleshooting techniques, Preventative maintenance	4	4
5		**Teachers Specific Content**		

"Required CAD Software: Autodesk Fusion 360 (cloud-based CAD Design software). Fusion 360 is free for students" or any other similar software.

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks 1. Internal Test – One MCQ based and one extended answer type- 10 Marks 2. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks 3. Case Studies/Projects/Site visit/others – 10
	B. Semester End examination Written Test (70 marks) Time : 1½ hours 1. MCQ - 20 Marks 2. Short answer questions (6 out of 8 questions)-6x5=30 marks 3. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Gibson, Ian, et al. Additive manufacturing technologies. Vol. 17. Cham, Switzerland: Springer, 2021.
2. Redwood, Ben, Filemon Schffer, and Brian Garret. The 3D printing handbook: technologies, design and applications. 3D Hubs, 2017.

Suggested readings

1. Spady, W.G.(1994). Outcome based education: Critical issues and answers. American Association of School Administrators

2. Spady, W.G.(2020). Outcome-based education's empowering essence: Elevating learning for an awakening world. Mason Works Press
3. Anderson, L. W., & Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Longman.
4. Generative Design: A Paradigm for Design Exploration by Carlo E. Ratti and Matthew Claudel.
5. Killi, Steinar Westhrin. Additive manufacturing: design, methods, and processes. CRC Press, 2017.
6. Chua, Chee Kai, and Kah Fai Leong. 3D Printing and additive manufacturing: Principles and applications (with companion media pack)-of rapid prototyping. World Scientific Publishing Company, 2014.
7. Gibson, Ian, et al. Additive manufacturing technologies. Vol. 17. Cham, Switzerland: Springer, 2021.
8. Horvath, Joan, and Rich Cameron. Mastering 3D printing. Berkeley, CA: Apress, 2014.
9. Hayner, Crystal L. An Examination of the Myriad of Skills Properties Artisans Utilize and How They Are Attained. Louisiana State University and Agricultural & Mechanical College, 2022.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**
Course Name	Data Science for AI **(Specialization: AI and Machine Learning)**
Type of Course	DSE
Course Code	MG4DSEECT202
Course Level	**200-299**
Course Summary and Justification	Deep Learning is a very popular nowadays. It can handle many different types of data. This course will cover the mathematics and intuition behind the Deep Learning.

Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60

Pre-requisites	Knowledge of Python Language, Machine Learning Algorithms

Course Outcome

CO No.	Expected Course Outcome	Learning Domain*	PSO No.
1	Understand convolution and how it is used for Deep Learning	U	2,3,9,10
2	Apply CNNs to Natural Language Processing (NLP)	A	3,4,10
3	Understand and explain the architecture of a convolutional neural network (CNN)	An	1,3
4	Knowledge of the intuition behind of each architecture	An	1,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Unit)

Module	Unit	Course description	Hours	CO No.
1	1.1	Floating point numbers, Tensors: Multidimensional Arrays, Indexing Tensors	3	1
	1.2	Named tensors, Tensor element types, Tensor API, the different storage capabilities	4	1
	1.3	Tensor metadata: Size, offset and stride, Moving tensors to GPU	3	1
	1.4	Working with images, 3D images and volumetric data	5	1
2	2.1	Convolutional Layer – Local Connectivity, spatial arrangement: depth, stride, zero padding	3	2

	2.2	Convolution over images: 1D and 3D, 1x1 convolution, Dilated convolution	4	2
	2.3	Pooling Layer – Max pooling and general pooling,	3	2
	2.4	Fully connected layer, Convnet Architectures – Layer patterns, Layer sizing patterns	5	2
3	3.1	What is RNN? How it differs from Feed forward Networks? Recurrent Neuron and Unfolding	3	3
	3.2	Types of RNNs, Back propagation through Time (BPTT)	4	3
	3.3	Long Short Term Memory (LSTM) and its working	4	3
	3.4	Generative Learning, Auto encoder Machine Learning	4	3
4	4.1	What is attention Mechanism? Need for attention mechanism? High Level Overview of attention Mechanism	3	4
	4.2	How does attention mechanism work?	3	4
	4.3	Types of Attention: Self Attention, Multi Head Attention	4	4
	4.4	Cross Attention, Casual Attention, Global Vs Local attention	5	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks 1. Internal Test – One MCQ based and one extended answer type- 10 Marks 2. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks 3. Case Studies/Projects/Site visit/others – 10 Marks
	B. Semester End examination 1.Written Test (70 marks) Time : 1½ hours a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 mark c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Eli Stevens, Luca Antiga, Thomas Viehmann , “Deep Learning with Pytorch”, Manning
2. CosmaRohillaShalizi, “Advanced Data Analysis from an Elementary Point of View”, 2015.
3. Deng & Yu, “Deep Learning: Methods and Applications”, Now Publishers, 2013.
4. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

Suggested Readings

1. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Single Board Computers for IoT Applications					
Type of Course	DSE					
Course Code	MG4DSEECT203					
Course Level	**200-299**					
Course Summary and Justification	This course introduces the various single board computers available for IoT applications. The course deals with the architecture, programming and interfacing of various single board computers. This course equip the student to design a practical system for IoT applications					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites	Knowledge of Digital Electronics, Basic Programming Skill					

Course Outcome

CO No.	Expected Course Outcome	Learning Domain*	PSO No.
1	Understand the architecture and programming of single board computers	U	2,3
2	Expertise the interfacing of various single board computers	A	2,3,5,9,10
3	Expertise of simulation software OCTAVE, MATLABs	A	2,3,5,9,10
4	Live interaction with single board computers	S	1,2,3,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Unit)

Module	Unit	Course description	Hours	CO No.
1	1.1	Arduino Uno Architecture	3	1
	1.2	Setup for IDE, Programming using Embedded C	3	1
	1.3	Interfacing with LEDs, push button and sensors	3	1
	1.4	Introduction to ESP8266 Wi-Fi Module, interfacing with Web Services	3	1
2	2.1	Introduction to Raspberry Pi and Architecture, Pin Assignments and onboard components	3	2
	2.2	Raspbian OS- installation, Linux command familiarization	3	2
	2.3	Basic operations of the Raspberry Pi, Working with Python	5	2

	2.4	General Purpose I/O (GPIO) and their control using Python, Introduction to networking in relation to IoT applications, Communication between Raspberry Pi and IoT-based Clouds	7	2
3	3.1	TinkerBoard, BeagleBone, LattePanda- Architecture and features	2	3
	3.2	LattePanda, NVIDIA Jetson Nano - Architecture and features	2	3
	3.3	OS Description and programming	3	3
	3.4	IoT applications	8	3
4	4.1	Familiarization, programming and IoT Applications of SBCs	30	4
	4.2	• Familiarization of Raspberry Pi SBC- Simple experiments and IoT Applications • Familiarization of TinkerBoard and BeagleBone SBC- Simple experiments and IoT Applications		
	4.3	Group Project on IoT applications using any of the above SBCs		
	4.4	Software Simulation Assignment Based on module 4		
5		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks 1. Internal Test – One MCQ based and one extended answer type- 10 Marks 2. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks 3. Case Studies/Projects/Site visit/others – 10 Marks
	B. Semester End examination 1.Written Test (70 marks) Time : 1½ hours a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Arduino Book for Beginners, Mike Cheich, Programming Electronics Academy
2. Raspberry Pi Cookbook, 4th Edition by Simon Monk, O'Reilly Media, Inc.
3. Practical Tinker Board: Getting Started and Building Projects with the ASUS Single-Board Computer by Liz Clark, Apress.

Suggested Reading

1. Internet of Things with Arduino Cookbook, Marco Schwartz, Packt Publishing
2. Internet of Things with Arduino & Bolt Ashwin Pajankar, BPB Publishers.
3. Exploring BeagleBone - Tools and Techniques for Building with Embedded Linux 2nd edition by Derek Molloy, Wiley.
4. Programming the Beaglebone Paperback by Yogesh Chavan
5. IoT Projects with NVIDIA Jetson Nano: AI-Enabled Internet of Things Projects for Beginner, by Agus Kurniawan, Apress

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Robotics					
Type of Course	DSE					
Course Code	MG4DSEECT203					
Course Level	**200-299**					
Course Summary and Justification	This course provides learners with a comprehensive understanding of industrial automation, covering key components, PLC programming, robotic systems, and hands-on skills in designing automated systems.					
Semester	**4**	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites	Basic knowledge in Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the principles and applications of Robotics and Automation	U	1,2
2	Apply automation techniques using PLC	A	1,2
3	Analyze and troubleshoot automation systems in real-world scenarios	An	1,2,10
4	Design and develop automated solutions for specific tasks	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	What is a robot, sensing and programming, types of automation, generations, human vs robots	3	1
	1.2	The mechanical arm – types of joints – prismatic, revolute and ball and socket joints, Degrees of freedom, classification of robots by types of joints , Cartesian and cylindrical, spherical, horizontally articulated, vertically articulated	5	1
	1.3	Comparison of robots work envelops, suitability for particular tasks, link construction	4	1
	1.4	Robot arm drive units – Electric, hydraulic, pneumatic. Direct and indirect drives	3	1

2	2.1	Industrial automation- Definition, Purpose, Different types, Industry Standard- Industry 4.0	2	2
	2.2	Sensors - Basic concepts of piezoelectric sensor, IR proximity sensor. PIR Sensor	2	2
	2.3	Motors - Basic concepts of Servo Motors and Stepper Motors.	6	2
	2.4	Actuators - Basic concepts of Electrical Actuators	5	2
3	3.1	Different types of PLCs, Basic programming, basics of Ladder Logic	5	3
	3.2	Introduction to PLC -Inputs and Outputs, Types of I/O Modules	4	3
	3.3	PLC interfacing with LED and Motor	2	3
	3.4	PLC interfacing with PIR Sensors	4	3
4	4.1	Control systems and their role in robotics, Example of closed loop control system - Automatic water level system	6	4
	4.2	Components of an Automatic conveyor belt mechanism	5	4
	4.3	Robotics in industry- pick and place, spot welding	4	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks 4. Internal Test – One MCQ based and one extended answer type- 10 Marks 5. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks Case Studies/Projects/Site visit/others – 10 Marks
	B. Semester End examination 1.Written Test (70 marks) Time : 1½ hours d. MCQ - 20 Marks e. Short answer questions (6 out of 8 questions)-6x5=30 marks Essay questions -2 out of 4 - 2x10=20 marks

References

1. Shoham, Moshe. *A Textbook of Robotics 1: Basic Concepts*. Springer Science & Business Media, 2012.
2. Merat, Frank. "Introduction to robotics: Mechanics and control." IEEE Journal on Robotics and Automation 3.2 (1987): 166-166.
3. Chakraborty, Kunal, Palash De, and Indranil Roy. Industrial applications of programmable logic controllers and scada. Anchor Academic Publishing, 2016.

Suggested readings

1. Ghosal, Ashitava. Robotics: fundamental concepts and analysis. Oxford university press, 2006.
2. Lin, Patrick, Keith Abney, and George A. Bekey, eds. Robot ethics: the ethical and social implications of robotics. MIT press, 2014.
3. Yamamoto, Ikuo. Practical robotics and mechatronics: marine, space and medical applications. Institution of Engineering and Technology, 2016.
4. Shell, Richard. Handbook of industrial automation. CRC press, 2000.
5. Lamb, Frank. Industrial automation: hands-on. McGraw-Hill Education, 2013.
6. Jack, Hugh. Automating manufacturing systems with PLCs. Lulu. com, 2009.
7. Petruzella, Frank. Programmable logic controllers. McGraw-Hill, Inc., 2004.

Mahatma Gandhi University
Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Continuous and Discrete Systems					
Type of Course	DSE					
Course Code	MG4DSEECT205					
Course Level	**200-299**					
Course Summary and Justification	This course provides essential understanding of continuous and discrete electronic systems.					
Semester	4	**Credits**			4	
Course details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**Total Hours**
		3		2		75
Pre-requisites	Knowledge in basic electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Illustrate the basic concept of BJT and its amplifier configuration.	U	1,2
2	Analyse the properties and applications of operational amplifiers	U	1,2
3	Summarize the design and operation of registers and counters.	An	1,2
4	Develop hands-on circuits that involve the design, implementation, and testing.	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Bipolar Junction Transistor, Operating point of BJT ,Modes of Operation, Voltage divider biasing, RC Coupled Amplifier	7	1
	1.2	Principle of Sinusoidal Oscillators - Barkhausen Criteria, RC Phase Shift Oscillator.	5	1
	1.3	Block diagram representation of a typical op-amp – schematic symbol - A general purpose IC Op amp – IC 741, pin diagram. Op-Amp parameters - input offset voltage and offset current, common mode rejection ratio (CMMR), slew rate.	1	1
	1.4	Equivalent circuit of an op-amp, Open-loop op-amp Configurations, Closed-loop non-inverting and inverting amplifiers.	2	1
2	2.1	Op-amp Circuits performing mathematical operations- adder, subtractors, Integrator, Differentiator	4	2
	2.2	Op-Amp based oscillator circuits: Wein Bridge Oscillator – Colpitts Oscillator, Phaseshift Oscillator	4	2
	2.3	Active filters using op-amp (High pass, Low pass, Band pass Filters), Ideal and Practical characteristics	3	2
	2.4	Non-linear Applications – Comparator Introduction to NE555, astable multivibrator using 555	4	2,3

3	3.1	Introduction to Number Systems: Binary, decimal, octal, and hexadecimal systems, 1's complement, 2's complement, Binary Addition, subtraction	3	3
	3.2	Familiarization of Logic Gates and Boolean Algebra (Rules, Laws and Theorems), K-map simplification using SOPs. Half adder, Full Adder.	4	3
	3.3	Introduction to Flip-Flop ,types- SR, D, JK, T Serial in Serial out Shift registers	4	3
	3.4	Counters : Ring counter, Johnson counter and applications, 2 bit Synchronous counter , Asynchronous Decade Counter	4	3
4	4.1	**Practical using Components and ICs (Any 4)** 1. Op-amp – Square Wave Generator 2. Op-amp – Digital/Analog Converter 3. Op-amp –Summing Amplifier 4. OP-Amp – inverter, non-inverter, buffer Amplifier 5. Op-amp Phase Shift Oscillator 6. Astable multivibrartor using 555	30	4
	4.2	**Digital (Any 4)** 7. Realization of logic gates – AND, OR and NOT – Using universal gates 8. Half Adder 9. Full adder 10. Verification of De Morgan's theorems – Using IC 7400 11. JK Flip Flops using IC 7400 & 7410 – Verification of truth table 12. 2 bit synchronous counter		
5		**Teacher specific content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **5. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **6. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour a. Viva b. Lab report c. Demonstration

References

1. Mottershead, Allen. Electronic devices and circuits. Goodyear Publishing Company, 1973.
2. Gayakwad, Ramakant A. "Op-amps and linear integrated circuit." (2012).
3. Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.

Suggested Readings

1. Malvino, A. P., & Leach, D. P. (2017). "Digital Principles and Applications." Tata McGraw-Hill Education.
2. Millman, Jacob. Electronic Devices and Circuits [by] Jacob Millman [and] Christos C. Halkias. McGraw-Hill, 1967.
3. Pandiankal Abhilash : Filters :ebook – kindle edition:- kindle stor

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Wireless Technology					
Type of Course	DSC B					
Course Code	MG4DSCECT203					
Course Level	200-299					
Course Summary and Justification	This course introduces wireless communication principles, provides hands-on experience with RF systems, and culminates in a project to apply acquired knowledge. The course aims to foster critical thinking, problem-solving skills, and creativity, preparing learners for advanced studies in modern RF system design.					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites	Foundational knowledge in electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
1	Understand the basics of wireless communication	U	1,2
2	Gain detailed knowledge of RF systems	U	1,2
3	Learn to analyze and implement SDR systems,	U	1,2,10
4	Discuss the Integration of Theory and Practical Application	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to Wireless Communication: History and evolution, Applications and benefits	3	1
	1.2	Basic Concepts: Frequency, bandwidth, and signal types, Modulation and demodulation techniques	4	1
	1.3	Wireless Communication Channels: Path loss, fading, and interference, Noise and its effects	4	1
	1.4	Wireless Communication Systems: Cellular networks, Wi-Fi, Bluetooth, and other personal area networks	4	1
2	2.1	RF Fundamentals: Introduction to RF systems, RF spectrum and regulations	5	2
	2.2	RF Components and Circuits: Antennas, amplifiers, and filters, Oscillators and mixers	4	2

	2.3	Communication Standards: Overview of major standards (GSM, LTE, 5G, Wi-Fi), Protocols and their applications	2	2
	2.4	Design and Implementation: Basics of RF circuit design, Simulation tools and techniques	4	2
3	3.1	Introduction to Software Defined Radio (SDR): Definition and advantages of SDR, SDR architecture and components	4	3
	3.2	SDR Implementation: Software and hardware platforms (GNU Radio, USRP, etc.)	4	3
	3.3	Applications of SDR: Cognitive radio and dynamic spectrum access, SDR in modern communication systems	3	3
	3.4	Security in SDR, Future trends and developments.	4	3
4	4.1 4.2	**Practicals (**Any 3) 1. Bluetooth (HC-05) interfacing with Arduino/ESP32 2. WiFi (ESP8266) interfacing with Arduino/ESP32 3. NFC (PN532) based card reader using Arduino/ESP32 4. GPS (NEO 6M GPS) based position tracking implemented using Arduino/ESP32 5. 5.4G (A7672S) network access using Arduino/ESP32 **OR** Group activities (any 2) 1. Compare various wireless communication technologies such as Wi-Fi, Bluetooth, and cellular networks 2. Design and test a basic RF circuit, such as an RF amplifier or filter 3. Analyze different communication standards (e.g., GSM, LTE, 5G, Wi-Fi) 4. Implement a simple SDR transceiver using GNU Radio and USRP 5. Perform spectrum analysis of a chosen frequency band using SDR	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal)** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 25 Marks 1. Internal Test – One MCQ based and one extended answer type- 15 Marks 2. Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar - 10 Marks Practical : 8 Marks 1.lab: A combination of quizzes, assignments - 2 Marks 2.Performance - 3 Marks Case Study - 3 Marks
	B. Semester End examination 1.Written Test (50 marks) Time : 1½ hours a. MCQ - 10 Marks

	b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (17 marks) (Internal) Time : 2 hours a. Viva - 9 marks b. Lab report - 3 marks c. Demonstration - 5 marks

References

1. T. S. Rappaport, "Wireless Communications: Principles and Practice," Prentice Hall, 2001.
2. Bowick, Christopher. *RF circuit design*. Elsevier, 2011.
3. Wyglinski, Alexander M., Robin Getz, Travis Collins, and Di Pu. *Software-defined radio for engineers*. Artech House, 2018.

Suggested Reading

1. J. G. Proakis and M. Salehi, "Communication Systems Engineering," Pearson, 2013.
2. D. M. Pozar, "Microwave Engineering," Wiley, 2012.
3. R. E. Collin, "Foundations for Microwave Engineering," McGraw-Hill Education, 2001.
4. A. Molisch, "Wireless Communications," Wiley, 2011.
5. A. S. Huang and L. Rudolph, "Bluetooth Essentials for Programmers," Cambridge University Press, 2007.
6. R. Heydon, "Bluetooth Low Energy: The Developer's Handbook," Prentice Hall, 2012.
7. F. Ohrtman, "Wi-Fi Handbook: Building 802.11b Wireless Networks," McGraw-Hill, 2000.
8. S. S. Miller, "Wi-Fi Security," McGraw-Hill, 2003.
9. S. Farahani, "ZigBee Wireless Networks and Transceivers," Newnes, 2008.
10. Zigbee Alliance, "ZigBee-2007 Specification."
11. V. Coskun, K. Ok, B. Ozdenizci, "Near Field Communication (NFC): From Theory to Practice," Wiley, 2012.
12. E. D. Kaplan and C. Hegarty, "Understanding GPS: Principles and Applications," Artech House, 2006.
13. P. Misra and P. Enge, "Global Positioning System: Signals, Measurements, and Performance," Ganga-Jamuna Press, 2006.
14. W. Stallings, "Wireless Communications and Networks," Prentice Hall, 2004.
15. L. Korowajczuk, "LTE, WiMAX and WLAN Network Design, Optimization and Performance Analysis," Wiley, 2011

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Computer Organization					
Type of Course	DSC B					
Course Code	MG4DSCECT204					
Course Level	200-299					
Course Summary and Justification	This course describes the design concepts of a computer system.					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites	Foundational knowledge in digital electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No.
1	Understand the fundamental structure and operation of computers	U	1
2	Understand and apply the principles of control organization, number systems, logic gates, Boolean algebra, and I/O organization	UA	1,2
3	Understand and apply DeMorgan's theorems and Karnaugh Maps to simplify logic expressions, and design combinational and sequential circuits	UA	1,2
4	Demonstrate the ability to implement and verify basic digital logic circuits, including gates, adders, multiplexers, decoders, flip-flops, counters, and memory systems.	A	2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Basic Structure of computers – functional units - basic operational concepts - data representation - instruction execution, and memory hierarchy - bus structures- addressing modes.	3	1
	1.2	Memory system: basic concepts – semiconductor RAMs. memory system considerations interfacing memory with CPU- memory map- ROMs, cache memory, mapping Techniques	5	1
	1.3	Arithmetic algorithms: Adder and subtractor units - Booth's multiplication algorithm - access.	5	1

2	2.1	Control organization – Hardwired control-microprogram control of processor unit – Microprogram sequencer, micro programmed CPU organization - I/O organization: accessing of I/O devices – interrupts, interrupt hardware -Direct memory access	5	2
	2.2	Number Systems, Decimal, Binary, Octal and Hexadecimal), Conversion-From one number system to another,. Concept of binary addition and subtraction- 1's Complement , 2's complement, Subtraction using 1's and 2's Complement- BCD numbers- concept and addition	5	2
	2.3	Logic gates- AND, OR, NOT, NAND, NOR, XOR and XNOR. Truth tables - Basic laws of Boolean Algebra, Simplification of Expressions	3	2
3	3.1	DeMorgan's theorems, Simplification of expressions using K-MAP (up to 4 variables)	3	3
	3.2	Combinational Logic Circuits : Adders-Half adder, Full adder – parity generator- Encoders- Decoders- Multiplexers – Demultiplexers	8	3
	3.3	Sequential - Logic Circuits: Flip flops- Latch, Clocked, RS, JK, T, D, Triggering of flip flops, Master Slave flip flops - Concept of Registers, Shift Registers- SISO, SIPO, PISO, PIPO	5	3
4	4.1 4.2	**Practicals** 1. Familiarization of logic gates and verification of truth tables 2. Implementation of a logic equation using gates. 3. Verification of DeMorgan's Theorem 4. Implementation of logic gates using universal gates. 5. Implementation of flip flop using gates 6. Verification of flip flop IC, truth table states. 7. Implementation of Half Adder 8. Implementation of Full Adder 9. Implementation of 3 to 8 decoder 10. Implementation of seven segment display. 11. Implementation of 8:1 multiplexer 12. Implementation of 1:8 demultiplexer 13. Implementation of 3 bit counter 14. Understanding shift operations. 15. Implementation of a 4 bit memory system	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ICT Enabled lectures, Group discussion, Peer discussion, Lab exercises
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** 1. Written test 2. Assignments **CCA for Practical: 15 Marks** 1. Practical assignments

	2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination **ESE for Theory: 50 Marks (1.5 Hrs)** **Written Test(50 Marks)** Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) **ESE for Practical: 35 Marks (1.5 Hrs)** 1. Viva - 15 Marks 2. Demonstration - 10 Marks 3. Record - 10 Marks **Semester End examination** 1.Written Test (50 marks) MCQ - 10 Marks Short answer questions (4 out of 6 questions)-4x5=20 marks Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (17 marks) (Internal) Viva - 9 marks Lab report - 3 marks Demonstration - 5 marks

REFERENCES

1. Carl Hamachar, ZvoncoVranesic and SafwatZaky(2019).Computer Organization (6th edition). McGraw Hill.
2. Thomas L Floyd- Digital Fundamentals, Ninth edition, PEARSON Prentice Hall.

