THE MAHATMA GANDHI UNIVERSITY

UNDERGRADUATE PROGRAMMES (HONOURS)

SYLLABUS

MGU-UGP (Honours)

(2024 Admission Onwards)

Combined Faculty: Technology and Applied Sciences & Science

Combined BoS: Electronics & Computer Application

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

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

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Preface

BSc Electronics with computer technology and Computer Science is a double major programme under FYUGP of Mahatma Gandhi University, Kottayam. This double major programme offers a comprehensive education that bridges the gap between hardware and software technologies. This interdisciplinary program equips students with a robust foundation in both fields, combining the principles of electronics with computer science. Students gain a holistic understanding of how software and hardware interact, essential for modern technological solutions.

This double major programme is ideal for students passionate about both electronics and computer science, offering a unique blend of theoretical knowledge and practical skills applicable to numerous high-demand career fields.

The Curriculum includes major courses from Electronics as Basic Electronics, Analog &Digital Electronics, Microprocessors& Microcontrollers, Digital Image &Signal Processing, Communication Systems, Embedded Systems, and Robotics. It also includes Computer Science courses like Computer Fundamentals & Hardware, Programming, Data Structures, Operating Systems, Database Management, Computer Networks, Artificial Intelligence, Machine Learning, Internet of Things (IoT), Cloud computing.

Graduates of this double major programme are well-prepared for diverse career paths in industries such as Electronics and Semiconductor Industry, Software Development, Computer Networking, Telecommunications, Automation and Robotics, Research and Development.

We believe that the Outcome-Based Syllabus presented here will serve as a guiding framework to empower students to become competent, ethical, and innovative professionals in the field of Electronics and Computer Science. It is our hope that this syllabus will inspire a lifelong passion for learning and exploration in the ever-evolving realm of technology.

Board of Electronics (UG), Mahatma Gandhi University, Kottayam

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11	Dr.Mary Joseph Associate Professor Department of Electronics M.A College of Engineering, Kothamangalam	Member

Board of Computer Application (UG), Mahatma Gandhi University, Kottayam

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10	**Dr. Sowmya M R,** Assistant Professor, Department of Computer Science, Sree Sankara College, Kalady
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Syllabus Index

Name of the Major: **Electronics with Computer Technology and Computer Science(Double Major Programme)**

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

SEMESTER: 1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG1DSCECC100	Emerging Electronics	DSC A	4	5	3		2	
MG1DSCECC101	Art of Computing and Problem Solving	DSC B	4	5	3		2	
MG1DSCECC102	Computer Fundamentals	DSC B	4	5	3		2	
MG1MDCECC100	Creative Robotics	MDC	3	4	2		2	

SEMESTER: 2

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG2DSCECC100	Essential Concepts in Digital Electronics	DSC A	4	5	3		2	
MG2DSCECC101	Python Programming	DSC B	4	5	3		2	
MG2DSCECC102	Fundamentals of OS and Linux	DSC B	4	5	3		2	
MG2MDCECC100	IOT based smart farming	MDC	3	4	2		2	

SEMESTER: 3

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG3DSCECC200	Analog Electronics	DSC A	4	5	3		2	
MG3DSEECC200	Programming in C	DSE A	4	5	3		2	
MG3DSCECC201	Database Management Systems	DSC B	4	5	3		2	
MG3DSCECC202	Networking Fundamentals	DSC B	4	4	4			
MG3MDCECC200	Cloud Computing Essentials	MDC	3	3	3			
MG3VACECC200	Green Electronics	VAC	3	3	3			

SEMESTER: 4

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG4DSEECC200	IoT System Design	DSE A	4	5	3		2	
MG4DSCECC200	Electronics Service Technology	DSC A	4	4	4			
MG4DSCECC201	OOPs Concepts Using JAVA	DSC B	4	5	3		2	
MG4DSEECC201	Mobile App Development	DSE B	4	5	3		2	
MG4SECECC200	Solar Technology and Applications	SEC	3	3	3			
MG4VACECC200	Environmental monitoring using sensors	VAC	3	3	3			
MG4INTECC200	INTERNSHIP	INT	2					

SEMESTER: 5

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG5DSCECC300	Digital Design using Verilog	DSC A	4	5	3		2	
MG5DSCECC301	Artificial Intelligence and Machine Learning	DSC A	4	5	3		2	
MG5DSEECC300	Computer Assembling and Maintenance	DSE A	4	4	4			
MG5DSEECC301	Industrial Automation	DSE A	4	4	4			
MG5DSCECC302	Software Engineering	DSC B	4	4	4			
MG5SECECC300	Office automation and Content Creation	SEC	3	3	3			