SUGGESTED READINGS

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier.
2. John P. Hayes, Computer Architecture and Organization, McGraw Hill.William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education
3. Thomas C Bartee- Digital Computer Fundamentals, Sixth Edition, TATA McGraw Hill Edition

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Programme						
Course Name	Circuit Simulation and PCB Design					
Type of Course	SEC					
Course Code	MG4SECECT200					
Course Level	200-299					
Course Summary and Justification	This course provides a comprehensive exploration of fundamental concepts and practical skills in the field of circuit design and PCB simulation. Electronics					
Semester	4	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites	Should have a foundational knowledge in Basic Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No.
1	Explain the basics of PCB designing	U	1,2,10
2	Apply advanced techniques, skills and modern tools for designing and fabrication of PCBs	A	1,2,10
3	Analyze and troubleshoot common issues in PCB designs	An	1,2,10
4	Discuss concepts of Printed Circuit Board Fabrication	C	1,2,3,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Fundamentals of Printed Circuit Board Design. Electronic Components and Schematic Capture	2	1
	1.2	Various types of Printed Circuit Boards-Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards.	2	1
	1.3	Study of SMD Components.	4	1
	1.4	Substrate Material Selection, Layer Stackup, Copper Cladding	4	1
2	2.1	Design rules for Digital circuit PCBs, Analog circuit PCBs	2	2
	2.2	High frequency and fast pulse applications. IPC standards for schematic, designing	2	2

	2.3	Design Issues: Transmission line, Cross talk and Thermal management	3	2
	2.4	Copper Etching- Photoresist Application, Exposure and Development, Etching	4	2
	2.5	Drilling and Plating - Through-Hole Drilling, Automated Drilling Machines, Through-Hole Plating	4	2
3	3.1	Brief Introduction of various simulators, EasyEDA, Proteus, ki CAD (Any One)	4	3
	3.2	Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing	4	3
	3.3	PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silkscreen) to design, Creating report of design	4	3,4
	3.4	Creating manufacturing data (GERBER) for design	3	3,4
	3.5	PCB Assembly (SMT and Through-Hole) - Surface Mount Technology (SMT), Through-Hole Assembly	3	4
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 2. Assignment - 5 3. Case Study/Project/ Site Visit/Workshop/Internship- 10
	Semester End examination 1.Written Test (50 marks) Time : 1½ hours MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5:- 3x5)

References

1. Khandpur, Raghbir Singh. "Printed Circuit Boards Design, Fabrication, and Assembly." (2006).
2. Bosshart, Walter C., Arvind Shah, and S. R. Bhat. Printed circuit boards: design and technology. Tata McGraw-Hill, 1983.

Suggested Readings

1. Coombs, Clyde F. "Printed circuits handbook." (2001).

Mahatma Gandhi University Kottayam

Programme						
Course Name	PCB Design & 3D Printing					
Type of Course	SEC					
Course Code	MG4SECECT201					
Course Level	**200-299**					
Course Summary and Justification	This course offers learners a comprehensive understanding and practical skills in PCB design and 3D printing. With a focus on hands-on experience, learners will develop critical thinking, problem-solving abilities, and effective communication skills essential for various engineering and design applications.					
Semester	4	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		45				45
Pre-requisites	Knowledge in Basic Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Explain the principles of PCB design	U	1,2
2	Summarize 3D printing technologies and processes	U	1,2
3	Examine the Integration of PCB Design and 3D Printing process	An	1,2,10
4	Evaluation and Optimization of PCB/3D Printed Designs	E	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Fundamentals of Printed Circuit Board Design. Overview of electronic components and their functions	4	1
	1.2	Introduction to EDA software. (Altium[1]/Eagle/Proteus). Hands-on Lab: Designing a simple PCB	4	1
	1.3	Advanced PCB concepts. Various types of Printed Circuit Boards-Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards	4	1
	1.4	Study of Packages of Electronic Components. Study of SMD Components. Process of PCB design and product development flow Design rules for PCBs	3	1
2	2.1	3D Printing Techniques. Fundamentals of 3D printing	3	2

	2.2	Introduction to design software (TinkerCad, Fusion 360). Detailed exploration of 3D printing methods	4	2
	2.3	CAD softwares for 3D modeling. Hands-on Workshop: Complex 3D printing projects	3	2
	2.4	Design for 3D Printing. Guidelines for designing printable models	5	2
3	3.1	Case Studies in Integration, Analyzing real-world examples, Identifying challenges and solutions	8	2,3,4
	3.2	Collaborative Project, Design and build a prototype integrating PCB and 3D printing, Team-based collaboration	1,2	3,4
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 Marks 2. Assignment – 5 Marks 3. Case Study/Project/ Site Visit/Workshop/Internship- 10 Marks
	B. Semester End examination 1.Written Test (50 marks) Time : 1½ hours MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5:- 3x5)

References

1. Owen, Tony. "The Art Of Electronics , by Paul Horowitz and Winfield Hill Cambridge University Press, Cambridge, 1990, 1, 125 pages, including index
2. Williams, Tim. The circuit designer's companion. Elsevier, 2004.

Suggested Readings

1. Evans, Brian. Practical 3D printers: The science and art of 3D printing. Apress, 2012.h
2. Gebhardt, Andreas. "Understanding additive manufacturing." (2011).

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Programme						
Course Name	Solar Technology and Applications					
Type of Course	**SEC**					
Course Code	MG4SECECT202					
Course Level	**200-299**					
Course Summary and Justification	This course is designed to meet the growing demand for skilled professionals in the renewable energy sector, specifically in the field of solar photovoltaic.					
Semester	4	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites	Knowledge in Basic Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Demonstrate the basics of PV based power plant	U	1,2
2	Develop a solar power plant based on the estimation of power requirement	C	1,2
3	Analyse and troubleshoot issues in solar power system	An	1,2
4	Design an expertise in the installation of Solar power plant	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Overview of Photovoltaic (PV) Technology- Introduction, History and Evolution of PV Technology	2	1
	1.2	Basic Principles of Solar Energy Conversion, Types and Modules	3	1
	1.3	PV Materials and Manufacturing Processes	2	1
	1.4	PV System Components and Configurations- Inverters, Charge Controllers, Different kinds of battery technology - Tubular, SMF, Li-ion battery	8	1
2	2.1	PV System Configurations: On-grid, Off-grid, and Hybrid Systems	2	2
	2.2	PV System Design- Site Assessment, Solar Resource Analysis, System Sizing, Design, and Performance Estimation	4	2

	2.3	MPPT Basic- MPPT Design with PO Algorithm, IC Algorithm, Fuzzy logic (Basic Ideas only)	4	2
	2.4	Electrical Wiring and Connection in Solar Installations. Safety Practices, Regulations, Economic and Environmental Aspects of Solar Power	5	2
3	3.1	Basics of Solar PV Powered Electric Vehicle System, Design and components of the solar water pumping system	4	1
	3.2	Performance Monitoring, Data Analysis, Maintenance and Troubleshooting of Solar PV Systems	3	3
	3.3	Emerging Trends and Innovations in Photovoltaic. Case Studies of Successful PV Implementations	4	1
	3.4	Practical Workshops: Maintenance Procedures and Analysis of PV Systems	4	3,4
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 2. Assignment - 5 3. Case Study/Project/ Site Visit/Workshop/Internship- 10
	B. Semester End examination 1.Written Test (50 marks) Time : 1½ hours MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5:- 3x5)

References

1. Solanki C.S, Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Prentice Hall India Learning Private Limited,2013
2. Ryan Mayfield, Photovoltaic Design & Installation For Dummies by Ryan Mayfield, For Dummies, 2019

Suggested Readings

1. Chenming, H. and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983
2. Chetan Singh Solanki, Solar Photovoltaics : Fundamentals Technologies And Applications,PHI Learning, 2015
3. D.P. Kothari, RENEWABLE ENERGY SOURCES AND EMERGING TECHNOLOGIES, PHI Learning; 3rd edition, 2022
4. Jay Warmke, Designing and Installing Solar PV Systems: Commercial and Large Residential Systems,Blue Rock Station LLC, 2022

Mahatma Gandhi University Kottayam

Programme						
Course Name	User Interface and User Experience for App Development					
Type of Course	**SEC**					
Course Code	MG4SECECT203					
Course Level	**200-299**					
Course Summary and Justification	This course on User Interface and User Experience for App Development equips students with a comprehensive understanding of UI/UX principles, enabling them to design aesthetically pleasing and user-friendly interfaces. The hands-on modules ensure practical application, fostering critical thinking and problem-solving skills essential for effective app development.					
Semester	4	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites	Knowledge in Basic Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Understand the principles of UI/UX design	U	2,3
2	Apply the basics of UI design in app development	A	2,4
3	Implement advanced UI design features effectively	A	2,5
4	Analyze and adhere to UI design rules for optimal user experience	A	1,8

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to UI (User Interface) and UX (User Experience)	2	1
	1.2	Designing User interface components: Widgets, Icons, and Transitions	3	1
	1.3	Android App Layouts Graphics and Responsive Design – Responsive user interface design – case studies	3	1
	1.4	Designing User interface components: Widgets, Typography, Icons, and Transitions	2	1
2	2.1	Mobile Design Guidelines, UI-patterns and Antipatterns – Android and IOS design patterns	3	2
	2.2	UI Anti patterns – Android design patters for home screen, Search, Sorting and filtering, data entry, forms, navigation, and tablet patterns	3	2

	2.3	The Full Design: prototyping, visuals, design, animation. Mobile Wireframing: Representing inputs, gestures and motion	3	2
	2.4	Justinmind | mockplus - Lean Principles for UX, UX Considerations	3	2
3	3.1	Combine Layout Grids and Constraints, Prototype interactions, Prototype interaction navigation to page	3	3
	3.2	Auto layout properties, Auto layout options, Footer, SVG colour and overlay edits, Auto layout menu footer	3	3
	3.3	Layers toolbar, hide and lock, Prototype viewer, Frames and page, Difference between frames and groups	3	3
	3.4	Navigation bar, Button design, Fonts and Figma colours	3	3
	3.5	UI Design Rules, Mobile Prototyping: Methods of prototyping, Using Device to prototype columns and rows	3	2
	3.6	How to get started – the basics, Frames, Grid Shapes, Import images, Labeling and grouping, Text and text size	3	2
	3.7	1. Create an User Interface design for Chatting Application. 2. Create a clone whatsapp user interface design ,containing 5 minimum page .(login page, password, registration, forget password, profile page, edit profile page, OTP verification, chat page) 3. Create an entertainment App Interface design with minimum 5 pages(login page, registration page, forget password, homepage, profile page, edit profile) 4. Create an online shopping App user Interface design which includes cart page, order placement page, home page, searching page. (Any 2)	5	4
4		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal)** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 2. Assignment - 5 Case Study/Project/ Site Visit/Workshop/Internship- 10
	B. Semester End examination 1.Written Test (50 marks) Time : 1½ hours a. MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5:- 3x5)

References

1. Jeff Gothelf and Josh Seiden, Lean UX: Applying Lean Principles to Improve User

2. Austin Govella, Hacking Product Design: Help Any Team Build a Better Experience, Apr 25, 2018, ISBN-13:978-1491975039
3. Hartson, Rex, and Pardha S. Pyla. The UX Book: Process and guidelines for ensuring a quality user experience. Elsevier, 2012.

Suggested Readings

1. Anderson, Jonathan, John McRee, and Robb Wilson. Effective UI: The art of building great user experience in software. " O'Reilly Media, Inc.", 2010

Mahatma Gandhi University Kottayam

Programme						
Course Name	Multimedia Electronics					
Type of Course	**SEC**					
Course Code	MG4SECECT204					
Course Level	**200-299**					
Course Summary and Justification	This course equips learners with a profound understanding of multimedia technologies, providing hands-on experience in audio and video interfacing, different types of microphone and loudspeakers					
Semester	4	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites	**Knowledge in Basic Electronics**					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Understand the principles of Multimedia Electronics	U	1,2
2	Develop the knowledge in Audio and Video Interfacing	C	1,2
3	Classify Microphone and Loudspeaker Technologies	An	1,2
4	Construct and Develop Audio and Video Processing Equipment	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Characteristics and properties of sound- amplitude, frequency, pitch, overtone , timbre, Interval, octaves and harmonics	3	1
	1.2	Audio file formats, wav,MP3, flac,.amr formats, audio, Basic image formats - jpg, png and bitmap, Video formats - .mp4, .avi, .mkv, .mov, .flv	3	1
	1.3	Concept of pre-amplifier and power amplifier, amplifier classes (Block level only)	3	1
	1.4	Types of audio connectors RCA audio and video colour codes, TRS,OMTP, XLR, MIDI, SPDIF, Speaker on connectors for audio	3	1
2	2.1	Video formats and encoders, HDMI, DVI and Fiber optic cable for Video	3	2
	2.2	Concept of Live streaming, Chroma Key, Graphics card selection	4	2
	2.3	Characteristics and requirements of microphone, polar diagram	3	2
	2.4	Characteristics of loudspeaker- types of loudspeakers - moving coil, Electro dynamic, Horn, Pizeo electric loudspeakers	4	2

3	3.1	Head phones wired and wireless headphones, woofer, sub woofer and tweeter, vibration speaker concept of cross over network , Public address system	3	3,4
	3.2	Tone control circuit , graphic equalizer and mixer console	3	3,4
	3.3	Video and audio console unit, DJ console and controls, audio delay, and special effects	3	3,4
	3.4	Introduction to audio and Video editing software - audacity, nero wave editor, movavi and film or a video editor Make a short movie with audio-video tools and software	10	3,4
4		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 2. Assignment - 5 Case Study/Project/ Site Visit/Workshop/Internship- 10
	B. Semester End examination 1.Written Test (50 marks) Time : 1½ hours a. MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5:- 3x5)

References

1. Gupta, R. G. Audio and video engineering systems: principles & troubleshooting. Tata McGraw-Hill, 2001.
2. Sinclair, Ian Robertson. "Audio electronics reference book." (1989).

Suggested Readings

1. Alten, Stanley R. "Audio in media." (2011).
2. Owsinski, Bobby. The recording engineer's handbook. Hal Leonard Corporation, 2005.
3. Stewart, Peter, and Ray Alexander. Broadcast journalism: Techniques of radio and television news. Routledge, 2016.

Mahatma Gandhi University Kottayam

Programme						
Course Name	Environmental monitoring using sensors					
Type of Course	**VAC**					
Course Code	MG4VACECT200					
Course Level	**200-299**					
Course Summary and Justification	This course provides learners an understanding of environmental monitoring using sensors and microcontrollers. Learners will be trained to build a real time monitoring system to monitor the air quality through activities and a mini project.					
Semester	4	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Explain the need for monitoring environmental parameters	U	1,2
2	Apply the sensor technology and methods of data collections	A	1,2
3	Create comprehensive reports on environmental monitoring findings	C	1,2,10
4	Design and implement sensor-based environmental monitoring systems	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hour	CO No.
1	1.1	Importance of Environmental Monitoring: Explore the critical role of monitoring environmental parameters in addressing global issues. Examine real-world examples illustrating the impact of environmental problems	5	1
	1.2	Concept of green house effect, Impact of various green house gases on environment	5	1,2
	1.3	Air quality index and its importance	5	2,3
2	2.1	Types of Sensors for environmental monitoring- Familiarize various environmental sensors, including those for temperature and humidity, Gas sensors for air quality monitoring - carbon monoxide, smoke, methane, and ozone.(Working principle only)	5	2,3
	2.2	Introduction to MQ135 and its pin diagram and specifications	5	3

	2.3	Reading analog data from MQ 135 with Arduino board and print it on serial monitor(Block diagram only)	5	3,4
3	3.1	Concept of weather station. Role of IoT for environmental monitoring	5	3,4
	3.2	Countermeasures for air pollution - Regulatory Measures, Air filtering, Vehicle Emission Controls, Public Awareness and Education	5	4
	3.3	Case study - vehicle density and air pollution or field visit to local weather station	5	4
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Activity, Mini Project
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory -25 1. Internal Test – MCQ and written exams- 10 2. Assignment - 5 3. Case Study/Project/ Site Visit/Workshop/Internship- 10
	B. Semester End examination 1.Written Test (35 marks) Time : 1½ hours MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5,:- 3x5)

References

1. Vallero, Daniel A. Fundamentals of air pollution. Academic press, 2014.
2. Bhatia, S. C. Textbook of air pollution and its control. Atlantic Publishing, India, 2008.

Suggested Readings

1. Oner, Vedat Ozan. Developing IoT Projects with ESP32: Automate your home or business with inexpensive Wi-Fi devices. Packt Publishing Ltd, 2021.
2. Kurniawan, Agus. Internet of Things Projects with ESP32: Build exciting and powerful IoT projects using the all-new Espressif ESP32. Packt Publishing Ltd, 2019.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**
Course Name	Digital Design Using Verilog
Type of Course	DSC
Course Code	MG5DSCECT300
Course Level	**300-399**
Course Summary and Justification	This course equips learners in designing digital circuits, behavior and RTL modeling of digital circuits using Verilog HDL, verifying these Models and synthesizing RTL models to standard cell libraries. Learner assimilates practical experience by designing, modeling, implementing and verifying several digital circuits.

Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the language constructs and programming fundamentals of Verilog HDL	U	1,3,10
2	Choose the suitable abstraction level for a particular digital design	A	1,3,10
3	Construct combinational and sequential circuits in different modeling styles using Verilog HDL	A	1,3,4,10
4	Analyse and Verify the functionality of digital circuits/systems	C	1,4,6,9

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Verilog as HDL, Levels of Design Description, Concurrency, Program Structure	3	1
	1.2	Keywords, Identifiers, Characters, Numbers, Logic Values, White spaces, Comments	2	1
	1.3	Data Types	3	1
	1.4	Operators	4	1
2	2.1	Description of and/or, buf/not, xor/xnor type gates	3	1,2
	2.2	Rise, fall and turn – off delays, min, max and typical delays	3	1,2
	2.3	Design of Half Adder, Full Adder, Half Subtractor and Full Subtractor	4	3

	2.4	Design of Decoders, Multiplexers, Flip-flops and Counters	4	3
3	3.1	Data flow Modeling - Continuous Assignments, Delay Specifications, Expressions, Operators	4	2,3
	3.2	Design of Decoders, Multiplexers, Flip-flops, registers and Counters in Data flow Modeling	5	2,3
	3.3	Initial and always blocks, delay control, conditional statements in Behavioral Modeling, Creating Test benches	5	2,3
	3.4	Design of Decoders, Multiplexers, Flip-flops, registers and Counters in Behavioral Modeling	5	2,3
4	4.1	**Practicals (Any 8)** 1. Basic Logic Gates 2. Universal Gates and Implementation using universal gates 3. Half- Adder and Full-Adder 4. Half-Substractor and Full-Substractor 5. Encoder and Decoder-4 bit 6. 4:1 Mux and 1:4 DeMux 7. Gray to Binary and Binary to Gray 8. 2 Bit Adder 9. Flip-Flops- SR, JK, T and D 10. 1-Bit Parity Checker 11. LIFO and FIFO Registers 12. Counters- 4 Bit Up-Down and Decade Counter 13. 8-Bit ALU	30	4
5		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions, Study Tour (In order to fosters personal growth, and cultural awareness, Encouraging Adaptability and global perspectives , study tour is recommended after the end of fifth semester examination. Reports of study tour should be submitted)
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignment, Performance, Case Study.
	I. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination)

	a. Viva b. Lab report c. Demonstration

References

1. Jayaram Bhasker A VHDL Primer, AT & T Publications
2. Samir Palnitkar-Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd Ed., 2009.

Suggested Readings

1. Michel D. Ciletti, Advanced Digital Design with Verilog HDL,2nd Ed., PHI, 2009
2. Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016
3. S.Brown, Zvonko , Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3 rd Ed., 2014.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Artificial Intelligence and Machine Learning					
Type of Course	**DSC**					
Course Code	MG5DSCECT301					
Course Level	300-399					
Course Summary and Justification	It aims to introduce learners to hands-on experiences in the area of machine learning. Topics in this course include: Python programming, classification, regression, clustering and deep learning					
Semester	5	Credits			4	**Total Hours**
Course details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites						

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Summarize machine learning according to the taxonomy of supervised, unsupervised, reinforcement learning, etc.	U	1,2,10
2	Apply methods of linear and nonlinear methods of regression or classification to data sets	A	1,2.4,10
3	Create appropriate supervised and unsupervised learning algorithms on real and synthetic data sets and interpret the results	C	1,2.4,9,10
4	Design machine learning solutions and evaluate the associated performance	C	1,2,3,9,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Machine Learning , Types of Machine Learning Systems, Main Challenges of Machine Learning	3	1
	1.2	Performance Measure, Creating the workspace, Study on data,	3	1
	1.3	Linear Regression, Gradient Descent	3	1
	1.4	Polynomial Regression, Learning Curves	5	1

2	2.1	Logistic Regression and the Perceptron, Cross – entropy loss, Multi – class classification	5	2
	2.2	Linear and Non Linear SVM Classification	5	2
	2.3	Kernel Tricks, Decision Trees	3	2
	2.4	KNN and model selection, Introduction to Neural Networks	5	1
3	3.1	Multilayer perceptron	2	1
	3.2	Back propagation Learning	3	2,3,4
	3.3	CNN architectures	4	2,3,4
	3.4	RNN architectures	4	2,3,4
		Practicals (Any 5) 1. Lab experiments to Familiarize with Scikit Learn 2. Lab experiments to Familiarize with SVM classification 3. Lab experiments to Familiarize with SVM Kernel tricks 4. Lab experiments to Familiarize with Decision Trees 5. Lab experiments to Familiarize with KNN architecture 6. Lab experiments to Familiarize with Feed forward networks 7. Lab experiments to Familiarize with CNN architecture 8. Lab experiments to Familiarize with RNN architecture	30	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions, Study Tour
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks

	c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow" O'Reilly Media, Inc.", 2022.
2. Watt, Jeremy, Reza Borhani, and Aggelos K. Katsaggelos. Machine learning refined: Foundations, algorithms, and applications. Cambridge University Press, 2020.

Suggested Readings

1. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2016.
3. Michael Nielsen, Neural Networks and Deep Learning
4. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, the MIT Press, 2012.

Mahatma Gandhi University
Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Cloud computing					
Type of Course	**DSE**					
Course Code	MG5DSEECT300					
Course Level	300 -399					
Course Summary and Justification	This course provides learners with a comprehensive understanding and practical skills in cloud computing, preparing them for a rapidly evolving digital landscape. Through hands-on experiences, learners will not only master the technical aspects but also develop critical thinking and communication skills essential for the modern workplace.					
Semester	5	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Comprehend the principles underlying Cloud Computing and differentiate between its deployment models.	U	1
2	Demonstrate proficiency in utilizing major Cloud Platforms for computing and storage.	A	1,2
3	Evaluate and implement Cloud Security concepts, services, and compliance measures.	An	1,2,8,10
4	Assess the effectiveness of Cloud Security concepts	E	1,2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Cloud computing Historical Overview, Cloud computing: Virtualization, Understand the fundamental elements of cloud computing, Planning Cloud transformations	4	1
	1.2	Service models-Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Model Comparison	3	1
	1.3	Essential Characteristics-Introduction, On-demand self-service, Broad network access, Resource pooling, Rapid elasticity, Measured service	3	1

	1.4	Deployment Models-Cloud Computing Deployment Models Overview, Public Cloud, Private Cloud, Hybrid Cloud, Selection of cloud model	5	1
2	2.1	Public Cloud Basics- Private versus public cloud, Understanding the business case, Considering costs, Evolving market. Public Cloud Platforms-Requirement Analysis, Selection of right service	4	2
	2.2	Amazon Web Services- Application and data compatibility, Types of services, Managing Identities and Access, Managing Compute, Monitoring and Logging, Managing Security, Management and Compliance, cloud migration, summary	4	2
	2.3	Google Cloud Platform-Application and data compatibility, Types of services, Google Cloud Resource Hierarchy, Cloud monitoring and management, Security and governance	4	2
	2.4	Microsoft Azure- Application and data compatibility, Types of services, Management and Monitoring in Azure, Governance and Compliance in AZURE, Summary. Alibaba Cloud-Application and data compatibility, Types of services, Security and governance, Summary	3	2
3	3.1	Introduction-Understanding cloud security. Cloud Security Basics- Business case for cloud security, Breach scenarios and attack vectors	4	3
	3.2	Infrastructure-level cloud security, Application-level cloud security, Data-level cloud security, Rise of identity and access management, Compliance and security	4	3
	3.3	Cloud Compliance Services- Cloud security in healthcare, Cloud security in finance, Cloud security in retail, Cloud security in manufacturing	4	3
	3.4	Planning Cloud Security-Understanding Cloud security requirements, Selecting cloud security services, Architecture guidelines and hierarchy, Cyber security and Cloud Computing	3	3
	Cloud Networking Concepts: Solutions and Services(Detailed study not required)			
4	4.1	Cloud Networking Basics- Internal cloud network requirements, External cloud network requirements, Types of cloud networking solutions, Software-defined cloud networks, Moving networking to the cloud, Cloud networking basic hardware requirements, Cloud network monitoring and management, Cloud network troubleshooting	5	4
	4.2	Advanced Cloud Networking- AWS cloud networking, AZURE cloud networking, Google cloud networking, Cloud VPNs, Cloud network security, Cloud network governance, Cloud API Gateways, Global Content Delivery Networks	5	4

	4.3	Cloud Storage Basics-Cloud storage types, Block storage, Object storage, File storage, Storage plan selection criteria .Cloud Services That Leverage Cloud Storage-Cloud databases, Cloud file storage, Backup and recovery services, Other cloud services that leverage cloud storage, Sample applications	3	4
	4.4	Cloud Concepts: Hybrid Cloud-Hybrid Cloud Vendors, Hybrid Cloud Strategies Cloud Computing Careers and Certifications: Roles, Certifications, Emerging technologies and careers	2	4
5	Teachers Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) - Time : 2 hours a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Srinivasan, A. Cloud Computing: A practical approach for learning and implementation. Pearson Education India, 2014.
2. .Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. Cloud computing: Principles and paradigms. John Wiley & Sons, 2010.
3. Velte, Anthony T. Velte Toby J., and Ph D. Robert Elsenpeter. Cloud computing. 2010.
4. Furht, Borivoje, and Armando Escalante. Handbook of cloud computing. Vol. 3. New York: springer, 2010.

Suggested Readings

1. Nayyar, Anand. Handbook of Cloud Computing: Basic to Advance research on the concepts and design of Cloud Computing. BPB Publications, 2019.I
2. Sapna Sinha,Integration of cloud computing with emerging Technologies, Vishal Bhatnagar, CRC Press
3. Bahga, Arshdeep, and Vijay Madisetti. Cloud computing: A hands-on approach. CreateSpace Independent Publishing Platform, 2013

Mahatma Gandhi University
Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Computer Forensic					
Type of Course	DSE					
Course Code	MG5DSEECT301					
Course Level	300-399					
Course Summary and Justification	This course provides learners with a comprehensive understanding of computer forensics principles, practical skills in using forensic tools, and the ability to analyze and interpret digital evidence.					
Semester	5	**Credits**			4	Total Hours
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOME (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the principles and concepts of digital forensics	U	2,8
2	Interpret the basics of computer forensics fundamentals	U	1,2
3	Develop skills in using computer forensics software and tools through hands-on training exercises	C	9
4	Analyze and interpret digital evidence effectively	An	1,8

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Principles of Digital Forensics, Digital Forensics Process-Identification ,Collection, Examination, Analysis, Report Digital Forensics Categories-Computer Forensics, Mobile Forensics, Network Forensics, Database Forensics	2	1
	1.2	Introduction to Computer Forensics, Phases of computer forensics-Identification, preservation, Analysis, presentation. Computer Crimes: Definition of Computer Crimes Traditional computer crimes- Phreaking, Hacking, Theft of Intellectual Property. Contemporary computer crimes-Web-Based Criminal Activity, Malware, Theft of Information, Data Manipulation,	3	1

	1.3	**Digital Evidence**-Types of digital evidence, Sources of digital evidence, Challenge of Acquiring Digital Evidence, Digital File Metadata	2	1
	1.4	**Storage formats for digital evidence**-Raw format, Proprietary formats,Advanced Forensics Format (AFF) **Data Representation** - Decimal,binary,Hexadecimal,Computer Character Encoding Schema,Timestamps Decoder (Tool)	3	1
2	2.1	**Computer forensic domains**:Operating system,email Forensics,Live memory forensics,web forensics,network forensics,multimedia forensics. Data Acquisition and Authentication Process,Types of data acquisition-Static acquisition,Live acquisition RAID Data Acquisitions	4	2
	2.2	**Disk Structure and digital evidence**:OS with supported file system. **File systems**-Windows Systems- FAT32 and NTFS, UNIX file Systems,	4	2
	2.3	**Validating Data Acquisitions**-Validation techniques CRC-32, MD5, and SHA-1 to SHA-512	4	2
	2.4	**Analysis**- Analysis Tools, Timeline Analysis, File Hashing, Filtering, Data Carving	3	2
3		**Disk and File System Analysis** (Detailed study not needed)		
	3.1	**Free and open source Computer forensics tools**:Autopsy ,Sleuth Kit, REDLINE ,MAGNET AXIOM	6	3
	3.2	**Commercial Forensics Tools**-EnCase ,FTK ,X-Ways Forensics	5	3
	3.3	Supported File formats for different tools,Comparison of general features of computer forensic tools,Comparison of file system and disk forensic features.	4	3
	3.4	Hashing,Carving,Forensic Imaging	5	3
4	4.1	Comparison of operating system related features in forensic tools,Comparison of file system and disk forensic features	5	4
	4.2	Understanding storage formats and digital evidence, General comparison of live memory forensic toolkits.	5	4
	4.3	Case Studies - Recovery of deleted file from a hard disk	5	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others

	B. Semester End examination 1.Written Test (70 marks) –Time : 2 Hour a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

Reference

1. Carvey, Harlan, and Cory Altheide. Digital forensics with open source tools. Elsevier, 2011 (module 3)
2. Årnes, André, ed. Digital forensics. John Wiley & Sons, 2017 (module 1).
3. Hassan, Nihad A. Digital forensics basics: A practical guide using Windows OS. Apress, 2019. (module 1)
4. A R. Javed, W. Ahmed, M. Alazab, Z. Jalil, K. Kifayat, and T. R. Gadekallu, ‘‘A comprehensive survey on computer forensics: State Of-the-art, tools, techniques, challenges, and future directions,’’ IEEE Access, vol. 10, pp. 11065–11089, 2022

Suggested Readings

1. Arora, Bhavna. "Exploring and analyzing Internet crimes and their behaviours." Perspectives in Science 8 (2016): 540-542
2. Lin, Xiaodong, Xiaodong Lin, and Lagerstrom-Fife. Introductory Computer Forensics. Springer International Publishing, 2018

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Instrumentation					
Type of Course	**DSE**					
Course Code	MG5DSEECT302					
Course Level	**300-399**					
Course Summary and Justification	This course provides a comprehensive understanding of instrumentation electronics principles.					
Semester	**5**	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Illustrate the principles and fundamentals of instrumentation electronics.	U	1,2
2	Apply knowledge to select and use appropriate sensors and transducers for measuring physical parameters.	A	1,2
3	Design and implement signal conditioning circuits for amplification, filtering, and analog-to-digital conversion.	C	1,2,10
4	Analyze the principles and fundamentals of medical electronics	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Measurements, Significance of measurements, Methods of measurement.	3	1
	1.2	Static Characteristics of Instruments.	4	1
	1.3	Dynamic characteristics of instruments.	4	1
	1.4	Elements of a generalized measurement system.	4	1

2	2.1	Introduction, Electrical transducer, Selecting a transducer, Resistive transducer.	4	2
	2.2	Wire Strain Gauge, Semiconductor Strain Gauge, Thermistor.	4	2
	2.3	Thermocouple, Linear variable Differential Transducer, Capacitive transducer	4	2
	2.4	Load cell, Piezoelectric transducer.	3	2
3	3.1	Instrumentation amplifier, Sample and hold circuit	4	3
	3.2	Wheatstone Bridge, Maxwell Bridge	4	3
	3.3	Digital-to-analog Converter (DAC),R-2R ladder DAC, familiarization of chip D8562	5	3
	3.4	Analog-to-Digital Converter –Successive Approximation ADC, familiarization of chip ADC 1115	2	3
4	**Basic Medical Instrumentation system (Block level study only)**			
	4.1	Introduction to various Biomedical instruments – Electrocardiograph, Electroencephalograph.	4	4
	4.2	Pulse-Oximeter, Ultrasonic Blood flow meter, Digital Hearing aid.	4	4
	4.3	X-ray machine, Computed Tomography, Magnetic Resonance Imaging, Ultrasonic Imaging.	4	4
	4.4	Cardiac Pacemakers, Cardiac Defibrillators, Tele-medicine.	3	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

Text Books:

1. A. K. SAWHNEY , Electrical and Electronic Measurements , Dhanpat Rai & Sons, Educational and Technical Publishers.
2. H.S. Kalsi ,Electronic Instrumentation , McGraw Hill Education(India) Private Limited

References:

1. Alan S Morris, Principles of Measurements and Instrumentation – Prentice Hall of India 2nd Edition.
2. Joseph J Carr, Elements of Electronic Instruments and Measurements.
3. Prof. S.K. Venakata Ram,Bio-Medical Electronics and Instrumentation Galgotia Publication.
4. Leach & Malvino Digital Principles and Application McGraw Hill Education (India) Private Limited
5. R.S. Khandpur Handbook of Biomedical Instrumentation Tata McGraw-Hill Publishing Company Limited

Mahatma Gandhi University
Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Microwave Electronics					
Type of Course	**DSE**					
Course Code	MG5DSEECT303					
Course Level	**300-399**					
Course Summary and Justification	This course gives basics of electromagnetic wave theory and the principles behind microwave electronics. It also covers familiarization of different transmission lines and waveguides.					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES(CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Explain the concept of electromagnetic waves and understand their properties and applications	U	1,2
2	Demonstrate comprehension of transmission lines and waveguides.	U	1,2
3	Apply the concept of microwave tubes and devices, gaining hands-on experience	A	1,2
4	Create and design practical microwave systems	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	EM wave spectrum and its applications	2	1
	1.2	Electromagnetic Fields-TE,TEM and TM, Maxwell's Equations (Detailed analysis not required)	6	1
	1.3	Wave Polarization, Phase and Group Velocities	2	1
	1.4	Microwave Frequencies, Microwave Bands, Microwave Devices, Advantages of microwaves, Applications of microwaves	5	1
2	2.1	Two Wire Transmission lines - Equivalent circuit, Characteristics impedance, reflection Coefficient, Standing waves and VSWR, Losses in transmission lines, Impedance matching, Stub matching.(Detailed analysis not required)	6	2

	2.2	Multi-conductor Transmission lines - coaxial lines-Striplines- Microstrip line – Advantages and disadvantages	2	2
	2.3	Basic Concept of Waveguide, Advantages over Transmission Line, Qualitative Study of Rectangular Waveguide, TE and TM Modes	4	2
	2.4	Guide Wavelength, Cutoff Wavelength, Group velocity and Phase velocity, Dominant and Degenerate Modes	3	2
3	3.1	Limitations of vacuum tubes	4	3
	3.2	Multi-cavity Klystron – construction and operation	4	3
	3.3	Magnetrons-Working of Magnetrons	3	3
	3.4	Varactor diode, Gunn diode-Applications	4	3
4	4.1	Waveguide couplings, Bends and Corners	2	4
	4.2	Taper and Twists, T junctions, Magic Tees	4	4
	4.3	Hybrid rings, Cavity resonators	4	4
	4.4	Directional Couplers, Isolators, Circulators	5	4
5		**Teacher specific content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Kulkarni, Muralidhar. Microwave and radar engineering. Vol. 17. Umesh Publications, New Delhi, 2009.
2. Kennedy, George, Brendan Davis, and S. R. M. Prasanna. Electronic communication systems. Vol. 20. Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1985.

Suggested Readings

1. Liao, Samuel Y. Microwave devices and circuits. Pearson Education India, 1990.
2. Sadiku, Mathew NO. "'Principles of Electromagnetics', Oxford University Press Inc. First India edition, 2009. 2." (2015).
3. Jordan, Edward Conrad. "Electromagnetic waves and radiating systems." (1968).
4. D. M. Pozar, "Microwave Engineering," Wiley, New York, 1998.
5. Rao, Elements of Engineering Electromagnetics, Pearson.
6. Rao and Narayanappa, Engineering Electromagnetics, Cengage

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Smart Industry					
Type of Course	DSE					
Course Code	MG5DSEECT304					
Course Level	300-399					
Course Summary and Justification	This course provides a comprehensive understanding of Industry 4.0, about advanced PLC programming, and control system design, ensuring students acquire the understandings needed for modern industrial automation, fostering critical thinking.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Understand advanced principles of industrial automation, including Industry 4.0 concepts	U	3,6
2	Apply advanced PLC programming techniques for complex industrial control systems	A	2,8
3	Integrate and troubleshoot DCS, HMI, SCADA, motors, and communication protocols in industrial settings	A	4,5,9
4	Analyze and design sensor-based systems for automation application	An	1,2,7,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Module	Unit	Course description	Hours	CO No.
1	1.1	Industry 4.0 overview: Definition and historical context of Industry 4.0, Evolution of industrial revolutions: From Industry 1.0 to Industry 4.0, Key features and principles of Industry 4.0.	4	1
	1.2	Advanced principles in industrial automation: Overview of traditional automation vs. advanced automation, Advanced sensor technologies for real-time data acquisition, Robotics and their applications in manufacturing processes.	4	1
	1.3	Simulation of Industry 4.0 scenarios	3	1

		Overview of Industry 4.0 Simulation, Benefits and Advantages of Simulation, Simulation for Training and Skill Development (Gazebo)		
	1-4	Future Trends and Emerging Technologies Edge AI and its role in real-time decision-making. Advanced robotics and human-robot collaboration. Sustainable and green manufacturing practices.	4	1
2	2.1	Definition and purpose of PLCs. Advantages of using PLCs in industrial automation. Overview of different types of PLCs based on application, size, and complexity.	4	2
	2.2	PLC Hardware Architecture , Central Processing Unit (CPU).Input and output modules. Power supply. Communication interfaces.	3	2
	2.3	PLC Applications - Industrial Automation Applications Process Control Applications	4	2
	2.4	Introduction to Robotics and Motion Control: Overview of robotics and motion control systems in industrial automation. Types of Motion Control: Point-to-point motion. Continuous path motion., Interpolation techniques.	4	2
3	3.1	Comprehensive integration of DCS, HMI. Definition and importance of comprehensive integration in industrial automation. Overview of key components: DCS (Distributed Control System), HMI (Human-Machine Interface).	4	3
	3.2	SCADA - Definition of SCADA, Components of SCADA Systems, Security in SCADA Systems.	4	3
	3.3	Servo motors - Introduction to Servo Motors, Operating Principle of Servo Motors, Types of Servo Motors (AC servo motors, DC servo motors)	4	3
	3.4	Communication protocols.:Ethernet/IP, CAN (Controller Area Network), DeviceNet, Modbus TCP/IP.	3	3
4	4.1	Sensors and their applications in industrial automation: Introduction to sensor-based automation and its significance in industrial applications. Basic principles of sensors and their role in automation.	3	4
	4.2	Types of Sensors Overview of different sensor types, (proximity sensors, photoelectric sensors, temperature sensors), Basic working principle of each sensor, Key characteristics of sensors: - accuracy, precision, sensitivity, and resolution.	5	4
	4.3	Sensor Technologies in Automation Contact Sensors vs. Non-contact Sensors, Solid state relays. IoT Integration in industrial automation, Role of Wireless Sensor Networks in automation	4	4
	4.4	Panel wiring in industry. Relevance of Panel wiring in industry - color code, labeling, connectors and cable	3	4

		management. An overview of Cyber-physical system Security.		
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B.Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Gupta, Ashwani K., and Satish K. Arora. Industrial automation and robotics. Laxmi publications, 2011.
2. Sawhney, A. K., and P. Sawhney. A course in mechanical measurements and instrumentation. Vol. 3. Dhanpat Rai, New Delhi, 1995.

Suggested Readings

1. Nathan Clark PLC Programming Using RSLogix 5000: Understanding Ladder Logic and the Studio 5000 Platform
2. Lamb, Frank. Industrial automation: hands-on. McGraw-Hill Education, 2013.
3. Correll, Nikolaus, et al. Introduction to autonomous robots: mechanisms, sensors, actuators, and algorithms. Mit Press, 2022.
4. Pallas-Areny, Ramon, and John G. Webster. Sensors and signal conditioning. John Wiley & Sons, 2012.
5. Kumar, Kaushik, Divya Zindani, and J. Paulo Davim. Industry 4.0: developments towards the fourth industrial revolution. Cham, Switzerland: Springer, 2019.
6. Richey, Drew Jackson. Leveraging PLC ladder logic for signature based IDS rule generation. Mississippi State University, 2016.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Computer Assembling and Maintenance					
Type of Course	**DSE**					
Course Code	MG5DSEECT305					
Course Level	**300-399**					
Course Summary and Justification	This course provides a comprehensive understanding of computer hardware components, fostering practical skills and analytical thinking crucial for IT professionals in troubleshooting and maintaining computer systems.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Summarize the key components of a computer system, including the motherboard, processor, and memory types.	U	1, 2
2	Apply knowledge of new expansion slots and peripheral devices	A	1, 2
3	Develop hands-on skills in assembling and disassembling computer hardware components	A, C	5, 9,10
4	Analyze and troubleshoot common hardware issues	An	1, 6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Components of a Computer System, Computer Hardware vs. Software, Operating Systems (OS) Inside a PC - central processing unit (CPU), memory devices, input devices, and output devices.	4	1
	1.2	Basic Input/ Output System (BIOS):BIOS and its functions, Motherboard and its components, Motherboard Form Factors	4	1

	1.3	Types of Memory: Primary Memory, RAM, ROM,PROM, EPROM	4	1
	1.4	Different Types of Expansion Slots, Expansion Cards and Peripherals(PCI,AGP,PCI-e)	3	1
2	2.1	Input Devices Keyboard, Pointing, positioning devices (Mouse & Light pen)	3	2
	2.2	Output Devices LCD & LED Display , Laser and Inkjet printer ,LCD projectors	3	2
	2.3	Storage Devices Optical storage, Magnetic Storage and semiconductor Storage (SSD)	4	2
	2.4	Networking Devices Connecting Devices(Router, Hub and Switch) and interfacing Cards	5	2
3	3.1	Diagnostic Tools and Techniques System Information Utilities, Hardware Diagnostic Software	5	3
	3.2	Common Hardware Issues Overheating Problems, Power Supply Issues, Memory Failures	5	3
	3.3	Troubleshooting and Maintenance Troubleshooting Methodology (Testing flow chart), Preventive Maintenance.	2	3
	3.4	Future Trends in Computer Hardware Advanced Processors, Memory Technologies	3	3
	Hands-on Experience			
4	4.1	Assembling and Disassembling Components Tools and Equipment, Motherboard Installation, Connecting Power Supply Cables	5	4
	4.2	Installation of New Expansion Cards Understanding and Installing the Expansion Card	3	4
	4.3	BIOS Configuration Installation of Operating Systems(Windows & Ubuntu)	2	
	4.4	Peripheral Device Configuration Identifying Peripheral Devices, interfacing	3	4
	4.5	Basic Hardware Troubleshooting Introduction to Troubleshooting, Identifying Hardware Issues	2	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Mueller, Scott. Upgrading and repairing PCs. Que Publishing, 2004
2. James, K. L. Computer Hardware: Installation, Interfacing, Troubleshooting And Maintenance. PHI Learning Pvt. Ltd., 2013.
3. Rajaraman, V., and Neeharika Adabala. Fundamentals of computers. PHI Learning Pvt. Ltd, 2014.

Suggested Readings

1. Anderson, Howard, and Mike Tooley. Newnes PC troubleshooting pocket book. Elsevier, 2003.
2. Herres, David. Troubleshooting and repairing commercial electrical equipment. McGraw-Hill Prof Med/Tech, 2013.
3. D Balasubramanian Computer Installation and Servicing ,McGraw Hill Education; 2nd edition (15 July 2005)
4. Bigelow, Stephen J. Troubleshooting, maintaining, and repairing PCs. McGraw-Hill, Inc., 1998.
5. Minasi, Mark. The complete pc upgrade and maintenance guide. SYBEX Inc., 1994.
6. Manahar, Lotia, and Nair Pradeep. Modern All About Motherboard.(1996)

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Industrial Automation					
Type of Course	**DSE**					
Course Code	MG5DSEECT306					
Course Level	**300-399**					
Course Summary and Justification	This course provides a comprehensive understanding of Industry 4.0, about advanced PLC programming, and control system design, ensuring students acquire the understandings needed for modern industrial automation, fostering critical thinking.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Understand advanced principles of industrial automation, including Industry 4.0 concepts	U	3,6
2	Apply advanced PLC programming techniques for complex industrial control systems	A	2,8
3	Integrate and troubleshoot DCS, HMI, SCADA, motors, and communication protocols in industrial settings	A	4,5,9
4	Analyze and design sensor-based systems for automation application	An	1,2,7,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Industry 4.0 overview, Definition and historical context of Industry 4.0, Evolution of industrial revolutions: From Industry 1.0 to Industry 4.0, Key features and principles of Industry 4.0.	4	1
	1.2	Advanced principles in industrial automation, Overview of traditional automation vs. advanced automation, Advanced sensor technologies for real-time data acquisition, Robotics and their applications in manufacturing processes.	4	1

	1.3	Simulation of Industry 4.0 scenarios Overview of Industry 4.0 Simulation, Benefits and Advantages of Simulation, Simulation for Training and Skill Development (Gazebo)	3	1
	1-4	Future Trends and Emerging Technologies Edge AI and its role in real-time decision-making. Advanced robotics and human-robot collaboration. Sustainable and green manufacturing practices.	4	1
2	2.1	Definition and purpose of PLCs. Advantages of using PLCs in industrial automation. Overview of different types of PLCs based on application, size, and complexity.	4	2
	2.2	PLC Hardware Architecture , Central Processing Unit (CPU).Input and output modules. Power supply. Communication interfaces.	3	2
	2.3	PLC Applications - Industrial Automation Applications Process Control Applications	4	2
	2.4	Introduction to Robotics and Motion Control: Overview of robotics and motion control systems in industrial automation. Types of Motion Control: Point-to-point motion. Continuous path motion., Interpolation techniques.	4	2
3	3.1	Comprehensive integration of DCS, HMI. Definition and importance of comprehensive integration in industrial automation. Overview of key components: DCS (Distributed Control System), HMI (Human-Machine Interface).	4	3
	3.2	SCADA - Definition of SCADA, Components of SCADA Systems, Security in SCADA Systems.	4	3
	3.3	Servo motors - Introduction to Servo Motors, Operating Principle of Servo Motors, Types of Servo Motors (AC servo motors, DC servo motors)	4	3
	3.4	Communication protocols.:Ethernet/IP, CAN (Controller Area Network), DeviceNet, Modbus TCP/IP.	3	3
4	4.1	Sensors and their applications in industrial automation: Introduction to sensor-based automation and its significance in industrial applications. Basic principles of sensors and their role in automation.	3	4
	4.2	Types of Sensors Overview of different sensor types, (proximity sensors, photoelectric sensors, temperature sensors), Basic working principle of each sensor, Key characteristics of sensors: - accuracy, precision, sensitivity, and resolution.	5	4
	4.3	Sensor Technologies in Automation Contact Sensors vs. Non-contact Sensors, Solid state relays. IoT Integration in industrial automation, Role of Wireless Sensor Networks in automation	4	4
	4.4	Panel wiring in industry	3	4

		Relevance of Panel wiring in industry - color code, labeling, connectors and cable management An overview of Cyber-physical system Security.		
5		Teachers Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Gupta, Ashwani K., and Satish K. Arora. Industrial automation and robotics. Laxmi publications, 2011.
2. Sawhney, A. K., and P. Sawhney. A course in mechanical measurements and instrumentation. Vol. 3. Dhanpat Rai, New Delhi, 1995.

Suggested Readings

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3. Correll, Nikolaus, et al. Introduction to autonomous robots: mechanisms, sensors, actuators, and algorithms. Mit Press, 2022.
4. Pallas-Areny, Ramon, and John G. Webster. Sensors and signal conditioning. John Wiley & Sons, 2012.
5. Kumar, Kaushik, Divya Zindani, and J. Paulo Davim. Industry 4.0: developments towards the fourth industrial revolution. Cham, Switzerland: Springer, 2019.
6. Richey, Drew Jackson. Leveraging PLC ladder logic for signature based IDS rule generation. Mississippi State University, 2016

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Cyber Security					
Type of Course	**DSE**					
Course Code	MG5DSEECT307					
Course Level	**300-399**					
Course Summary and Justification	This course is designed to provide the learners with a comprehensive understanding of the principles, strategies, and technologies involved in securing digital systems and data. The course covers a range of topics, including network security, cryptography, ethical hacking, risk management, and incident response.					
Semester	5	**Credits**			4	
Course Details	**Learning Approach**	**Theory**	**Lecture**	**Practical**	**Others**	**Total Hours:**
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	*Expected Course Outcome*	Learning Domain*	PO No.
1	Understand the Cyber security Fundamentals.	U	1, 6, 8,10
2	Build knowledge in Threat Assessment and Mitigation	C	1,2,10
3	Utilize the awareness of Cybercrime and Legal Implications	A	1,2,4,6,8,10
4	Develop the competence in Internet, Web, and Mobile Security	A	1,2,4,6,8,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Cyber Security, Risks to Cyber security.	2	1
	1.2	Treads and Attacks, active attacks, passive attacks, Software attacks, hardware attacks.	5	1
	1.3	Hacking and Cracking, password cracking, Password Cracking Techniques & Tools.	4	1
	1.4	Security Models, Layers of Security,CIA Triad	4	1

2	2.1	Introduction Cyber Threat, Definition of Cyber Crime, Classification.	5	2
	2.2	Cyber terrorism, Cyberspace & Criminal Behaviour.	4	2
	2.3	Cyber Security Regulations, Cyber Law, Need for Cyber Law, Roles of International Law	3	2
	2.4	The INDIAN Cyberspace, National Cyber Security Policy	3	2
3	3.1	Components of Internet, Weak Points of Internet	5	1,3
	3.2	What is Internet Security, Technology for Internet security	3	1,3
	3.3	Technique of web hacking, methods of attacking users	3	1,3
	3.4	Web server, Internet service providers, Domain name servers, HTTP protocol.	4	1,3
4	4.1	Introduction, Mobile and Wireless Devices, Authentication Service Security	3	1,4
	4.2	Trends in Mobility, Credit card Frauds in Mobile, Attacks on Mobile/Cell Phones.	3	1,4
	4.3	Security Challenges by Mobile Devices, Organizational Measures for Handling Mobile.	5	1,4
	4.4	Security Policies and Measures in Mobile Computing	4	1,4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Suggested Readings

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press. 2.
2. Introduction to Cyber Security, Chwan-Hwa (john) Wu,J.David Irwin.CRC PressT and FGroup

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**
Course Name	Advanced Python
Type of Course	**DSE**
Course Code	MG5DSEECT308
Course Level	**300-399**
Course Summary and Justification	This Python course content covers all the latest topics from basics to advanced level like Python for Machine Learning, AI and Data Science.

Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOME (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO Nos
1	Demonstrate the basic principles of Python programming language	U	1,2,10
2	Examine the object oriented programming concepts such as encapsulation, inheritance and polymorphism as used in Python	An	1,2,7,10
3	Analyze the commonly used operations involving file systems and regular expressions	An	3,7,9,10
4	Adapt Machine Learning Algorithms	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Basic coding skills, working with data types and variables	4	1
	1.2	Working with numerical data and string data and Python functions	4	1
	1.3	Working with Boolean expression, selection structure, iteration structure	3	1
	1.4	IO and error handling in Python	4	1
2	2.1	Opening and closing a file, working with text and binary files, with statement	3	3

	2.2	Checking the existence of file, pickle(), seek() and tell() methods, working with directories	3	3
	2.3	Finding patterns of texts with Regular Expressions. More pattern matching with Regular Expressions	3	3
	2.4	Using Regular Expressions on file, sequence characters, quantifiers and special characters in Regular Expressions	3	3
3	3.1	OOPs concepts, Classes and Objects	3	2
	3.2	Classes in Python, Constructors, Class Variables	4	2
	3.3	Instance Variables and methods	3	2
	3.4	Namespaces and Inner Classes	3	2
4	4.1	Inheritance, Encapsulation, Types of Inheritance, super() method	5	2
	4.2	Polymorphism, Types of Polymorphism, Operator Overloading, Method Overriding	5	2
	4.3	Usage of Numpy for Numerical data	5	4
	4.4	Usage of Pandas for Data Analysis and Matplotlib for plotting	5	4
5	Teacher Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Richard L Halterman, Learning to program with Python

Suggested Readings

1. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Analog and Digital Communication					
Type of Course	**DSE**					
Course Code	MG5DSEECT309					
Course Level	**300-399**					
Course Summary and Justification	This course provides learners with a foundational understanding of analog and digital communication systems, modulation techniques and equips them with skills to develop the communication systems.					
Semester	**5**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Lab**	**Others**	
		4				**60**
Pre-requisites						

COURSE OUTCOMES

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Interpret the communication fundamentals and the difference between analog and digital communications.	U	1,2
2	Analyze the different analog modulation techniques	An	1,2
3	Analyze the digital modulation techniques	An	1,2
4	Develop projects that involve the design and implementation of different modulation circuits.	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to the Communication System. Definition and basic concepts	4	1
	1.2	Elements of Communication System- block diagram	3	1
	1.3	Digital and analog communication. Comparison	4	1
	1.4	Modulation-need for modulation- types of modulation	4	1
2	2.1	Amplitude Modulation- Frequency spectrum of AM wave – Representation of AM wave, Power relation in AM wave, Generation of AM- DSBSC, Concept of SSB	4	2
	2.2	Frequency Modulation – Theory of Frequency modulation, Mathematical representation of FM, De-emphasis, Pre-emphasis	4	2

	2.3	FM Generation and Detection- Direct method, Indirect method	4	2
	2.4	Phase modulation – PM from FM – comparison of PM and FM	3	2
3	3.1	Digital communication system – baseband and broadband communication	3	3
	3.2	Pulse Code Modulation (PCM) – block diagram – sampling- quantization- encoding. Sampling Theorem- quantization noise- companding	4	3
	3.3	Differential pulse Code Modulation (DPCM) – Delta modulation – Adaptive delta modulation	4	3
	3.4	Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) – Phase Shift Keying(PSK)	4	3
4		Simulations using LTSpice (Any Five) 1. Colpitts oscillator 2. Hartley oscillator 3. Filters – HPF, LPF, BFP 4. AM generation 5. FM generation 6. Balanced mixer 7. ASK generation 8. FSK generation 9. PSK generation	15	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) -2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References:

1. Haykin, Simon, and Michael Moher. Introduction to analog and digital communications. John Wiley & Sons, Inc., 2007.
2. Lathi, Bruce. "Modern digital and analog communication systems." (2010).
3. Kennedy, George, Brendan Davis, and S. R. M. Prasanna. Electronic communication systems. Vol. 20. Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1985.

Suggested Readings

1. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3rd Edition, PearsonEducation, 2007.
2. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2009.

Mahatma Gandhi University

Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Robotics and Industrial Automation					
Type of Course	DSE					
Course Code	MG5DSEECT310					
Course Level	300-399					
Course Summary and Justification	This course provides learners with a comprehensive understanding of Industrial automation, covering key components, PLC programming, robotic systems, and hands-on skills in designing automated systems.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites	Knowledge in Basic Electronics					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Explain the principles and applications of Robotics and Industrial Automation	U	1,2
2	Apply automation techniques using PLC	A	1,2
3	Analyze and troubleshoot automation systems in real-world scenarios	An	1,2,10
4	Design and develop automated solutions for specific tasks	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction to Robotics and its Evolution **(Basics)**	2	1
	1.2	Industrial automation- Definition, Purpose, Different types, Industry Standard- Industry 4.0	2	1
	1.3	Sensors - Basic concepts of piezoelectric sensor, IR proximity sensor. PIR Sensor	6	1
	1.4	Motors - Basic concepts of Servo Motors, geared DC motors and Stepper Motors. Actuators - Basic concepts of Electrical Actuators	5	1
	2.1	Different types of PLCs, Basic programming, basics of Ladder Logic	5	2
	2.2	Introduction to PLC -Inputs and Outputs, Types of I/O	4	2

2		Modules		
	2.3	PLC interfacing with LED and Motor	2	2
	2.4	PLC interfacing with Temperature, humidity Gas and PIR Sensors	4	2
3	3.1	Control systems and their role in robotics, Example of closed loop control system - Automatic water level system	5	3
	3.2	Components of an Automatic conveyor belt mechanism	4	3
	3.3	Robotics in industry- pick and place, spot welding.	6	3
4	**Practical / Simulation** (OpenPLC Editor, i-TRiLOGI, WPLSoft, Do-more Designer, plcsimulator.online or any other). **Minimum 6 experiments** 1. Basic ON/OFF Control: Use a switch to control an output (e.g., a lamp) using PLC. 2. Toggle Operation: Implement a toggle switch to alternate between two outputs. 3. Timer Functionality: Use timers to control the ON/OFF duration of an output. 4. Latching Circuit: Create a latch/unlatch mechanism to maintain output state. 5. Logic Gates Implementation: Use PLC programming to simulate AND, OR, NOT logic functions. 6. Motor Control: Control the direction and speed of a motor using PLC. 7. Traffic Light Simulation: Simulate a traffic light system with different timing sequences. 8. Temperature Control: Control a heating or cooling system based on temperature sensor inputs. 9. Water Level Monitoring: Use sensors to monitor and control water levels in a tank. 10. Conveyor Belt Control: Control the operation and speed of a conveyor belt using PLC. 11. Alarm System: Create an alarm system based on sensor inputs or specific conditions. 12. Robotic Arm Control: Basic control of a robotic arm using PLC 13. Robotic Application: Robotic arm pick-and-place tasks using PLC		30	4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type

	Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- Time : 1½ hours h. MCQ - 10 Marks (Answer all - 10x1=10 Marks) i. Short answer questions (4 out of 6 questions)-4x5=20 marks j. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) - Duration 2 Hour d. Viva e. Lab report f. Demonstration

References

1. Merat, Frank. "Introduction to robotics: Mechanics and control." IEEE Journal on Robotics and Automation 3.2 (1987): 166-166.
2. Chakraborty, Kunal, Palash De, and Indranil Roy. Industrial applications of programmable logic controllers and scada. Anchor Academic Publishing, 2016.

Suggested Readings

1. Ghosal, Ashitava. Robotics: fundamental concepts and analysis. Oxford university press, 2006.
2. Lin, Patrick, Keith Abney, and George A. Bekey, eds. Robot ethics: the ethical and social implications of robotics. MIT press, 2014.
3. Yamamoto, Ikuo. Practical robotics and mechatronics: marine, space and medical applications. Institution of Engineering and Technology, 2016.
4. Shell, Richard. Handbook of industrial automation. CRC press, 2000.
5. Lamb, Frank. Industrial automation: hands-on. McGraw-Hill Education, 2013.
6. Jack, Hugh. Automating manufacturing systems with PLCs. Lulu. com, 2009.

Mahatma Gandhi University Kottayam

Department	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Office Automation and Content Creation					
Type of Course	**SEC**					
Course Code	MG5SECECT300					
Course Level	**300-399**					
Course Summary and Justification	This course enhances learners' abilities to apply and create word documents, spreadsheets, presentations, and projects using various office suite tools. Emphasizing communication skills and fostering lifelong learning the course prepares students with practical skills for effective professional engagement.					
Semester:	5	**Credits**			3	**Total Hours**
Course Details	**Learning Approach**	**Theory**	**Lecture**	**Practical**	**Others**	
		3				45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Illustrate Word Processing Document	U	1,2
2	Build different Excel Sheet Skills	A	1,2
3	Develop Effective PowerPoint Presentation	C	1,2,10
4	Discuss about the Integration and Manage different Office Suite Tools	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Basic components of a Word window - Creating and Editing New Documents - Insert, Delete, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Saving and Printing a Document	3	1
	1.2	Formatting page-Page Orientation - Viewing Documents - Setting Tabs - Page Margins – Indents – Ruler - Formatting Techniques - Font Formatting	3	1

		- Paragraph Formatting - Page Setup - Headers & Footers - Bullets and Numbered List - Borders and Shading - Find and Replace - Page Break, Page Numbers ,Case settings, Highlighting, Special symbols, Alignments, Line Space, Converting files to different formats, Importing & Exporting documents, Sending files to others		
	1.3	Creating Tables- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, and Formula, Drawing - Inserting ClipArts, Pictures/Files ,Tables Side – By - Side and Nested Tables	3	1
	1.4	Mail Merging -Spelling and Grammar Checking – Thesaurus – Macros, Drawing options, Inserting images, url, autoshapes, word art	3	1
2	2.1	Spread Sheet & its Applications, Opening Spreadsheet, Formatting toolbar	3	1.2
	2.2	Working With Cell and Cell Addresses - Selecting a Range, Moving, Cutting, Copy, Paste - Insert and Delete Cells - Freezing Cells	3	1.3
	2.3	Formatting worksheet-Adding, Deleting and Copying Worksheet within a Workbook - Renaming a Worksheet - Formatting Fonts-Aligning-Wrapping and Rotating Text - Using Borders - Boxes and Colors, Mathematical functions, Arrange data in ascending or descending order	3	2
	2.4	Centering a Heading, Changing Row/Column Height / Width - Formatting a Worksheet Automatically - Insert Comments, Insert picture or clipart in excel sheet.	3	2
3	3.1	Creating Presentation - Advantages of Presentation, Inserting and Deleting Slides	3	3
	3.2	Formatting Slides - Slide Layout Views in Presentation, Insert new slides with different layout	4	3
	3.3	Editing a slide, Inserting picture to a slide, Inserting Sounds and	4	3

		Videos , Colour Scheme , Background Action Buttons - Slide Transition - Custom Animation		
	3.4	Creating Master Slides - Managing Slide Shows - Using Pen Setting Slide Intervals	4	3
	3.5	Creating a simple LaTeX document,Understanding the preamble,Document classes and styles,Font styles,Special characters,	5	4
	3.6	Creating bullet and numbered lists,Creating tables,Writing mathematical expressions,Including Graphics and images,Bibliographies and Citations,Apply learned skills to create a complete LaTeX document and word document	3	4
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** A. Continuous Comprehensive Assessment (CCA) Theory - 25 Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1. Written Test (50 marks)- Time : 1½ hours 1.MCQ - 35x1= 35 Marks 2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Gini, Courter & Annette Marquis, Ms-Office 2013, BPB Publications.
2. Patrick Blattner, Louie Utrich. Ken Cook & Timothy Dyck, Special Edition Ms Excel 2013, Prentice Hall India Pvt. Ltd
3. Kopka, Helmut, and Patrick W. Daly. *Guide to LATEX*. Pearson Education, 2003.

Suggested Readings

1. Building a Foundation with Microsoft Office 2013
2. Grätzer, G. *Math into LaTeX*. Birkhäuser
3. Walkenbach, John. *Ms Office Excel 2007 Formulas (With Cd)*. John Wiley & Sons, 2007.

4. Mittelbach, Frank, et al. The LATEX companion. Addison-Wesley Professional, 2004.

Mahatma Gandhi University Kottayam

Programme	Electronics with Computer Technology					
Course Name	Mobile App Development					
Type of Course	SEC					
Course Code	MG5SECECT301					
Course Level	**300-399**					
Course Summary and Justification	This course is designed to equip learners with a strong foundation in DART programming language, an understanding of diverse mobile application architectures, proficiency in Flutter features, and practical experience in mobile app development.					
Semester	5	Credits			3	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3	-			45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate the features of DART Programming Language	U	1, 2, 10
2	Explain different Mobile Applications	U	1 2,
3	Develop Proficiency in Flutter Features	A	1,2
4	Design and Develop mobile App using Flutter	C	1, 2, 10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
Dart programming				
1	1.1	**Data Types** Variables, Built-in types,Numbers,Strings, Booleans,Lists, Maps,Sets, Runes, Null, Comments,	3	1
	1.2	**Operators** - Arithmetic, Increment and Decrement, Assignment and Logical operators.	3	1

	1.3	**Control-flow statements** - Conditions, Switch case, Loops, Break and continue, Ternary operator	3	1
	1.4	**Object oriented programming(OOP)** - Classes, Objects,Encapsulation, Inheritance, Polymorphism, Abstraction.	2	1
Flutter Basics				
2	2.1	**Basics of vs code or android studio**, Flutter Installation in Windows,Widgets - Stateless, Stateful, Styled widgets,Functions, Collections - List, Map, Set. Working with assets - Fonts, Images.	3	2
	2.2	**Version control systems** - Git and Github Package manager - Pub.dev, How to use packages.	3	2
	2.3	Working with API's - Generating models using Serialisable. Restful api's, **Web sockets,**Exception handling	3	2
	2.4	"State management - Provider,Bloc, MVVM(Model View Viewmodel) architecture, Animations - Hero, Opacity, Curved animation, Animation controller, Animated builder, Animated widgets."	3	2
Database and Testing Concepts				
3	3.1	Storage - SqfLite, Shared preference, Hive, Firebase - Authentication, Storage, Firestore, Push notifications, Remote config.	3	3
	3.2	Advanced dart - Core libraries, Streams and Futures. Functional programming, Async/ Await.	3	3
	3.3	Testing - Widget testing,Unit testing, **Integration testing**	3	3
	3.4	Dev tools - Use of Flutter inspector, Performance and memory management	2	3
	3.5	**Hands on session**	11	
		1.Installation of Flutter 2.Develop simple mobile applications in Flutter using Dart language 3.Develop mobile applications using database Connections 4.Build simple Flutter application using simple widgets and layouts		
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, a hands-on lab sessions

Assessment Types	**MODE OF ASSESSMENT** A. Continuous Comprehensive Assessment (CCA) Theory - 25 Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1. Written Test (50 marks)-1 Hour 30 Minutes (Duration of Examination) 1.MCQ - 35x1= 35 Marks 2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Michael Katz, Kevin David Moore, Vincent Ngo & Vincenzo Guzzi Flutter Apprentice Second edition
2. Zammetti, Frank. Practical Flutter. Berkeley, CA: Apress, 2019.

Suggested Readings

1. Chopra, Deepti, and Roopal Khurana. Flutter and Dart: Up and Running: Build native apps for both iOS and Android using a single codebase (English Edition). BPB Publications, 2023.

Mahatma Gandhi University Kottayam

Programme	Electronics with Computer Technology					
Course Name	Low Voltage System for Building Management					
Type of Course	SEC					
Course Code	MG5SECECT302					
Course Level	300-399					
Course Summary and Justification	This course provides an in-depth exploration of low voltage systems as integral components of modern building management. It covers the fundamental principles, components, and applications of low voltage systems in the context of building automation..					
Semester :	5	Credits:			3	
Course Details	**Learning Approach**	**Lecture**	**Theory**	**Practical**	**Others**	**Total Hours**
		3				45
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	*Expected Course Outcome*	Learning Domain	PO No.
1	Demonstrate Understanding of Building Management Systems	U	1,2
2	Identify and Evaluate Low Voltage Components	A	1,2
3	Apply Control Strategies, Implement Energy Management Techniques	A	1,2,10
4	Design and Implement a Low Voltage System, Analyze and discuss real-world case studies of successful low voltage system implementations	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Overview of Building Management Systems	3	1
	1.2	Role of low voltage systems in BMS, Integration with other building systems	4	1
	1.3	Introduction to low voltage systems, Types of low voltage systems.	3	1
2	2.1	Lighting Control Systems: - Dimming techniques, Integration with building automation.	5	2
	2.2	HVAC - components and control strategies, Building automation for energy efficiency, Sensors and actuators in HVAC systems.	5	2
	2.3	Use of Relays and Low-power TRIAC. Types of sensors used in BMS (temperature, humidity, IR sensor)	5	2
	2.4	Actuators and their role in building automation Integration of sensors and actuators in low voltage systems. Lift Management System.	5	2
3	3.1	Intrusion detection systems, Access control technologies, Video surveillance and monitoring	4	3
	3.2	Fire Protection system - Fire detection and alarm systems, Emergency communication systems, Integration with other safety systems.	4	3
	3.3	Access control system- Access cards, • Card readers, Access control keypads.	4	3
	3.4	Monitoring and analyzing energy usage, Demand response strategies, Renewable energy integration	3	3
4	4	**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory - 25 Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1.Written Test (50 marks)- Time 1 ½ Hours MCQ - 35x1= 35 Marks Short Essay Question = 15 Marks (3 out 5)- 3x5

References

1. Kennedy, Terry, and John E. Traister. Low Voltage Wiring: Security/Fire Alarm Systems. McGraw Hill Professional, 2001.
2. A Low-Cost IoT Based Buildings Management System (BMS) Using Arduino Mega 2560 And Raspberry Pi 4 For Smart Monitoring and Automation,

Muhammad Uzair et al.International Journal of Electrical and Computer Engineering Systems Volume 13, Number 3, 2022

Suggested Readings

1. Papadopoulou, Elena. Energy management in buildings using photovoltaics. Springer Science & Business Media, 2012.
2. Harvey, LD Danny. A handbook on low-energy buildings and district-energy systems: fundamentals, techniques and examples. Routledge, 2012.

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Cloud Computing and IoT					
Type of Course	DSC					
Course Code	MG6DSCECT300					
Course Level	300-399					
Course Summary and Justification	This course offers a comprehensive exploration of the integration between the Internet of Things (IoT) and Cloud Computing. It covers the fundamental principles, architectures, and applications of IoT, alongside the critical role that Cloud Computing plays in supporting and enhancing IoT ecosystems.					
Semester:	6	**Credits:**			4	**Total Hours:**
Course Details	**Learning Approach**	**Lecture**	**Theory**	**Practical**	**Others**	
		3		1		75
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain	PO No.
1	Explain the fundamental principles of IoT concepts.	U	1,2
2	Develop IoT standards and protocols in practical scenarios.	A	1,2,10
3	Categories the compatibility and integration of different IoT standards and protocols.	An	1,2,8
4	Organize the relevance of IoT standards and protocols in diverse applications.	E	1,2,8

Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	**IoT Architecture**			
1	1.1	Definition, and evolution of IoT, IoT hardware components (sensors, actuators & ESP32)	3	1
	1.2	Arduino IDE for IoT Development, Developing sensor based application through embedded system platform(Using DHT11 and IR Proximity Sensor)	4	1

	1.3	Challenges in IoT:- Design challenges, Development challenges, Security challenges, Other challenges	4	1
	1.4	Edge computing vs. Cloud computing in IoT. Implementing IoT concepts with python	4	1
2	**IoT Communication Technologies**			
2	2.1	Communication protocols (MQTT, CoAP, HTTP), Physical design of IoT, Logical design of IoT, Functional blocks of IoT	4	2
	2.2	Communication models & APIs (Blynk, Thing Speak) IoT & M2M (Machine to Machine), Difference between IoT and M2M, IoT networks, Software define Network	4	2
	2.3	Wired and wireless communication, Bluetooth(BLE), Zigbee, LoRa, and 5G in IoT	4	2
	2.4	Familiarization of development board ESP32	3	2
3	**Cloud Computing**			
3	3.1	Cloud service models (IaaS, PaaS, SaaS), Deployment models (public, private, hybrid). Cloud: Deployment models of cloud, Cloud configuration using thingspeak, concept of AWS.	4	3
	3.2	Cloud-based IoT platforms, Data storage and analytics in the Cloud	4	3
	3.3	Security and Privacy in IoT and Cloud - Authentication and authorization, Encryption and secure communication	4	3
	3.4	Edge Computing in IoT - Edge devices and gateways, Benefits and challenges of edge computing	3	3
4	**Practical**			
		Any one innovative project based on Cloud Computing and IoT. Suggested topics : 1. Smart Home Automation System 2. Health Monitoring Wearable 3. Smart Agriculture System 4. Industrial IoT for Predictive Maintenance 5. Traffic Management System 6. Environmental Monitoring Network 7. Smart Energy Management System 8. Wireless weather station using DHT11 9. Water Quality Monitoring System 10. Smart Parking Solution	30	4
5	Teachers Specific Content (This can be either classroom teaching practical sessions , field visit etc. as specified by the teacher concern and will be evaluated internally)			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **C. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- Time 1 ½ Hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) d. Viva e. Lab report f. Demonstration

References

1. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.
2. Monk, Simon, and Michael McCabe. Programming Arduino: getting started with sketches. Vol. 176. New York: McGraw-Hill Education, 2016.

Suggested Readings

1. Bali, Vikram, et al., eds. Disruptive Technologies for Society 5.0: Exploration of New Ideas, Techniques, and Tools. CRC Press, 2021.
2. Nayyar, Anand. Handbook of Cloud Computing: Basic to Advance research on the concepts and design of Cloud Computing. BPB Publications, 2019.
3. Jamsa, Kris. Cloud computing. Jones & Bartlett Learning, 2022.
4. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. Cloud computing: Principles and paradigms. John Wiley & Sons, 2010.
5. Bahga, Arshdeep, and Vijay Madisetti. Cloud computing: A hands-on approach. CreateSpace Independent Publishing Platform, 2013.
6. Arduino by Example by Adith Jagadish Boloo
7. Internet of Things- Shriram K Vasudevan, Abhishek Nagarajan, RMD Sundaram, Wiley India
8. IoT and its Applications- Prof. Satish Jain, Shashi Singh, BPB publications

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Computer Networking					
Type of Course	DSC					
Course Code	MG6DSCECT301					
Course Level	**300-399**					
Course Summary and Justification	This course equips learners with a comprehensive understanding of computer networks, emphasizing practical applications in setting up and configuring networks. It fosters critical thinking and analytical reasoning essential for addressing contemporary networking challenges.					
Semester	6	Credits			4	Total Hours
Course Details	**Learning Approach**	**Lecture**	**Theory**	**Practical**	**Others**	
		3		1		75
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain the Fundamentals of Computer Networks	U	1,2
2	Contrast Network Models and Configurations	U	1,2
3	Develop skill on Analyzing IP Addressing and Protocols	A	1,2
4	Build Internet Access Techniques	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	units	Course description	Hrs	CO No.
Introduction to Computer Networks			15	1
1	1.1	Introduction to computer networks –Definition-Basic Concepts - Uses of network.	4	
	1.2	Classification of Network(LAN, WAN,MAN,PAN)	3	
	1.3	Network Topologies Different types of Topologies (Star, Mesh, Ring, Bus, Hybrid)	3	
	1.4	IP Addressing and Subnet Masks Introduction, IP v4, IPv6, IP Address, Concept of Classes	5	
IP and OSI Model			15	2
	2.1	TCP/IP Model (Functions of each layer only)	5	
	2.2	Network Devices- Hub, Switch, Router and Inter Networking Devices- Bridge , Gateway	4	
	2.3	Introduction - Dynamic Host Configuration Protocol	2	
	2.4	Introduction toVirtual local area network (VLAN}	4	
An overview about Network Routing and Internet Access			15	3
3	3.1	Routing Introduction, Static Routing, Dynamic Routing	4	
	3.2	Introduction to Internet Access Internet Infrastructure, Internet Service Provider	3	
	3.3	Wireless Access Technologies Wireless Networks Overview, Wi-Fi Technology	4	
	3.4	Wireless Security: Security considerations for wireless networks. Introduction to encryption.	4	
		Practicals (Any 4)	30	4
4		1. Study of Network Cables and Implementation of Cables 1.1 Crimping 1.2 Punching 2. IP configuration in a Computer 3. Modem/Router Configuration 4. Configuring Computer in a Network 5. Create a Computer Network (LAN) a Using Switch b Using Modem/Router 6. VLAN Implementation(Cisco based packet tracer software) 7.Connecting Devices Configuration 8.Router and manageable Switches (Cisco based packet tracer software)		
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1 Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2 Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments , Performance ,Case Study.
	D. Semester End examination 1.Written Test (50 marks)- Time 1 ½ Hours a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Andrew S, Tanenbaum, And Wetheral.David J. "Computer Networks Fifth Edition." (2011).
2. Forouzan, Behrouz A. *Data communications and networking*. Huga Media, 2007.

Suggested Readings

1. Bonaventure, Olivier. *Computer Networking: Principles, Protocols and Practice*. Washington: Saylor foundation, 2011.
2. Kurose, James F. *Computer networking: A top-down approach featuring the internet, 3/E*. Pearson Education India, 2005.
3. Comer, Douglas. *Computer networks and internets*. Cambridge, MA, USA:: Pearson, 2015.

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Natural Language Processing					
Type of Course	DSE					
Course Code	MG6DSEECT300					
Course Level	300-399					
Course Summary and Justification	This course provides the ability to harness, employ and analyze linguistic and textual data effectively is a highly desirable skill for academic work, in government, and throughout the private sector. This course is intended as a theoretical and methodological introduction to the most widely used and effective current techniques, strategies and tool kits for natural language processing, with a primary focus on those available in the Python programming language.					
Semester	6	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Demonstrate how to represent words for machine learning techniques.	U	1,2
2	Evaluate the strengths and weaknesses of various NLP technologies and frameworks as you gain practical experience in the NLP tool kits available.	E	1,2
3	Choose machine learning techniques in the context of textual data analysis.	E	1,2
4	Develop innovative solutions by combining and adapting NLP methods and machine learning techniques to address complex challenges in natural language processing.	C	1,2, 10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	**Introduction**			

	1.1	Concept of Natural Language Processing, Different use cases of NLP. Introduction to NLTK, Python and Jupyter Notebook	4	1, 2
	1.2	Accessing Text Corpora and Lexical Resources.	3	1, 2
	1.3	Tokenization, N – grams	4	1, 2
	1.4	Stop words and its removal, Text features	4	3
2	**Building your corpus and introduction to Vectorization of words**			
	2.1	POS Tagging, The word in a text	3	2, 3
	2.2	Stemming and Lemmatization, Synsets and Hypernyms	4	2, 3
	2.3	Build your Corpus, One hot encoding	4	2, 3
	2.4	Bag of words, TF-IDF	4	2, 3, 4
3	**Applications and plot**			
	3.1	Spam Classification and sentiment Analysis using BOW and TF - IDF	3	2, 3
	3.2	Name Entity Recognition	3	2, 3, 4
	3.3	Context based representation of words, Plotting the text, Relations in words	3	2, 3
	3.4	Document Clustering and Word Vectors	4	2, 3
4	**Word2Vec**			
	4.1	Models of Word2vec – CBOW and Skipgram models	5	3, 4
	4.2	Different types of wordvectors	4	3
	4.3	Machine Learning approaches to Textual Data	5	3, 4
	4.4	Applications of Word2vec	3	3, 4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Bird, Steven, Ewan Klein, and Edward Loper. *Natural language processing with Python: analyzing text with the natural language toolkit*. " O'Reilly Media, Inc.", 2009.
2. Sarkar, Dipanjan. *Text analytics with python*. Vol. 2. New York, NY, USA:: Apress, 2016.

Suggested Readings

1. Patel, Stephen, and Joseph Smarr. "CS 224N Final Project, Stanford University, Spring 2001."

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Optoelectronics					
Type of Course	DSE					
Course Code	MG6DSEECT301					
Course Level	300-399					
Course Summary and Justification	This course provides learners with a comprehensive understanding of optoelectronic devices, optical fiber communication, and hands-on experience with sensors.					
Semester	**6**	Credits			**4**	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		4				60
Pre-requisites						

COURSE OUTCOME (CO)

CO No.	**Expected Course Outcome**	Learning Domain	PO Nos
1	Understand the concept of Optoelectronics and the components used.	U	1,2
2	Illustrate various Optical Detectors and its Applications	U	1,2
3	Build knowledge about Optical fiber accessories and measurement equipment.	C	1,2
4	Experiment with Optoelectronic Devices	A	1,2,10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Properties of light, Basic OFC communication building blocks, Benefits of OFC communication and application fields	4	1
	1.2	LED, Types of LED, Semiconductor LASER, Helium Neon LASER	3	1
	1.3	Introduction to Optical fiber, Step index, Graded index optical fiber	3	1
	1.4	Factors affecting on optical fiber communication - attenuation, dispersion	5	1
2	2.1	Introduction to light detectors, LDR, Photo multiplayer tube	4	2
	2.2	Semiconductor Photodiode, Phototransistors, optocouplers	4	2
	2.3	PIN Diode and APD Diode	4	2
	2.4	Application of Optical detectors	3	2
3	3.1	Optical fiber connectors, Fiber End preparation, Splicing and Source coupling	4	3
	3.2	Optical lenses and splitters	4	3
	3.3	Optical converters optical to RF converter	4	3
	3.4	Optical measurement tools - Optical spectrum analyser, multi-function optical test unit, Optical power attenuator, conformance analyzer, visual fault indicator	3	3
4	4.1	Point to point OFC communication system development, Laser crossing alarm design, Optical Counting system, Design and development of LiFi System	15	4
5		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Keiser, Gerd. Optical fiber communications. Vol. 2. New York: McGraw-Hill, 2000.
2. Palais, Joseph C. "Fiber optic communications." Englewood Cliffs (1984).

Suggested Readings

1. Piprek, Joachim. Semiconductor optoelectronic devices: introduction to physics and simulation. Elsevier, 2013.
2. Khare, R. P. "Fiber optics and optoelectronics." (2004).
3. Optoelectronics: An Introduction book, John Wilson.

Mahatma Gandhi University Kottayam

Programme	Electronics with Computer Technology
Course Name	Biometric Authentication System
Type of Course	DSE
Course Code	MG6DSEECT302
Course Level	300-399
Course Summary & Justification	This course provides a comprehensive understanding of various biometric identification techniques including fingerprint, face, and iris recognition. It emphasizes the acquisition, processing, and security aspects of biometric systems while exploring multiple evidence sources and their integration

Semester	6	Credits			4	Total Hours
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Understand the practical applications of biometric systems across various domains, demonstrating the ability to analyze and evaluate their effectiveness.	U	1
2	Build knowledge and comprehension of the techniques and technologies employed in fingerprint image acquisition, enhancement, and pre-processing, applying critical thinking to assess their implications.	A	1,2
3	Apply the principles of iris features and matching algorithms to solve practical problems in identification and verification scenarios, integrating the knowledge to create innovative solutions.	A	1,6
4	Evaluate and synthesize knowledge of multimodal biometrics, demonstrating the ability to address specific challenges related to accuracy and reliability in authentication processes through the application of advanced problem-solving skills.	A	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
	1.1	Biometric systems Introduction, Person Recognition	3	1

	1.2	Biometric Systems, Biometric Functionalities, Biometric System Errors	4	1
	1.3	The Design Cycle of Biometric Systems (Basic Concept)	4	1
	1.4	Applications of Biometric Systems.	4	1
	2.1	Fingerprint Recognition - Introduction, Friction Ridge Pattern	4	2
	2.2	Fingerprint Acquisition, Feature Extraction, Matching, Fingerprint Indexing, Fingerprint Synthesis, Palmprint	4	2
	2.3	Face Recognition – Introduction, Psychology of face recognition, Facial features, Design of a face recognition system	4	2
	2.4	Image Acquisition -2D Sensors, 3D Sensors, Video sequences, Face Detection, Feature Extraction and Matching	3	2
	3.1	Iris Recognition - Design of an Iris Recognition System,	2	3
	3.2	Image Acquisition, Iris Segmentation, Iris Segmentation Iris Normalization	4	3
	3.3	Iris Encoding and Matching, Iris Quality, Performance Evaluation.	5	3
	3.4	Additional Biometric Traits – Ear, Gait, Hand Geometry, Soft Biometrics	4	3
4	**Advanced Biometric systems(Detail study not required)**			
	4.1	Sources of Multiple Evidence- Multi-sensor systems, Multi-algorithm systems, Multi-instance systems, Multi-sample systems, Multimodal systems	5	4
	4.2	Acquisition and Processing Architecture -Acquisition sequence, Processing sequence.	4	4
	4.3	Security of Biometric Systems – Introduction, Adversary Attacks, Attacks at the User Interface	4	4
	4.4	Attacks on Biometric Processing, Attacks on the Template Database.	2	4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others

	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. "Jain, Anil K., Patrick Flynn, and Arun A. Ross, eds. Handbook of biometrics. Springer Science & Business Media, 2007.
2. Wayman, James L., et al., eds. Biometric systems: Technology, design and performance evaluation. Springer Science & Business Media, 2005.
3. Wayman, J. L., Jain, A. K., Maltoni, D., & Maio, D. (Eds.). (2005). Biometric systems: Technology, design and performance evaluation. Springer Science & Business Media.

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Embedded Computer Vision					
Type of Course	DSE					
Course Code	MG6DSEECT303					
Course Level	300- 399					
Course Summary and Justification	In this course students will learn the fundamentals of digital image processing and computer vision .Students also gain the skills needed to analyse, interpret and manipulate visual data.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Explain the fundamentals of Computer vision	U	1,2
2	Identify the techniques to perform digital image processing	A	1,2
3	Assess features from images and objects	E	1,2
4	Apply the knowledge in real-world problems related to visual information using computer vision techniques	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	**Introduction to Computer vision and image processing(13 hrs)**			
	1.1	Definition and goals of computer vision- Historical overview and key milestones Applications of computer vision in real-world scenarios-	4	1
	1.2	Image Representation-Simple image formation model,Representing Digital images	2	1
	1.3	Basic relationships between pixel,Distance measures	3	1

	1.4	Representation of digital images, Types of images,File formats,Color spaces-RGB,HSV,	4	1
2	**Image Processing Techniques(15 hrs)**			
	2.1	Image EnhancementTechniques - Contrast Stretching, Histogram Equalization,	3	2
	2.2	Image Filtering - Convolutions, Blurring,Sharpening	4	2
	2.3	Basics of Morphological Operations-Structuring Element, Erosion, Dilation, Opening and Closing	3	2
	2.4	Connectedness, Object Labelling and Counting, Boundary descriptors - Chain codes	5	2
3	**Imaging System and Feature Detection(20 hrs)**			
	3.1	Camera models -Orthographic and Perspective projection,geometric transformations,basic idea of camera models, 3D -imaging system -Stereo Vision	5	3
	3.2	Feature Extraction: Edge detection -edges,lines,active contours,Normalized cuts,Graph cuts -Sobel, Canny.	6	3
	3.3	Point and corner detection (Harris corner detector).-Scale-invariant feature transform (SIFT)	5	3
	3.4	Shape from X,Shape matching,Structure from motion	4	3
4	**Motion Analysis and Object Detection(12 hrs)**			
	4.1	Motion Analysis-Regularization theory,Optical flow:brightness constancy equation,aperture problem	3	4
	4.2	Object detection - Face detection -Pedestrian detection	3	4
	4.3	Face recognition- Eigenfaces - and 3D shape models	3	4
	4.4	Motion estimation and object tracking-Overview	3	4
5	Teachers Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Gonzalez, Rafael C. Digital image processing. Pearson education india, 2009.

Suggested Readings

1. Szeliski, Richard. Computer vision: algorithms and applications. Springer Nature, 2022.

2. Gupta, Deep, et al., eds. Computer Vision and Image Processing: 7th International Conference, CVIP 2022, Nagpur, India, November 4–6, 2022, Revised Selected Papers, Part I. Springer Nature, 2023.
3. Digital Image Processing 2ND edition -by S Jayaraman, S Esakkirajan , T Veerakumar July 2020

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Automotive Electronics					
Type of Course	DSE					
Course Code	MG6DSEECT304					
Course Level	300-399					
Course Summary and Justification	The course provides a comprehensive understanding of electronics, embedded systems, sensors, and communication networks specific to automotive applications, preparing students for roles in the rapidly evolving field of automotive electronics.					
Semester	6	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PSO No.
1	Illustrate the basic principles of electronics in applied to automotive systems	U	1,2
2	Extend hands-on experience in designing and programming embedded systems used in automotive applications	U	1,2
3	Explain in-depth knowledge of various sensors employed in automotive electronics	A	1,2,6
4	Develop a comprehensive understanding of communication networks and protocols	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyze (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	**Fundamentals in Automotive Electronics**(Detailed study not required)			
	1.1	Introduction to Automotive Electronics - Evolution of automotive electronics, Importance of electronic components in enhancing vehicle performance and efficiency.	4	1
	1.2	Type of Voltage regulators, Type of Batteries	4	1
	1.3	Overview of automotive lighting systems- Introduction to LED and HID lighting technologies, Adaptive lighting and automatic lighting control.	4	1

	1.4	Introduction to Electronic Control Unit, Basics of Control Area Network Protocol and Local Interconnect Network Protocol	3	1
2	**Embedded Systems in Automotive Electronics**(Detailed study not required)			
	2.1	Introduction to Embedded Systems in Vehicles- Definition and significance of embedded systems in automotive applications, Role of embedded systems in enhancing vehicle performance and efficiency	3	2
	2.2	Real-Time Operating Systems (RTOS)- Introduction to RTOS and its role in automotive embedded systems, Task scheduling and management in real-time environments. (Detail study not required)	5	2
	2.3	Working of Air Bag System, Electronic stability control (ESC) systems, Anti-lock braking systems (ABS)	4	2
	2.4	Electronic brake-force distribution (EBD), Advanced driver assistance systems (ADAS).	3	2
3	**Sensors in Automotive Electronics(Detailed study not required)**			
	3.1	Role of sensors in modern automotive electronics, Significance for safety, performance, and efficiency.	3	3
	3.2	Working Principles of Automotive Sensors Introduction to various sensors used in automobiles Functions and applications of:-Temperature sensors, pressure sensors, position sensors.	3	3
	3.3	Applications of Sensors in Vehicle Systems, Engine Control Systems, Braking Systems, Climate Control Systems.	5	3
	3.4	Familiarizing sensor simulator -Open-source simulator AURELION. (Use simulation tools to design and analyze sensor integration scenarios)	4	3
Automotive Backbone Network and Autonomous Vehicle (Detailed study not required)				
4	4.1	Automotive Protocols for Diagnostic Communication Introduction to diagnostic communication protocols- On-Board Diagnostics (OBD), Use of protocols for vehicle diagnostics and maintenance	3	4
	4.2	Network Topologies and Security in Automotive Networks Bus structures and star configurations in automotive networks, Importance of securing automotive networks against cyber threats, Implementation of security protocols and encryption.	3	4
	4.3	Introduction to Electronics in Hybrid vehicle and Electric vehicle :- Concept of regenerative Braking , Battery Management System	5	4
	4.4	Future trends in automotive electronics and Concept of Autopilot vehicle	4	4

5	**Teachers Specific Content**

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Ribbens, William. Understanding automotive electronics: an engineering perspective. Butterworth-heinemann, 2017.
2. Gupta, K. M., and Nishu Gupta. Advanced electrical and electronics materials: processes and applications. John Wiley & Sons, 2015.
3. Bosch, R. "Automotive Electrics Automotive Electronics. Systems and components, Robert Bosch GmbH." (2007).

Suggested Readings

1. Automotive Electronics: Principles and Practices" by Gupta, R & Singh, S).

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Wireless Communication					
Type of Course	DSE					
Course Code	MG6DSEECT305					
Course Level	300-399					
Course Summary and Justification	This course provides learners with a comprehensive understanding of wireless communication, covering fundamental concepts, modulation techniques, various wireless protocols, and advanced topics in 5G technology. The hands-on experiences and projects ensure practical application, preparing learners for critical thinking and problem-solving in the rapidly evolving field of wireless communication.					
Semester	6	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate the fundamentals of modulation techniques	U	1,2
2	Organize the principles of wireless communication systems.	A	1,2
3	Analyze and compare various wireless protocols including WiFi, Zigbee, LoRa, and 5G	An	1,2
4	Develop skills in creating solutions for real-world wireless communication Challenges	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1		**Fundamentals of Wireless Communications (Detailed Study not required)**		

	1.1	Introduction to Wireless Communication Elements of wireless communication system	3	1
	1.2	Wireless Communication Systems - Overview of various wireless communication systems (cellular, satellite, Wi-Fi, Bluetooth). Types of Wireless Communication - Point-to-point, Broadcast, Multi-Point Communications.	4	1
		Signal Propagation in Wireless Channels. Signal to Noise Ratio, QoS: - Packet loss, Bitrate, Transmission Delay, Jitter.	4	1
	1.4	An overview of 2G,3G,4G,5G and next generation. Fundamentals of frequency, bandwidth. Basic principles of Modulation, Types of Modulation - ASK, FSK, PSK.	4	1
2	**Wi-Fi Standards**			
	2.1	Wireless Communication Standards Introduction to Standards Bodies - IEEE, 3GPP, and Wi-Fi.	4	2
	2.2	Overview of Popular Standards - IEEE 802.11 (Wi-Fi), Zigbee, LoRa, MIMO. Overview about Wireless Fiber (Wireless Optical Communication) and Semantic Communication	4	2
	2.3	Ham Radio, Security Concern in Wireless Communication Role of encryption and decryption in wireless communication systems. Regulation for using frequency bands in brief.	4	2
	2.4	Role of wireless communication in Healthcare, Smart Cities, Manufacturing, Agriculture, Home Automation, Emergency Services.	3	2
3	**Satellite Communication**			
	3.1	Introduction to satellite Communication Block schematic of satellite communication, Frequency allocation.	4	3
	3.2	Satellite Orbits Classifications of Orbits LEO, MEO, GEO, HEO, Polar, Elliptical, Equatorial, Satellite Air Ground Integrated Network (SAGIN)	4	3
	3.3	Application: - DTH, Satellite Phone, VSAT	4	3
	3.4	Satellite Internet Services: - Working Principles, CPE, Uses	3	3
4	**Case Study**			

		Suggested Topics in Case Study **(Select any one topic from the below list)** **Topic 1:** Environmental Monitoring with Wireless Sensors **Topic 2:** Wireless Technology in Disaster Management **Topic 3:** Privacy and Security Concerns in Wireless Networks **Topic 4:** Wireless Healthcare Monitoring System **Topic 5:** Wireless technology in women and child safety **Topic 6:** Lora-Based Mobile Emergency Management System **Topic 7:** Wireless Communication in Precision Agriculture **Topic 8:** Wireless Sensor Networks for Wildlife Conservation **Any 6 tasks from the following must be included in the case study.** 1. Reliability Analysis 2. Cost-Benefit Assessment 3. Threat Assessment 4. Encryption Protocols 5. Impact Assessment 6. Integration Challenges 7. User-Friendly Solutions 8. Emergency Response Effectiveness 9. Community Engagement 10. Performance Analysis 11. Scalability Assessment 12. Security Audit 13. Legal and Ethical Considerations 14. Experience Assessment 15. Data Security 16. Ecosystem Monitoring	15	4
5		Teachers Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Rappaport, Theodore S. Wireless communications: principles and practice. Cambridge University Press, 2024.
2. Xu, Zheng, et al. "Participatory sensing-based semantic and spatial analysis of urban emergency events using mobile social media." EURASIP Journal on Wireless Communications and Networking 2016 (2016): 1-9.

Suggested Readings

1. Andrews, Jeffrey G., Arunabha Ghosh, and Rias Muhamed. Fundamentals of WiMAX: understanding broadband wireless networking. Pearson Education, 2007.
2. Beard, Cory, and William Stallings. Wireless communication networks and systems. Pearson, 2015.
3. Stallings, William. Wireless communications & networks. Pearson Education India, 2009.

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology					
Course Name	Edge Computing					
Type of Course	DSE					
Course Code	MG6DSEECT306					
Course Level	300-399					
Course Summary and Justification	This course provides a foundational understanding of essential edge computing concepts, Deep learning work flow and fostering problem-solving skills using TensorFlow Lite for Microcontrollers (TinyML). Students gain hands-on experience through TensorFlow Lite for Microcontrollers, and prepare them for practical applications.					
Semester	6	Credits			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	*Expected Course Outcome*	Learning Domain*	PO No.
1	Understand the definition and the concepts of embedded systems to Edge computing, Deep learning workflow and TinyML.	U	1,2
2	Illustrate the proficiency to make use of a data set Training and validation using Google colab.	U	1,2
3	Demonstrate the pin diagram and functions of the GPIO pins of the ESP 32.	U	1, 2, 10
4	Develop knowledge to make use of Tensorflow Lite for microcontrollers, edge computing, deploy an ML model on MCU for real-time inference, and for deep learning projects.	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	**Introduction to Edge computing, Deep learning workflow and TinyML**			
	1.1	Edge computing vs fog computing vs Cloud computing	4	1
	1.2	Artificial Intelligence vs Machine Learning vs Deep learning	5	1
	1.3	Neural networks, Deep learning workflow and TinyML overview	6	1
	Data set Training and validation using Google colab			
2	2.1	Introduction to Google colab, Tensorflowlite, keras and python	2	2
	2.2	TinyML applications in industry, healthcare and smart traffic systems	4	2
	2.3	Data set, AI model graph, loss, accuracy	4	2
	2.4	Data split - Training, validation and testing, underfitting and overfitting, epochs.	5	2
	Get started with microcontrollers and TensorFlow Lite for Microcontrollers			
3	3.1	Embedded systems development overview, Development boards (ESP32), Basics of C programming (language, environment, and tools), Arduino IDE.	6	3
	3.2	Familiarization of development board ESP32	1	3
	3.3	ESP 32 GPIO pin functions	1	3
	3.4	Familiarization of arduino IDE software – board library installation	2	3
	3.5	TensorFlow Lite for ESP 32 Microcontrollers: Setup and upload a simple TensorFlow sketch on ESP32	5	3
	Building and Training a Model Experiments to be done with IoT development board ESP32 Software: Arduino IDE/ESPIDF, Google colab, Tensorflowlite, keras and python. Deploy an ML model on MCU for real-time inference.			
4	4.1	**Overview** of a Tiny ML building and Training the "Hello World" model of TinyML.	4	4
	4.2	**Data set and training:** Obtain a simple dataset, train a deep learning model, Evaluate the model's performance(Optional)	5	4
	4.3	**ML Model improvement**: improving the created model, neurons, dense layer, epochs, etc.(Optional)	6	4
5	Teachers Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Buyya, Rajkumar, and Satish Narayana Srirama, eds. Fog and edge computing: principles and paradigms. John Wiley & Sons, 2019.

2. "Warden, Pete, and Daniel Situnayake. Tinyml: Machine learning with tensorflow lite on arduino and ultra-low-power microcontrollers. O'Reilly Media, 2019.

Suggested Readings

1. Taheri, Javid, and Shuiguang Deng. Edge Computing: Models, Technologies and Applications. The Institution of Engineering and Technology (IET), 2020.

3. Shibu, K. V. Introduction to embedded systems. Tata McGraw-Hill Education, 2009.

4. Barnett, Richard H., Sarah Cox, and Larry O'Cull. Embedded C programming and the Atmel AVR. Thomson Delmar Learning, 2006.

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology
Course Name	Secure Communication
Type of Course	DSE
Course Code	MG6DSEECT307
Course Level	300-399
Course Summary and Justification	This comprehensive course in Secure Communication provides a thorough understanding of crucial elements in cybersecurity and cryptography, ethical hacking, cipher types, Data Encryption Standards (DES), types of Malware, Firewall structures and VPN.

Semester :	6	Credits:			4	**Total Hours:**
Course Details	**Learning Approach**	**Lecture**	**Theory**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Illustrate Cryptography and Network Security Fundamentals	U	1,2
2	Classify Symmetric and Block Ciphers	An	1,2
3	Assess in Designing Secure Systems	E	1,2,8
4	Develop Cybersecurity Best Practices	A	1,2, 8

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	**Introduction to Cryptography & Network Security**			
	1.1	Introduction Cryptography & Crypto analysis	3	1
	1.2	Model of Network Security	4	1
	1.3	Ethical Hacking basics	4	1
	1.4	OSI Security Architecture (Security Attacks, Security Services, Security Mechanisms – all in detail)	4	1
2	**Symmetric & Asymmetric Ciphers**			
2	2.1	Classical Encryption Techniques -Symmetric Cipher model-Cryptography, Cryptanalysis	3	2
	2.2	Substitution Technique -Caeser Cipher, Transposition Techniques (Basics)	4	2

	2.3	Steganography	4	2
	2.4	The Enigma Machine (No detailed study needed).	4	2
3	**Block & Stream Ciphers**			
3	3.1	Basic principle of Block Ciphers with example	3	3
	3.2	Basic principle of Stream Ciphers with example	4	3
	3.3	Data Encryption Standards (DES)	4	3
	3.4	Basic Block & Theory (Encryption / Decryption)	4	3
4	**Secure System Design**			
4	4.1	Firewall - Structure & Types – VPN (Basics)	3	4
	4.2	Trusted System Concept – Types of Malware – Trojan Horse Defense	4	4
	4.3	Cyber Security & Concept of Dark net	4	4
	4.4	Practices to be Cyber Safe (including Secure E-commerce)	4	4
5	Teachers Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

Refertences

1. William, Stallings. Cryptography and network security: For VTU. Pearson education india, 2006.
2. Stinson, Douglas R. Cryptography: theory and practice. Chapman and Hall/CRC, 2005.

Suggested Readings

1. Pfleeger, Charles P., and Shari Lawrence Pfleeger. Analyzing computer security: A threat/vulnerability/countermeasure approach. Prentice Hall Professional, 2012.
2. Russell, Deborah, and G. T. Gangemi. Computer security basics. " O'Reilly Media, Inc.", 1991.
3. Schneier, Bruce. Applied cryptography: protocols, algorithms, and source code in C. john wiley & sons, 2007.

4. Ferguson, Niels, Bruce Schneier, and Tadayoshi Kohno. Cryptography engineering: design principles and practical applications. John Wiley & Sons, 2011.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Product System Design and Branding for Start-up					
Type of Course	**DSE**					
Course Code	MG6DSEECT308					
Course Level	300-399					
Course Summary and Justification	This course provides students with a comprehensive understanding of safety management, ethical decision-making and practical application of safety regulations. It equips them with the skills needed for leadership roles in promoting safety and ethical conduct in various professional settings.					
Semester	6	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain	PSO No.
1	Demonstrate an understanding of the principles of effective product design for start-ups.	U	1,2
2	Apply branding principles effectively to enhance the market presence of start-up products.	A	1,2,10
3	Examine legal considerations relevant to product development and branding in start-ups.	An	1,8,10
4	Formulate a comprehensive strategy that integrates product system design and branding for a start-up.	C	1,6,10

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	**Introduction to Start-up Ecosystem and Product Design**			

	1.1	Overview of Start-up Ecosystem Definition and key components of a start-up ecosystem. Understanding the role of stakeholders such as incubators, accelerators, and venture capitalists. Understanding different funding stages (seed, angel, venture capital).	3	1
	1.2	Principles of Product Design for Start-ups Importance of understanding user needs and behavior, Prototyping tools and techniques.	3	1
	1.3	Case Studies in Start-up Success Common characteristics and strategies among successful start-ups. Understanding the reasons behind start-up failures. Case studies of start-ups that achieved long-term success.	4	1
	1.4	Hands-on Workshop: Ideation Brainstorming sessions for generating innovative ideas.	5	1
2	**Branding Strategies for Start-ups**			
	2.1	Fundamentals of Branding Formulating a brand strategy aligned with business goals. Building a brand that resonates with the target audience. Managing and enhancing brand image	4	2
	2.2	Branding in the Context of Start-ups Unique challenges faced by start-ups in branding. The role of founders in shaping the brand.	3	2
	2.3	Digital Branding and Online Presence Importance of digital presence in modern branding. Creating and managing brand presence on social media. Strategies for engaging with the audience on social platforms.	4	2
	2.4	Branding Exercise and Case Studies Search Engine Optimization (SEO) for Brand Visibility: Basics of SEO for improving brand visibility. Keyword strategies aligned with brand identity. Monitoring and optimizing online content for search engines.	4	2
3	**Integrating Product System Design and Branding**			
	3.1	Synergy Between Design and Branding The role of design in conveying brand values. Aligning design decisions with the target audience. Principles of designing for brand recognition.	4	3

	3.2	User-Centric Design and Brand Consistency Principles and methodologies of user-centric design. Ensuring that design choices reflect the core values of the brand.	3	3
	3.3	Creating a Brand Identity through Design Exploration of key design elements contributing to brand identity. Understanding the psychological impact of design choices on brand perception.	3	3
	3.4	Exercises in Designing Brand Elements Individual and group activities to design logos, color schemes, and other brand visuals. Group exercises to analyze and critique design choices from a user perspective.	5	3
4	**Intellectual Property and Legal Considerations**			
	3.1	Overview of Intellectual Property Definition and significance of intellectual property. Different forms of IP (patents, trademarks, copyrights, trade secrets). Role of IP in protecting creativity and innovation.	4	4
	3.2	Legal Framework for Start-ups Legal structures for start-ups (e.g., sole proprietorship, LLC, corporation). Compliance requirements for start-ups. Legal considerations in forming and operating a start-up.	4	4
	3.3	Protecting Innovation and Brand Assets Overview of the patent application process. Strategies for obtaining and enforcing patents. Importance of trademarks in building brand identity. Understanding copyrights in the context of start-ups.	4	4
	4.4	Workshop: IP Strategy and Legal Compliance Q&A sessions with legal experts	3	4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others

	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Ries, Eric. The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Currency, 2011.
2. Aaker, David A. Building strong brands. Simon and Schuster, 2012.

Suggested Readings

1. Tewari, Rupinder, and Mamta Bhardwaj. Intellectual Property: A Primer for Academia. Publication Bureau, Panjab University, 2021.
2. Shabran, Rohit P., Akhilesh Shahi, and Vijay Prakash Tiwari. Challenging Legal Issues In India. Booksclinic Publishing, 2023.
3. Wolfe, Robert. "Reforming WTO conflict management: Why and how to improve the use of 'specific trade concerns'." Journal of International Economic Law 23.4 (2020): 817-839.
4. Van Der Pijl, Patrick, Justin Lokitz, and Lisa Kay Solomon. Design a better business: New tools, skills, and mindset for strategy and innovation. John Wiley & Sons, 2016.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Power Electronics					
Type of Course	DSE					
Course Code	MG6DSEECT309					
Course Level	**300-399**					
Course Summary and Justification	The Power Electronics course provides a comprehensive understanding of devices, operations, and applications, fostering skills, critical thinking and analytical reasoning. Through hands-on experiences, learners develop problem-solving skills, ethical reasoning and a sense of social responsibility, promoting a holistic approach to power electronics and lifelong learning					
Semester	5	Credits			4	**Total Hours**
Course details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate various Power Electronics semiconductor Devices	U	1, 2
2	Explain analyse Commutation techniques, Converters, Inverters and Cycloconverters	U	1,2
3	Explain the operation and the parameters of waveforms of AC voltage controller, choppers and switched mode regulators	A	1,2,10
4	Build the applications by Integrating Power Electronics in Real-world Systems	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C),Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	An overview of power electronics components:-SCR, TRIAC(Introduction, construction & characteristics), IGBT (Introduction only)	6	1

	1.2	Thyristor protection techniques:- Concept of over voltage, overcurrent and gate protection	4	1
	1.3	Triggering methods of TRIAC and SCR	5	1
	1.4	Resistance triggering of SCR (demonstration activity) Familiarize need of cooling, heat sink mechanisms	5	1
2	2.1	Commutation techniques-Line commutation and Class A&B (Circuit and explanation only)	5	2
	2.2	Single phase half wave and full wave converter with R load, (Operation and waveform diagram)	4	2
	2.3	Single phase half bridge inverter (working with waveforms)	3	2
	2.4	Single phase Cycloconverters	3	2
3	3.1	Single phase full wave AC voltage controller – Principles of ON/OFF control ,Principle of phase control (working with waveforms)	3	3
	3.2	DC chopper-Introduction, Principle and Operation of step up and step down chopper, Control strategies	4	3
	3.3	Switched mode regulators-step down (buck)	4	3
	3.4	Step up (boost) (working with waveform)	4	3
4	4.1	Battery Charger	2	4
	4.2	Induction heating and illumination control using TRIAC	2	4
	4.3	Block schematic study of SMPS, UPS & HVDC	3	4
	4.4	***Suggested Activities*** Case Study of an AC voltage controller using a simple resistive load. Or Case Studies of Speed Control of DC motor using chopper Or Seminar/Webinar by Industry Expert	3	4
5	Teachers Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others

	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Rashid, M. H. Power Electronics Handbook. Academic Press (2011) .
2. Bimbhra, P. S. . Power Electronics. Khanna Publishers.
3. Mohan, Ned, Tore M. Undeland, and William P. Robbins. Power electronics: converters, applications, and design. John wiley & sons, 2003.

Suggested Readings

1. Singh, R. P. Power Electronics. McGraw-Hill Education (2015). .
2. Bose, B. K. Power Electronics and Motor Drives: Advances and Trends. Academic Press(2002) .
3. Hart, D. W. Introduction to Power Electronics. Prentice Hall(2010)
4. Erickson, R. W., & Maksimovic, D. Fundamentals of Power Electronics. Springer(2017) .

Mahatma Gandhi University
Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Advanced Power system design					
Type of Course	DSE					
Course Code	MG6DSEECT310					
Course Level	**300-399**					
Course Summary and Justification	The syllabus explores emerging applications in power electronics. Introduces power devices such as power BJT, MOSFET and IGBT including practical applications. Hands-on training includes circuit designing of motor drivers, voltage regulators and inverters.					
Semester	6	Credits			4	
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**Total Hours**
		4				60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO No
1	Understand the working of different components advanced power systems	U	1, 2
2	Design different power control circuits	An	1, 2
3	Apply hands on expertise in making power circuits	A	1, 2, 10
4	Construct Inverter and motor driver circuits	C	1, 2, 10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1		Introduction to Power electronics components		
	1.1	Safety precautions and guidelines for handling high voltage AC and DC supplies.	3	1
	1.2	Structure and working of Power BJT	4	1
	1.3	Characteristics of Power BJT. Testing of power BJT.	3	1

	1.4	Power transistors 2N3055- Analyse the Datasheet, Circuit diagram and working of voltage regulator.	5	1, 2
2				
	2.1	Structure of MOSFET, Working of Depletion type and Enhancement type	3	1
	2.2	Characteristics of Mosfet, Mosfet testing using multimeter, Working of Mosfet as a switch	3	1, 2
	2.3	Basic structure and working of BLDC motor (Basic ideas only), BLDC motor driver and speed control using MOSFET	5	2, 3
	2.4	DC Motor control using H bridge, DC motor driver circuit using Mosfet.	4	2, 3
3	Application of IGBT			
	3.1	Structure of IGBT, Characteristics, Testing of IGBT	3	1
	3.2	Working of IGBT as a switch. Simple switching circuit to control the current through a bulb.	4	2
	3.3	Adjustable power supply design using IGBT, Circuit diagram and working.	4	3, 4
	3.4	DC to AC conversion using IGBT- Square wave inverter circuit, Pulse width modulated Sine wave inverter (Qualitative ideas only).	4	4
4	Hands on Session			
	4.1	1. Build an adjustable voltage regulator using 2N3055 transistor 2. Simple dc motor driver using a single MOSFET and potentiometer 3. Build a 12V bulb flasher using MOSFET 4. Construct an inverter circuit (12V DC to 230V AC) using two or more Mosfets.	15	3, 4
5		**Teachers Specific content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks

	c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Vithayathil, Joseph. "Power electronics: principles and applications." (No Title) (1995).
2. Rashid, Muhammad H. "Devices, circuits, and applications." Power Electronics
3. Handbook; Academic: New York, NY, USA (2007): 245-259.

Suggested Readings

1. Baliga, B. Jayant. "Trends in power semiconductor devices." IEEE Transactions on electron Devices 43.10 (1996): 1717-1731.
2. Sedha, R. S. A textbook of applied electronics. S. Chand Publishing, 2008.
3. Patel, Rahul Kumar, et al. "Introduction to various controlling techniques for inverters as a part of undergraduate course in power electronics." 2014 IEEE International
4. Conference on MOOC, Innovation and Technology in Education (MITE). IEEE, 2014.
5. Power Electronics, B.R.Gupta and V.Singhal- S.K. Kataria & Sons
6. Bimbhra, P. S., and Surinder Kaur. Power electronics. Vol. 2. Delhi, India: Khanna publishers, 2012.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Linux Programming					
Type of Course	SEC					
Course Code	MG6SECECT300					
Course Level	**300-399**					
Course Summary and Justification	This course provides an in-depth understanding of Linux operating system concepts, installation, file system, basic commands ,disk partition and, package installation etc.					
Semester	6	Credits			3	
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**Total Hours**
		2	-	1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate linux operating system installation procedure	U	1,2
2	Demonstrate to use various linux commands, file handling and user administration	U	1,2,10
3	Develop skill to install packages and to manage storage devices	A	1.2,10
4	Create and develop programming skill	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
	Introduction to LINUX operating system			
1	1.1	History, concepts and architecture	3	1,3
	1.2	Linux distributions and features, Installation of Linux operating System- Installation methods, selection of distribution, creation of installation media, Installation steps (any distribution)	4	1,3
	1.3	Package installation, Methods of package installation: package management system, installing package, removing package, package update	4	1,3
	1.4	Linux File system- Linux Supported File Systems, Linux directory Structure	2	1,3

	1.5	Disk partition: concepts, creating partition, setting partition type, creating file system, mounting file system.	2	1,3
2	2.1	Basic commands- ls, pwd, mkdir, cd , rmdir, cp, mv, rm , uname, locate, touch, ln, cat, clear, ps, man, grep, echo, wget, whoami, sort, cal, whereis, df, wc	5	2,3
	2.2	User administration- types of accounts, managing accounts: create accounts, modify accounts, delete accounts. Changing file permissions and ownerships	5	2,3
	2.3	Introduction to shell programming, shell keywords and variables, mathematical commands, conditional statements, looping statements, parameter handling in shell scripting	5	2,3
		Practical (Any 5)	30	1,2,3
3		1. Installation of Linux OS (Any distribution) 2. Installation of packages 3. Creating disk partitions, formatting and mounting 4. Familiarizing basic commands in Linux 5. Managing user accounts (Create user, modify user, delete user) 6. Changing file permissions and ownerships 7. Write a shell script to count the number of files in a directory 8. Write a shell script to copy contents of one file to another 9. Write a shell script that displays all files in a directory 10. Write a shell script to find the number of words, characters and lines in a file using grep command		
4		**Teacher Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 2. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. Semester End examination 1.Written Test (35 marks)- 1 Hour (Duration of Examination) MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) - 2 Hour(Duration of Examination) Viva , Lab report , Demonstration

References

1. Nemeth, Evi, et al. "UNIX and Linux system administration handbook." USENIX Open Access Policy 59 (2018).

2. Barrett, Daniel J. Linux Pocket Guide: Essential Commands. " O'Reilly Media, Inc.", 2016.
3. Matthew, Neil, and Richard Stones. Beginning linux programming. John Wiley & Sons, 2008.

Suggested Readings

1. Negus, Christopher. Linux bible. Vol. 772. John Wiley & Sons, 2012.
2. Mastering Linux: A Comprehensive Guide to the Operating System – Sunil K Joseph, Surabhi Kurian- Notion Press
2. Shotts, William. The Linux command line: a complete introduction. No Starch Press, 2019.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Basics of Android App Development					
Type of Course	SEC					
Course Code	MG6SECECT301					
Course Level	**300-399**					
Course Summary and Justification	This course empowers learners with essential skills in Kotlin programming and Android app development. Through hands-on modules, learners gain practical experience, fostering critical thinking and problem-solving abilities crucial for creating functional Android applications.					
Semester	6	Credits			3	
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**Total Hours**
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Proficiency in Kotlin Programming Language	U	1,2
2	Understand Android Basics and Architecture	U	1,2
3	Apply Android App Development Concept	A	1,2
4	Creation of Basic Android Apps	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Android basics and architecture: Introduction to Android Studio, Building Tools: Kotlin, JDK,JRE, Android SDK	2	1
	1.2	Android Developer Tools: Setting up Android Environment and Android Emulator	2	1
	1.3	Introduction to Android OS: Android Architecture Stack, Linux Kernel, Android Libraries(ART)	3	1
	1.4	Android Architecture.: Overview of the Stack , Linux Kernel , Native Libraries, Dalvik Virtual Machine, Android Virtual Machine (ADT), Dalvik Debug Monitor Server (DDMS), LogCat, Application Framework, Application Licensing, Gradle.	3	1
2	2.1	**Introduction to Kotlin Programming**: Introduction, Advantages and Disadvantages, Kotlin for Android, Setting up Kotlin Environment (Android)	2	2

	2.2	Kotlin Data Types , Kotlin Variables, Variable Declaration, Type Annotation & Inference, Nullable, Safe Call Operator, Not Null Assertion , Nullable Type and Elvis Operator, Type Casting & Checking	3	2
	2.3	Operators & Expression: - Expression, Assignment, Arithmetic, Augmented Assignment, Increment & Decrement, Equality, Boolean Logical, Range & Bitwise. Flow Control: - for in, while, do while, Break & Continue, Break & Continue Labels, if, if else, if else if, when. Functions & Lambda	2	2
	2.4	Basic of OOPS, Inheritance & Sub classing	3	2
3	3.1	Introduction to Android Development: Android Core Building Blocks, Android Emulator, AndroidManifest.xml, R.java file, uses-permission, Project Structure, Layout resource.	2	3
	3.2	User Interface: Working with basic control,Button,TextView, EditText, Toast,Image Button CheckBox. Button, Toggle Button, Switch Button. Image Button, Alert Dialog, Spinner, Auto Complete Text View, Rating Bar	3	3
	3.3	Android Life Cycle: Activity, Intent, Android Menus, Layout Manger.	3	3
	3.4	Date Picker. Time Picker. Progress Bar.Camera, Android	2	3
4	4.1	**Android App Development Concepts** Notifications, Custom Toast, Dialogs, Status bar Notifications. Multithreading: Using Kotlin coroutines: Launch, Async, Threads, Dispatchers.	30	4
	4.2	Styles and Themes: Creating and applying simple Style, Inheriting built-in Style and User-defined style, Using Styles as themes. Resources and Assets: Android Resource, Using resources in XML and code, Localization		4
	4.3	Fragment Lifecycle, Fragment Example, Dynamic Fragment. Adaptor: Array Adaptor, ArrayList Adaptor, Base Adaptor. View: Grid View, Web View, Scroll View, Search View, Tab Host, DynamicListView, ExpandedListView		4
	4.4	1.Create a E-Commerce Application for food delivery with login page ,registration page and forget password page(XML File,UI only) 2.Create a E-Commerce Application for customer chat with home page with chat page(UI only) 3.Create a calculator Application with all functionalities (optional)		4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment 2. Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. Semester End examination 1.Written Test (35 marks)- 1 Hour (Duration of Examination) MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) - 2 Hour(Duration of Examination) Viva , Lab report , Demonstration

References

1. Head First Kotlin : by Dawn Griffiths, David Griffiths,Publisher(s): O'Reilly Media, Inc.ISBN: 9781491996690
2. Phillips, B., Hardy, D., & Marsicano, M. (2017). Android Programming for Beginners:

Suggested Readings

1. Kotlin Programming: The Big Nerd Ranch Guide (Big Nerd Ranch Guides) 1st Edition, by Josh Skeen (Author), David Greenhalgh (Author)
2. Kotlin in Action:Dmitry Jemerov and Svetlana Isakova Foreword by Andrey Breslav February 2017 ISBN 9781617293290
3. Jackson, Wallace, and Kunal Mittal. Android apps for absolute beginners. Vol. 22. Apress, 2012.
4. Meier, Reto. Professional Android 4 application development. John Wiley & Sons, 201

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	CCTV Installation and Maintenance					
Type of Course	SEC					
Course Code	MG6SECECT302					
Course Level	300-399					
Course Summary and Justification	This course delves into the principles, methodologies, and technologies associated with securing electronic systems and managing them efficiently. As technology continues to evolve, the importance of safeguarding electronic devices, systems, and networks from threats becomes paramount.					
Semester	6	Credits			3	
Course Details	**Learning Approach**	**Lecture**	**Theory**	**Practical**	**Others**	**Total Hours**
		2		1		60
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	*Expected Course Outcome*	Learning Domain	PO No.
1	Demonstrate a comprehensive understanding of the principles, methodologies, and technologies associated with electronics security and system management	U	1,10
2	Analyze Various threats to electronic systems, including software vulnerabilities, hardware tampering, and electromagnetic interference.	An	1,2,10
3	Design and deploy security protocols and best practices to safeguard electronic systems, ensuring data integrity, confidentiality, and availability.	C	1,2,10
4	Evaluate ethical standards and professional conduct in all aspects of electronics security and system management, fostering trust and integrity within the industry and society.	E	1,2,6,8,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**CCTV Systems**		
	1.1	The historical evolution and fundamental principles of Closed-Circuit Television (CCTV) systems.	2	1

	1.2	The emergence of CCTV, its foundational technologies, and its diverse applications in contemporary security.	3	1
	1.3	Types of CCTV Systems, Camera Specifications & Features- resolution, lens types, and field of view,.	2	1
	1.4	Detailed insights into advanced features like night vision, motion detection, and pan-tilt-zoom capabilities.	3	1
2		**Networking and Security**		
	2.1	Analog & IP Camera, Introduction to Digital Video Recorder (DVR), Classification of DVR.	3	2
	2.2	Categorization of DVRs based on functionality, such as standalone DVRs, hybrid DVRs, and embedded DVRs.	2	2
	2.3	Networking - Fundamental principles of networking in the context of CCTV systems.	2	2
	2.4	Network configurations, protocols, and the integration of surveillance systems into existing networks. Remote Access Configuration	3	2
	2.5	Need For Fire Alarm System, Types Of Fire Panels, Input-Output Modules, Indicators & Annunciators	**3**	
	2.6	The principles and applications of intrusion detection and alarm systems, Need For Intruder Alarm System	2	3
	2.7	Intrusion Detector Types : passive infrared sensors, door magnetic contacts, vibration detectors, motion detectors, glass break detectors, and panic switches	3	3
	2.8	Access Control System Topology – PIN, CARD, BIOMETRIC	2	3
3		**Practical**	**30**	
	3.1	CCTV Camera Installation: Understanding types of CCTV Camera Understanding the site sketches & drawings Network Cable laying RJ45 Connector Crimping Camera Mounting Assembly Camera Mounting Marking Mounting and Camera fixing Power supply unit Connection Network Cable Connection Lens Adjustment Safety Site tidiness	7	4
	3.2	CCTV Camera Configuration: Understanding the Configuration procedure Create User Access Assign IP Address Assign Video Compression Set Frame Rate Set bandwidth Set PTZ Preset Set Time and Date, Time Zone Set Recording mode Set Privacy marking/Zone Set OSD Name	7	4
	3.3	Network Video Recorder Installation : Understanding Installation Method Interpretation of sketches & drawings Network rack Installation Hard disk Installation Digital Video Recorder Mounting Assembly Digital Video Recorder Mounting Power Supply Adapter Connection Network Cable connection	8	4
	3.4	Network Video Recorder Configuration: Understanding method of configuration Create Username and Password Set Date and Time, Time Zone Initialize	8	4

		hard Disk Add Camera Assign Recording type Assign Frame Rate Assign Video Compression Set Bandwidth Create Backup Video Playback Audio Integration		
4		**Teachers Specific Content**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Utilize a combination of lectures and hands-on training to facilitate a comprehensive learning experience.
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** Theory -15 marks 1. Internal Test, Assignment Lab-15 marks A combination of quizzes, assignments, Performance, Case Study
	B. Semester End examination 1.Written Test (35 marks)- 1 Hour(Duration of Examination) MCQ - 35x1= 35 Marks (35 out of 40 -35x1=35) 2. Practical Exam (35marks) - 2 Hour(Duration of Examination) Viva , Lab report , Demonstration

Referencse

1. Electronic Security Systems A Managers Guide To Evaluating And Selecting System Solutions by Robert Pearson, Elsevier
2. Integrated Security Systems Design, by Thomas L. Norman, Elsevier Science

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Environmental Awareness and Human Rights					
Type of Course	**VAC**					
Course Code	MG6VACECT300					
Course Level	**300-399**					
Course Summary and Justification	This course provides an awareness of how decisions and actions of learners affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future					
Semester	**6**	**Credits**			**3**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3				**45**
Pre-requisites						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Summarize environment and the social norms	U	1,2
2	Explain the effects of human decisions and actions on environment, build knowledge and skills necessary to address complex environmental issues	U	1,6
3	Develop the sense of awareness about the environment and realize the inter-relationship between man and environment	A	1,6,7
4	Evaluate and take decisions about complex environmental issues	E	1,2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hours	CO
1	**Multidisciplinary Nature of Environmental Studies and Natural Resources**			
1	1.1	Natural Resources:- Forest Resources: Use and over-exploitation Water Resources : Sources and Over-utilization Mineral Resources : Use and exploitation Energy Resources: Renewable and non-renewable energy	5	1

		Land resources: Land as a resource, land degradation		
	1.2	Concept of an ecosystem Structure and function of an ecosystem Food chains, food webs and ecological pyramids.	4	1
	1.3	Introduction and Definition of Biodiversity, Value of biodiversity, Threats to biodiversity	3	1
	1.4	Hot-spots of biodiversity in India Endangered and endemic species of India	3	1
2	**Environmental Pollution**			
	2.1	Introduction Definition, Causes, effects and control measures of: - Air pollution , Water pollution , Soil pollution	4	2
	2.2	Definition, Causes, effects and control measures of: - Noise pollution , Thermal pollution	4	2
	2.3	Solid waste Management: Causes, effects and control measures of urban and industrial wastes.	4	2
	2.4	Role of an individual in prevention of pollution Disaster management: floods, earthquake, cyclone and landslides.	3	2
3	**Human Rights**			
	3.1	Introduction to Human Rights Classification of Human Rights	4	3,4
	3.2	Basic international Human Rights Document UDHR, ICCPR, ICESCR ,NHRC , SHRC	4	3,4
	3.3	Human Rights in Indian Constitution Six categories of fundamental rights Human Rights of women, minorities, children	4	3,4
	3.4	Six Organs of united Nations	3	3,4
4	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** B. Continuous Comprehensive Assessment (CCA) Theory - 25 Internal Test, Assignment, Case Study/Project/ Site Visit/Workshop.
	B. Semester End examination 1. Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination 1.MCQ - 35x1= 35 Marks

	2.Short Essay Question = 15 Marks (3 out 5:- 3x5

References

1. Bharucha, Erach. *Textbook of environmental studies for undergraduate courses*. Universities Press, 2005.
2. Dr. H. O. Agarwal, Human Rights, Central Law Publications

Suggested Readings

1. Miller, G. T., & Spoolman, S. (2017). Environmental Science. Cengage Learning.
2. Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A., & Kent, J.(2000). Biodiversity hotspots for conservation priorities. Nature, 403(6772), 853-858.
3. Martin, C. (2011). Environment and Human Rights. Edward Elgar Publishing.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	PyTorch for Deep Learning					
Type of Course	DCC					
Course Code	MG7DCCECT400					
Course Level	400-499					
Course Summary and Justification	Instantly familiar to anyone who knows Python data tools like NumPy and Scikit-learn, PyTorch simplifies deep learning without sacrificing advanced features. It's great for building quick models, and it scales smoothly from laptop to enterprise. To create deep learning and neural network systems with PyTorch					
Semester	7	Credits: 4				Total Hours:
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites	Familiar with Python data tools like NumPy and Scikit-learn					

COURSE OUTCOME(CO)

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Understand the deep learning data structures such as tensors and neural networks	U	1,2,10
2	Understand the PyTorch Tensor API, loading data in Python, and visualizing results	A	1,10
3	Implement modules and loss functions.	C	1, 10
4	Utilize pretrained models from PyTorch Hub	An	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Introduction, Software Requirements, Matrix Basics	2	1
	1.2	Torch to Numpy Bridge, Numpy to Torch Bridge, GPU and CPU Toggling, Basic Mathematical Tensor Operations, Variables and Gradients	3	2

	1.3	Linear Regression and Logistic Regression Introduction, Linear Regression Problems, Logistic Regression In - depth	5	1
	1.4	Linear Regression in PyTorch, Logistic Regression in PyTorch, Linear and Logistic Regression from CPU to GPU in Pyorch	4	2
2	2.1	Logistic Regression Transition to Feed-forward Neural Network, Non - Linearity	3	3
	2.2	Feed-forward Network in PyTorch, More Feed-forward Neural Network Models in PyTorch	4	4
	2.3	Feed-forward Neural Network from CPU to GPU in PyTorch, Summary, Feed-forward Neural Network Transition to CNN	4	4
	2.4	One Convolutional Layer, Input Depth of 1, Input Depth of 3, Calculations	4	1
3	3.1	Multiple Convolutional layers Overview, Pooling Layers, Padding for Convolutional Layers	4	1
	3.2	Output Size Calculations, CNN in PyTorch, More CNN Models in PyTorch	4	1
	3.3	Expanding model Capacity, CNN from CPU to GPU in PyTorch	3	2
	3.4	Introduction to Recurrent Neural Networks, RNN in PyTorch, More models of RNN, RNN from CPU to GPU in PyTorch	5	2,3
		Practical		
4	4.1	Software Installations, Review of Jupyter Notebook, Familiarizing with Tensor Operations	5	2,3
	4.2	Implementing Linear regression and Logistic Regression with PyTorch.	7	4
	4.3	Implementing feed – forward networks and CNN with PyTorch and Familiarizing models	9	4
	4.4	Implementing RNN with PyTorch and Familiarizing models	9	4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **E. Continuous Comprehensive Assessment (CCA)** **3. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar

	4. Practical: 15 Marks Components for assessment (suggestions): A combination of quizzes, assignments , Performance ,Case Study.
	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Jeremy Howard and Sylvain Gugger - Deep Learning for Coders with Fastai and PyTorch: AI Applications Without a PhD, O'Reilly Media; 1st edition (August 11, 2020); eBook (GitHub Edition: Jupyter Notebooks)
2. Eli Stevens, Luca Antiga, and Thomas Viehmann - Deep Learning with PyTorch, Manning Publications; 1st edition (August 4, 2020)

Suggested Readings

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola - Dive into Deep Learning, Amazon Science (Mar 25, 2022 - Date)
2. Francois Chollet - Deep Learning with Python, Second Edition,Manning; 2nd edition (December 21, 2021)

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Laser and its Applications					
Type of Course	DCE					
Course Code	MG7DCEECT400					
Course Level	400-499					
Course Summary and Justification	The aim of this Course is to make learners understand the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry, medicine & Defense					
Semester	**7**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites	**Basic undergraduate-level knowledge of Electromagnetics, Optics, and Modern Physics.**					

COURSE OUTCOME (CO)

CO No.	Expected Course Outcome	Learning Domain*	PSO No.
1	Explain the fundamentals of lasers and describe the operation of various types of laser systems: solid, semiconductor, liquid and gas lasers.	U	1,2
2	Demonstrate the students understand the actual functioning of various laser components and systems	U	1,2
3	Develop the knowledge for applications of lasers in industry.	A	1,2
4	Analyze cutting-edge advancements in the field of lasers.	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
	1.1	Introduction-Basic components of a laser system-Principles of light amplification and stimulated emission-Stimulated absorption -Spontaneous Emission-Stimulated Emission-Characteristic of laser radiation (coherence, monochromaticity, directionality)- speckles	3	1
	1.2	Principle of Laser action: Population inversion, metastable states, gain medium, Pumping mechanisms (optical, electrical, thermal), feedback mechanism, threshold condition for laser beam generation.	4	1
	1.3	Different Types of lasers- Solid State Lasers, Gas Lasers	4	1
	1.4	Tunable dye Lasers , Semiconductor Lasers, Free electron Laser	4	1

2	2.1	Laser Components-Optical cavities –General cavity concepts, Resonance, Sharpness of Resonance Q, Finesse, Photon lifetime, Diffraction Losses	4	2
	2.2	Laser Systems: Q factor, Q-switching Cavity dumping, mode-locking, Continuous-wave and pulsed lasers	4	2
	2.3	Laser resonators-Gaussian beams in simple stable resonators, mode volume in stable resonators	4	2
	2.4	Laser safety and hazards: Types of hazards, hazards to eyes and skin, Maximum Permissible Exposure (MPE), Classification of lasers, from the point of view of hazards, safety measures, NOHD, buffer zone, laser safety measures.	3	2
3	3.1	Applications In Material processing-Laser welding, hole drilling, laser cutting, other applications	4	3
	3.2	Lasers in defense, Laser tracking, LiDAR, Measurement of distance, Velocity measurement	4	3
	3.3	Lasers in Medicine, Holography, Lasers in electronic industry	4	3
	3.4	Additive manufacturing (3D printing)	3	3
4	4.1	Fiber Lasers: Principle and applications, Advantages over other types	4	4
	4.2	Ultrafast Lasers: Femtosecond and picosecond lasers	4	4
	4.3	Lasers in Communication and data transmission, Emerging trends in laser technology	4	4
	4.4	Applications of Lasers in research	3	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. A K Ghatak and K Thyagarajan,Lasers: Fundamentals and Applications,McMillan, 2003.
2. M N Vandhanulu,Lasers Theory and Applications, S Chand and Company Ltd. , 2001

Suggested Readings

1. K R Nambiar,Laser Principles, Types & Applications,, New Age International, 2004.
2. William T Sifvast,Laser Fundamentals, Cambridge University Press, 2004

3. J. Verdeyen, Laser Electronics, Prentice Hall, 1995
4. Reddy J.F., 'High Power Laser Applications', Academic Press, 1977.
5. Ian W. Boyd, 'Laser Processing of Thin Films and Microstructures', Springer - Verlag, 1987.
6. Duley W.W., 'Laser Processing and Analysis of Materials', Plenum Press, New York, 1983.
7. RM Measures,Laser Remote Sensing: Fundamentals and Applications,. John Wiley

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Wireless Network Security					
Type of Course	DCE					
Course Code	MG7DCEECT401					
Course Level	400-499					
Course Summary and Justification	This course primarily focuses on fundamental security issues in wireless networks; which helps students understand security threats, encryption methods, and security controls to reduce the probability of attacks on wireless networks. Topics also include understanding wireless security protocols, security of wireless standards, security issues in RFID, WSN, and vehicular networks, and different communication protocols.					
Semester	7	Credits			4	
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Project**	**Total Hours**
		4				60
Pre-requisites	Basic knowledge of Computer Networks, Information Theory					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No.
1	Demonstrate the security and privacy problems in the realm of wireless networks.	U	1,2
2	Analyze the security threats in wireless networks and apply proactive and defensive measures to counter potential threats, attacks and intrusions.	An	1,2
3	Explain the standards for wireless communications and their security controls	U	1,2
4	Analyse various security issues in RFID, WSN, and Vehicular networks; and apply this to do research based on communication protocols	An	1,2,10
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	Introduction to network security: Wired Vs. wireless network security, security requirements, security challenges, security services, security mechanisms, and network security models.	4	1

	1.2	Vulnerabilities, Threats, Attacks and Countermeasures – Cryptography, controls, firewalls, IDS, digital signatures.	3	1
	1.3	Overview of cryptographic algorithms and protocols: cryptanalysis, Message authentication, secure hash functions, Digital signatures.	5	1
	1.4	IEEE 802.11 standard security issues: Authentication and authorization mechanisms, Confidentiality and Integrity, pre-RSNA protocols (WEP), RSNA (802.11i).	3	1
2	2.1	Review of Wireless fundamentals - Overview of wireless network architecture, Wireless network protocols, Wireless Application Protocol (WAP), How WAP works, and the security status of WAP.	5	2
	2.2	Viruses, Authorization, Non-repudiation, Authentication, secure sessions, security products, WAP Security Architecture	4	2
	2.3	Wireless Middleware WEP security, RC4 Encryption, Threats-Cracking WEP, Securing the WLAN	3	2
	2.4	Wireless security: models, threats and solutions	3	2
3	3.1	Wireless Standards: Vulnerabilities in existing wireless networks, Bluetooth Security, Wi-Fi security, 5G Security. Trends and Upcoming Wireless Networks, Trends and Security challenges in wireless networks. Trust Assumptions and Adversary Models: Trust, Trust in Ubiquitous Computing.	4	3
	3.2	Physical Layer Security: Jamming, Wiretapping, Physical Layer defenses.	3	3
	3.3	MAC Layer Security: Operating principles of IEEE 802.11, Detecting selfish behavior in hotspots, Selfish behavior in pure ad hoc networks, MAC layer defenses.	4	3
	3.4	Network Layer Security: Securing ad hoc network routing protocols, Secure routing in sensor networks, and Network layer defences.	4	3
4	4.1	Communication Protocol: Zigbee, LoRaWAN, CAN, I2C and SPI protocol, RFID Security, Security for Wireless Sensor Networks, Security for Vehicular Networks.	5	4
	4.2	Project and presentation: Students are expected to do project development/case studies on a specific area like WSN, LoRaWAN, 5G Network security, etc., and make a product demonstration and 30-minute presentation on it. (Not for university examination; only for internal evaluation.)	10	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. William Stallings, 'Cryptography and Network Security: Principles and Practice', Seventh Edition, Pearson, 2017.
2. Tyler Wrightson, 'Wireless Network Security – A Beginner's Guide', Tata McGraw Hill, 2012.

Suggested Reading

1. Behrouz A. Forouzan; Debdeep Mukhopadhyay, 'Cryptography and Network Security', 3rd Edition, Tata McGraw Hill, 2015.
2. Pallapa Venkataram, Satish Babu: 'Wireless and Mobile Network Security', 1st Edition, Tata McGraw Hill, 2010.
3. Randall K. Nichols, Panos C. Lekkas: 'Wireless Security Models, Threats and Solutions', 1st Edition, Tata McGraw Hill, 2002.
4. Tom Karygiannis and Les Owens, 'Wireless Network Security 802.11, Bluetooth and Handheld Devices', NIST 2008.
5. Kaveh Pahlavan and Prashant Krishnamurthy, 'Principles of Wireless Networks', Prentice Hall, 2006.
6. Levente Buttyán, Jean-Pierre Hubaux, 'Security and Cooperation in Wireless Networks: Thwarting Malicious and Selfish Behavior in the Age of Ubiquitous Computing', Cambridge University Press, 2007.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Research Methodology and Statistical Analysis					
Type of Course	DCE					
Course Code	MG7DCEECT402					
Course Level	**400-499**					
Course Summary and Justification	The objective of the course is to acquaint students with important statistical techniques and quantitative models for managerial decision making and conduct research and process data.					
Semester	**7**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**60**
		4				
Pre-requisites	**A prerequisite for this course is the completion of an introductory course in basic electronics, Solid State physics**					

COURSE OUTCOME

CO No.	*Expected Course Outcome*	Learning Domain*	PO No.
1	Understand Sampling and Sample Design, Probability and Theoretical Distribution	U	1,2
2	Perform hypothesis testing and significance tests for attributes and variables, as well as regression, correlation, and statistical quality control	A	1,2
3	Perform Non Parametric Tests and Analysis of Variance	A	1,2,10
4	Demonstrate the ability to plan practical activities, apply research methodology techniques, write research projects, and exercise appropriate judgment in information selection and presentation	S	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	Introduction and Types of Sampling, Sampling Methods	4	1
	1.2	Sampling Methods, Sampling and Non-Sampling Errors	4	1
	1.3	Approaches to Probability, Theorems of Probability	3	1
	1.4	Binomial and Poisson Distribution, Exponential, Beta and Normal Distribution	4	1
2	2.1	Procedure of Testing a Hypothesis, Significance Test in Attributes	4	2
	2.2	Significance Test in Variables (Large Samples), Significance Test in Variables (Small Samples)	4	2
	2.3	Partial and Multiple Correlation, Multiple Regression Analysis	4	2
	2.4	Types and Techniques of Statistical Quality Control, Control Charts for Attributes and Variables	3	2
3	3.1	Chi-Square Test	3	3
	3.2	Sign Test & Median Test	3	3
	3.3	F Test / Multivariate Analysis Technique	3	3
	3.4	Analysis of Variance (ANNOVA)	3	3
4	4.1	Research Methodology Concepts, Approaches and Methods	4	4
	4.2	Research Design, Measurement and Scaling Techniques	4	4
	4.3	Methods of data collection – questionnaires, Methods of data collection – interviews	5	4
	4.4	Structuring your project report, report writing, plagiarism and references format	6	4
5		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. S. P. Gupta, Statistical Methods, Sultan Chand & Sons.
2. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan

Suggested Readings

1. Bendat and Piersol, Random data: Analysis and Measurement Procedures, Wiley Interscience.
2. D.C. Sancheti, V.K. Kapoor, Statistics, Theory methods and Application, Sultan Chand & Sons.
3. S C Agarwal, S C Khurana, Research Methodology and Statistical Analysis, V K Publications.
4. Kenneth S Bordens, Bruce B Abbott, Research Design and Methods: A Process Approach, Mayfield Pub. Co.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Deep learning					
Type of Course	DCE					
Course Code	MG7DCEECT403					
Course Level	400-499					
Course Summary and Justification	The "Deep Learning" course provides a solid foundation in deep neural networks, regularization techniques, and optimization strategies.					
Semester	7	Credits			4	Total Hours
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4	-			60
Pre-requisites	Basic knowledge of mathematics and programming					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate the principles of deep feedforward networks	U	1,2
2	Apply regularization and optimization strategies in deep learning	A	1,2
3	Analyze the impact of hyperparameters on deep learning models	An	1,2
4	Apply deep learning algorithms in solving real life problems	A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	Working of brain,Biological neuron	3	1
	1.2	AI,ANN,Machine Learning,Deep Learning	3	1
	1.3	McCulloch Pitts Neuron,Perceptron	2	1

	1.4	Sigmoid Activation function	2	1
2	2.1	Feedforward Neural Networks,fast matrix-based approach to computing,Multilayer neural networks	4	2
	2.2	Gradient Descent algorithm,stochastic gradient descent	4	2
	2.3	Cost function	4	2
	2.4	The four fundamental equations behind backpropagation,Proof of the four fundamental equations, The backpropagation algorithm	4	2
3	3.1	Overfitting and regularization	4	3
	3.2	Regularization Techniques	4	3
	3.3	The vanishing gradient problem	4	3
4	4.1	Convolutional Networks	4	4
	4.2	Recurrent neural networks or RNN	4	4
	4.3	Building Generative Adversarial Networks, LSTM networks	4	4
	4.4	Deep Learning Projects (group projects)	10	4
5		Teachers Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Aggarwal, Charu C. "Neural networks and deep learning." Springer 10.978 (2018)
2. Heaton, Jeff. Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep learning: The MIT Press, 2016, 800 pp, ISBN: 0262035618.Genetic programming and evolvable machines 19.1-2 (2018): 305-307.

Suggested Readings

1. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly, 2017
2. Venkata Reddy Konasani, Shailendra Kadre, Machine Learning and Deep Learning Using Python and TensorFlow, Mc Graw Hill, 2021

3. John Paul Mueller, Luca Massaron, Deep Learning For Dummies, 2019
4. Ovidiu Calin, Deep Learning Architectures: A Mathematical Approach, Springer, 2020
5. Michael Nielsen Neural Networks and Deep Learning
6. Deep Learning with Python by Francois Chollet

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	MEMS & NEMS					
Type of Course	DCE					
Course Code	MG7DCEECT404					
Course Level	**400-499**					
Course Summary and Justification	This course offers a comprehensive overview of Microelectromechanical Systems (MEMS) and Nanoelectromechanical Systems (NEMS). It covers historical evolution, size perspectives, design principles, materials, fabrication techniques, packaging, sensors, actuators, and applications. Case studies highlight successful applications, preparing students for careers in micro and nanoscale technologies.					
Semester	**7**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	**60**
		4				
Pre-requisites	**A prerequisite for this course is the completion of an introductory course in basic electronics, Solid State physics**					

COURSE OUTCOME

CO No.	*Expected Course Outcome*	Learning Domain	PO No.
1	Illustrate the fundamental principles of Microelectromechanical Systems (MEMS) and Nanoelectromechanical Systems (NEMS)	U	1,2
2	Demonstrate the knowledge of MEMS and NEMS materials and fabrication techniques	U	1,2
3	Analyze and design MEMS sensors and actuators	An	1,2,10
4	Evaluate the challenges and opportunities in NEMS devices and applications	E	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	History and evolution of MEMS and NEMS	4	1
	1.2	Size and scale perspectives in MEMS and NEMS	4	1
	1.3	Introduction to Design of MEMS and NEMS	3	1
	1.4	MEMS Materials and Properties: Silicon, Silicon Compounds, Polymers, Metals. Mechanical, electrical, and thermal properties of MEMS materials	4	1
2	2.1	Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation	4	2
	2.2	Etching techniques: Dry and wet etching, electrochemical etching	4	2
	2.3	Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology	4	2
	2.4	Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials	3	2
3	3.1	Principles of operation of various MEMS sensors - accelerometers, gyroscopes, and pressure sensors, Design and fabrication of MEMS actuators - micro-motors and micro-pumps	4	3
	3.2	MEMS in bioMEMS and lab-on-a-chip technologies, MEMS and NEMS for environmental monitoring and sustainability	4	3
	3.3	MEMS in wearable electronics and the Internet of Things (IoT)	3	3
	3.4	Case studies of successful MEMS applications	4	3
4	4.1	Size effects and challenges in NEMS fabrication, NEMS-based sensors, including nanowire and carbon nanotube sensors	4	4
	4.2	NEMS actuators and resonators for ultra-sensitive applications	4	4
	4.3	Nanogenerators and their applications	3	4
	4.4	Case studies of successful NEMS applications	4	4
5		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Tai Ran Hsu ,MEMS and Microsystems Design and Manufacture" ,Tata Mcgraw Hill
2. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers,2001
3. Marc Madou, Fundamentals of Microfabrication, CRC press 1997."

Suggested Readings

1. Chang Liu, Foundations of MEMS, Pearson education India limited

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	RFID and Applications					
Type of Course	DCE					
Course Code	MG7DCEECT405					
Course Level	**400-499**					
Course Summary and Justification	This course provides basic knowledge of the radio frequency identification (RFID) technology. In addition, learners will understand the structure, operation, and protocol of the components of RFID systems: tag, reader and middleware.					
Semester	**7**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		4				**60**
Pre-requisites	**Completion of an introductory course in basic electronics, Microprocessor and Digital Systems**					

COURSE OUTCOME

CO No.	**Expected Course Outcome**	Learning Domain	PO No.
1	Illustrate the basic concepts of RFID technology	U	1,2
2	Demonstrate the various components and working principle of RFID system	U	1,2
3	Evaluate the read range of RFID system Analyze various parameters of RFID parameters	E	1,2
4	Design RFID tag and reader antenna	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	Introduction to RFID System RFID System Configuration	4	1

	1.2	Classification of RFID System based on the mode of power transfer Near-field RFID, Far-field RFID	4	1
	1.3	Classification of RFID System based on the mode of powering up the tag Active RFID, Semi-active RFID, Passive RFID	3	1
	1.4	Frequencies and Regulations of RFID System Standardization of RFID System	4	1
2	2.1	Near-field Coupling Inductive Coupling Capacitive Coupling	4	2
	2.2	Load Modulation Far-field Coupling	4	2
	2.3	Physics of Passive UHF RFID System	4	2
	2.4	Passive tag memory layout	3	2
3	3.1	Introduction	3	3
	3.2	Radio Link- power link, backscatter communication link EIRP and ERP.	4	3
	3.3	Tag Antenna Gain Polarization matching coefficient Power transmission coefficient	4	3
	3.4	Antenna RCS Radar cross Section Antenna Scattering Antenna-mode RCS equation, Read Range Equation	4	3
4	4.1	Effect of Environment on RFID tag antenna Near-field tags Effects of metal material on tag antenna Effects of water on tag antennas	3	4
	4.2	Effect of Environment on RFID tag antenna Far-field tags Effects of metal material on tag antenna Effects of water on tag antennas	3	4
	4.3	Chip less RFID, Applications of RFID and Future Scope	4	4
	4.4	Case study	5	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. Zhi Ning Chen. Antennas for Portable Devices John Wiley & Sons, 04-Apr-2007 (Chapter 3)
2. Jerry Banks, Manuel A. Pachano, Les G. Thompson, David Hanny,RFID Applied" John Wiley & Sons
3. Klaus Finkenzeller RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification, Second Edition John Wiley & Sons, Ltd.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Digital Signal Processing					
Type of Course	**DCC**					
Course Code	MG8DCCECT400					
Course Level	**400-499**					
Course Summary and Justification	This course introduces signal theory and transforms. The representation of signals in discrete and continuous domains is covered. Z, Laplace and Fourier Transforms are introduced. DFT and FFT computations are discussed. Design techniques are introduced and digital filter design techniques are covered in this course. Simulation experiments and demonstrations are designed for the effective delivering of the course using OCTAVE/MATLAB					
Semester	**8**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites	**Knowledge of Digital Electronics, Basic Programming Skills**					

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domain*	PSO No.
1	Illustrate digital and discrete time signals, systems and their significance	U	1,2
2	Analyse the digital signals using various digital transforms DFT, FFT etc	An	1,2
3	Design the digital filters	C	1,2
4	Develop expertization in simulation software OCTAVE, MATLAB	A	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Discrete time signals	3	1, 4
	1.2	Special sequences	3	1, 4
	1.3	Shift invariance, Stability and causality	3	1, 4
	1.4	Impulse response, Difference equations	3	1, 4

2	2.1	Z-transforms by summation of left, right, and two-sided sequences	4	2, 4
	2.2	Regions of convergence and Z-transform properties	4	2, 4
	2.3	Inverse Z-transform	5	2, 4
	2.4	Implementation of Z-Transform using simulation software-OCTAVE/MATLAB	5	2, 4
3	3.1	Definition of DFT and relation to Z-transform	2	2, 4
	3.2	Properties of the DFT	2	2, 4
	3.3	The fast Fourier transform-DIT and DIF	3	2, 4
	3.4	Implementation of DFT & FFT, FFT for various signals and data - Using simulation software-OCTAVE/MATLAB	8	2, 4
Practical				
4	Digital filter design			
	4.1	Finite impulse response (FIR) filters, Infinite impulse response (IIR) filters	5	3,4
	4.2	FIR Filter Design-Window design techniques	5	3,4
	4.3	IIR Filter Design-Bilinear transform method	5	3,4
	4.4	Filter Design and filtering of signals using simulation software-OCTAVE/MATLAB	15	3,4
5	Teacher Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar **2. Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. S. K. Mitra,,Digital Signal Processing: A Computer-Based Approach, McGraw-Hill, Third edition, 2006.
2. A. Oppenheim and R. Schafer,Discrete-Time Signal Processing, Prentice Hall

Suggested Readings

1. The Student Edition of MATLAB, Prentice-Hall, New Jersey
2. V. Ingle, J. Proakis,Digital Signal Processing Using MATLAB (r), Brooks/Cole Pub. Co., 1999.
3. B. Porat,A Course in Digital Signal Processing, J. Wiley and Sons, 1996

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Natural Language Processing with Transformers in Python					
Type of Course	DCC					
Course Code	MG8DCCECT401					
Course Level	400-499					
Course Summary and Justification	Getting machines to understand natural languages is one of the biggest challenges that AI is tackling today. Get on the forefront of this challenge by familiarizing learners with Natural Language Processing and the different components involved in the discipline.					
Semester	**8**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		**1**		**75**
Pre-requisites	Familiar with Python data tools like NumPy and Scikit-learn					

COURSE OUTCOMES (CO)

CO No.	**Expected Course Outcome**	Learning Domain	PO No.
1	Demonstrate the areas in which NLP may be applied.	U	1,2
2	Illustrates the important concepts and mathematical models for NLP.	U	1,2
3	Design and Implement the programming languages and toolkits on NLP models for business applications.	C	1,2,10
4	Build and deploy NLP models on cloud infrastructure.	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
1	1.1	Word Vectors	3	1,2
	1.2	Attention Mechanism, Encoder – Decoder Framework	4	1,2
	1.3	Transformer Applications – Text Classification	3	2,3
	1.4	Transformer Anatomy	5	3
2	2.1	Name Entity Recognition - Training the model	4	3,4
	2.2	Text Generation – Training the model	4	3,4
	2.3	Summarization – Training the model	3	3,4
	2.4	Question Answering – Training the model	4	3,4

3	3.1	Large Datasets – challenges of building a Large Scale Corpus, Building custom code Datasets, Working with Large Datasets	4	1,2
	3.2	Building a Tokenizer, Training model from scratch	3	3,4
	3.3	Metrics for Language – ROUGE metric, Recall, Precision and F1	4	4
	3.4	Introduction to BERT	4	4
Practical				
4	4.1	Familiarizing with different word vectors	7	2,3
	4.2	Familiarizing with different Transformer Architectures	7	3,4
	4.3	Implementing different applications	8	4
	4.4	Familiarizing BERT model	8	2,4
5	Teacher Specific Content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar 2. **Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) d. Viva e. Lab report Demonstration

References

1. Lewis Tunstall, Leandro von Werra, Thomas Wolf - Natural Language Processing with Transformers, O'Reilly Media, Inc.
2. Liu, Zhiyuan, Yankai Lin, and Maosong Sun. *Representation learning for natural language processing*. Springer Nature, 2023.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Java Programming					
Type of Course	DCE					
Course Code	MG8DCEECT400					
Course Level	400-499					
Course Summary and Justification	The course orients the learner on the fundamental features of Object Oriented Programming (OOPs) and imparts expertise to setup Java JDK environment to create, debug and run Java programs.					
Semester	**8**	**Credits**			**4**	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		**75**
Pre-requisites	Understanding of computer fundamentals and familiarization with any of the basic programming languages such as assembly or C is an added advantage.					

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domain	PSO No.
1	Appraise OOPs programming fundamentals	U	1,2
2	Illustrate and apply OOP concept to develop Java program	U	1,2
3	Identify and employ multi-threaded programming and able to handle exceptions	A	1,2
4	Acquires programming ability using self-programs in Java	An	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	CO No.
1	1.1	OOP concepts, Overview of Java, JVM, Basics of Java Programming, Program structure	2	1
	1.2	Java tokens, Data types, Variables, scope of variables, Operators, Type conversions in expressions, Operator precedence and associativity	3	1
	1.3	***Decision making and branching:*** Decision making and looping, Arrays, Strings and Vectors	4	1

	1.4	**Objects and Classes:** Basics of objects and classes in Java, Constructors, Finalizer, Visibility modifiers, Methods and objects, in-built classes, Character, String Buffer, File, this reference	6	1
2	2.1	Inheritance in Java, Super and sub class, Overriding, Object class	4	2
	2.2	Polymorphism, Dynamic binding, Instance of operator, Abstract class, Interface in Java; Packages in Java	4	2
	2.3	Event handling in Java, Event types, Mouse and key events	4	2
	2.4	GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components	3	2
3	3.1	Managing Errors and Exceptions, Uncaught exceptions, Exception handling with try-catch-finally	3	3
	3.2	Multiple catch clauses, nested try statements, throw, throws, finally, creation your own exception subclasses, chained exceptions	4	3
	3.3	Java thread model, The main thread, Creating threads, stopping and blocking threads, thread methods,	4	3
	3.4	Thread exceptions, priority and synchronization, synchronized statement	4	3
Practical			30	4
4	4.1	JAVA basic programs: Java Programs to demonstrate the usage control structure, loops, roots of quadratic equation, multiplication of arrays, sorting	8	
	4.2	Programs to create a JAVA class, JAVA program demonstrating Method overloading and Constructor overloading, Java programs to implement: Various kinds of Inheritance, Super to call superclass constructor, Method Overriding	10	
	4.3	JAVA programs to implement Exception Handling: try, catch and finally blocks using built in exceptions; Nested try, catch and finally using; Creating Own Exception Subclasses	6	
	4.4	Program to catch Exceptions, Demonstrate the various mouse handling events JAVA programs to demonstrate Threads: Creation of Threads using The Thread Class & Runnable Interface, Setting Thread Priorities c. Threads Synchronization	6	
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory: - 30 Marks Internal Test, Seminar Presentation, Case Studies/Projects/Site visit/others
	B. Semester End examination 1.Written Test (70 marks) – 2 Hour (Duration of Examination) a. MCQ - 20 Marks b. Short answer questions (6 out of 8 questions)-6x5=30 marks c. Essay questions -2 out of 4 - 2x10=20 marks

References

1. E. Balagurusamy, Programming with JAVA, McGraw Hill, New Delhi

Suggested Readings

1. Herbert Schildt, Java The complete reference, 11th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Premchand S.Nair,,Java Programming Fundamentals: Problem Solving Through Object Oriented Analysis and Design, CRC Press

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**					
Course Name	Digital Image Processing					
Type of Course	DCE					
Course Code	MG8DCEECT401					
Course Level	**400-499**					
Course Summary and Justification	To provide the learners a foundation of digital image processing concepts. To build up the capability of implementing various image processing algorithms using Python/MATLAB/OpenCV					
Semester	**8**	**Credits**			**4**	**Total Hours**
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1		**75**
Pre-requisites	**Knowledge of Digital Electronics, Basic Programming Skills**					

COURSE OUTCOME

CO No.	**Expected Course Outcome**	**Learning Domain***	**PO No.**
1	Illustrate the fundamental relations between pixels and utility of 2-D transforms in image Processor.	U	1,2
2	Understand the enhancement processes on an image-spatial and frequency domain	U	1,2
3	Apply Image Compression and Compression standards	A	1,2
4	Develop Image Processing with OpenCV and Project	C	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	**Unit**	**Course description**	**Hours**	**CO No.**
1	1.1	Elements of Digital Image Processing	4	1
	1.2	Visual Perception and Image Representation	4	1
	1.3	Image Model, Basic Relationship between Pixels	4	1

	1.4	Image Geometry	3	1
2	2.1	Image Enhancement in Spatial Domain- Histogram Equalization, Spatial Filtering, Smoothing and Sharpening	5	2
	2.2	Review of Image Transforms- FFT, DCT, WT	4	1
	2.3	Image Enhancement in Frequency Domain- Smoothing, Sharpening	4	2
	2.4	Homomorphic filter	2	2
	Assignment Based on 1 and 2 Modules			
3	3	Image Restoration	15	3
	3.1	Noise models	3	3
	3.2	Degradation models-Methods to estimate the degradation	4	3
	3.3	Image deblurring- Restoration in the presence of noise only spatial filtering	5	3
	3.4	Periodic noise reduction by frequency domain filtering-Inverse filtering-Wiener Filtering	3	3
Practical				
4	4	Image Coding and Compression, Open CV	30	4
	4.1	Lossless compression versus lossy compression-Measures of the compression efficiency	3	4
	4.2	Hufmann coding-Bitplane coding, Transform coding	4	4
	4.3	-Lossy compression algorithm using the 2-D 6 6 DCT transform-The JPEG 2000 standard	3	4
	4.4	Open CV –Installation, Reading and Displaying Images, Image Processing using Open CV, Enhancement, Feature Detection, Face Detection, Linear Filtering	20	4
5		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions, Study Tour
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar 2. **Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.
	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks

	c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report c. Demonstration

References

1. Rafael C. Gonzalez, Richard E Woods and steven L. Eddings,Digital Image processing using MATLAB , 4/e, Pearson Education
2. A K Jain,Fundamentals of Digital image processing, 1989
3. ALAA, Nour Eddine, and Ismail Zine El Abidne. "Introduction to image processing with Python." LAMAI Laboratory FST Marrakech, Cadi Ayyad University (2021): 77.

Mahatma Gandhi University Kottayam

Programme	**BSc (Honours) Electronics with Computer Technology**
Course Name	Machine Learning from Scratch
Type of Course	DCE
Course Code	MG8DCEECT402
Course Level	400
Course Summary and Justification	Deep Learning is the go-to technique for many applications, from natural language processing to biomedical. Deep learning can handle many different types of data such as images, texts, voice/sound, graphs and so on. This course will cover the basics of DL including how to build and train multilayer perceptron, convolutional neural networks (CNNs)

Semester	8	Credits:			4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Tutorial**	**Practical**	**Others**	
		3		1		75
Pre-requisites	Basic Knowledge of Python					

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domain*	PO No.
1	Illustrate the basics of Deep Learning	U	1,2
2	Apply the tools to implement Deep Learning applications	A	1,2
3	Evaluate the performance of Deep Learning Models	E	1,2,10
4	Apply techniques of CNN for implementing Deep Learning Models	A	1,2,10

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hours	CO No.
Introduction to Deep Learning			15	
1	1.1	The Biological Neuron, The Perceptron, Perceptron Training	3	1
	1.2	Activation Functions - Linear, Sigmoid, Tanh, Softmax, ReLU, Loss Functions - Loss function Notation, Loss function for Regression, Loss function for Classification	4	1

	1.3	The Ex – OR Problem, Multilayer Perceptron	3	1
	1.4	Backpropagation intro and Chain Rule, Computation Graph	5	1
Training Neural Networks			15	
2	2.1	Stochastic Gradient Descent (SGD), Tips to improve SGD	3	2
	2.2	Tips to training Neural Networks, GPUs in Deep Learning	4	2
	2.3	Introduction to Keras library	4	2
	2.4	MLP Review, Convolution Layer, Convolution Design parameters, Why is convolution useful?	4	1
Deep Learning on images			15	
3	3.1	Convolution Layer, Convolution Design Parameters	3	2
	3.2	Pooling Layer, Multiple Convolution Layer, CNN Review	4	2
	3.3	Three Basic CNN architectures	4	3
	3.4	Training Tips, Transfer Learning	4	3
Practicals on the concepts discussed			30	
4	4.1	Familiarizing the different activation functions, loss functions, a percptron model to implement basic gates. The XOR gate in MLP	6	2
	4.2	Computational graphs assignments, chain rule implementation assignments	7	3
	4.3	Familiarizing Keras and implementing CNN on images	9	4
	4.4	Familiarizing Transfer Learning and implementing on images	8	4
5	**Teachers Specific Content**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Leverage a blended learning approach with a mix of lectures, interactive discussions, and hands-on lab sessions, Study Tour
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **A. Continuous Comprehensive Assessment (CCA)** **1. Theory: - 25 Marks** Internal Test – One MCQ based and one extended answer type Seminar Presentation – a real time application of emerging technology to be identified and present it as seminar 2. **Practical: 15 Marks** Components for assessment (suggestions): A combination of quizzes, assignments, Performance, Case Study.

	B. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks 2. Practical Exam (35 marks) – 2 Hour (Duration of Examination) a. Viva b. Lab report Demonstration

Reference

1. Seth Weidman, Deep Learning from Scratch: Building with Python from First Principles O'Reily
2. Francois Duval, Deep Learning for Beginners, Practical Guide with Python and Tensorflow

Suggested Readings

1. Goodfellow, I., Bengio, Y.,,Courville, A, Deep Learning, MIT Press, 2016.
2. Josh Patterson & Adam Gibson, Deep Learning
3. Charu Agarwal, Neural Networks and deep learning, A textbook
4. Nikhil Buduma, Fundamentals of Deep Learning, SPD
5. Francois chollet, Deep Learning with Python
6. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction

Internship Evaluation: 2 Credits with 50 marks

Continuous Comprehensive Assessment (CCA)	
Firm Identification	8 marks
Area of Internship	7 marks
Total	**15 marks**
End Semester Evaluation (ESE)	
Viva	18 marks
Report	7 marks
Certificate from Organization	5 marks
Relevant Photos	5 marks
Total	**35 marks**
Research Project / Dissertation Evaluation: 12 Credits with 200 marks	
Internal Evaluation (Semester 8)	
Synopsis	10 marks
Relevance of the research	5 marks
Literature Review	15 marks
Punctuality	10 marks
Project Content	20 marks
Total	**60 marks**
External Evaluation (Semester 8)	
Depth of Research	20 marks
Research Design	30 marks
Critical Thinking, Originality and Creativity	30 marks
Viva	30 marks
Thesis	30 marks
Total	**140 marks**

Syllabus revision workshop participants

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