SEMESTER: 6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG6DSCECC300	Computer Networking	DSC A	4	5	3		2	
MG6DSEECC300	Cloud Computing and IoT	DSE A	4	5	3		2	
MG6DSEECC301	Edge Computing	DSE A	4	4	4			
MG6DSEECC302	Big Data Analytics	DSE B	4	4	4			
MG6SECECC300	CCTV Installation and Maintenance	SEC	3	4	2		2	
MG6VACECC300	Environmental Awareness and Human Rights	VAC	3	3	3			

SEMESTER: 7

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG7DCCECC400	Pytorch for Deep Learning	DCC A	4	5	3		2	
MG7DCCECC401	Laser and its Applications	DCC A	4	4	4			
MG7DCCECC402	RFID and Applications	DCC A	4	4	4			
MG7DCEECC400	Wireless Network Security	DCE A	4	4	4			
MG7DCEECC401	Deep Learning	DCE A	4	4	4			
MG7DCEECC402	MEMS & NEMS	DCE A	4	4	4			
MG7DCEECC403	Advanced Operating System Concepts	DCE B	4	4	4			
MG7DCEECC404	Digital Image Computing	DCE B	4	4	4			
MG7DCEECC405	Big Data Management Using R	DCE B	4	4	4			

SEMESTER: 8

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG8DCCECC400	Digital Signal Processing	DCC A	4	5	3		2	
MG8DCCECC401	Natural Language Processing with Transformer in Python	DCC A	4	5	3		2	
MG8DCEECC400	Java Programming	DCE A	4	5	3		2	
MG8DCEECC401	Digital Image Processing	DCE A	4	5	3		2	
MG8DCEECC402	Machine Learning from Scratch	DCE A	4	5	3		2	
MG8DCEECC403	Neural Networks and Deep Learning	DCE B	4	5	3		2	
MG8DCEECC404	Pattern Recognition	DCE B	4	5	3		2	
MG8DCEECC405	Generative AI	DCE B	4	5	3		2	
MG8PRJECC400	Research project/Dissertation	PRJ	12					

SEMESTER: 1

Mahatma Gandhi University Kottayam

Programme	BSc (Honours) Electronics with Computer Technology and Computer Science(Double Major)					
Course Name	Emerging Electronics					
Type of Course	DSC A					
Course Code	MG1DSCECC100					
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	Hrs	CO No.
1	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
	1.3	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 & 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.	10	4

		Compulsory Experiment Familiarization of Domestic wiring (Wiring colour code and Selection of wire gauge), earthing, Switch board wiring, Staircase wiring		
	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 BC547 transistor Contactless power indicator, Rain detector. Making of electrical extension box (mandatory)	8	4
	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. 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 f. 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. SatheeshKumar, Electrical Wiring: An Introduction ,2nd ed.

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Programme	BSc (Honours) Electronics with Computer Technology and Computer Science(Double Major)					
Course Name	Art of Computing and Problem Solving					
Type of Course	DSC B					
Course Code	MG1DSCECC101					
Course Level	100					
Course Summary	This course covers fundamental concepts in computer programming, including algorithms, flowcharts, programming languages, control flow structures, arrays, and functions, emphasizing practical implementation through a series of hands-on exercises. Students will gain proficiency in solving problems using the C programming language.					
Semester	1	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 fundamentals of computing and problem-solving tools and techniques.	U	1
2	Illustrate the basics of programming using C language.	U	1
3	Apply C data structures and control structures in programming.	A	2
4	Apply logic in designing solutions to various problems using C Language.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Computing and Problem Solving.		15Hrs	
	1.1	Basics of Computing- Bit, Byte, Data, and Information-Computer as a Data Processing Machine-Computer Programs and Software-System and Application Software.	3	1
	1.2	Problem Solving Life Cycle (Software Development Method) – Specify the problem requirements - Analyze the problem- Design the algorithm - Implement the algorithm-Test and verify the completed program-Maintain and update the program.	3	1
	1.3	Understanding basic Problem-Solving Tools: Algorithms and Flowcharts- Examples.	4	1
	1.4	Problem solving approaches: Top-down approach, Bottom-up approach- Structured programming concepts.	2	1
	1.5	Computer Programming-Classification of Computer languages- Machine, Assembly and High-level languages, Language translators, Debugging, Types of errors- Syntax errors, Logical errors and Runtime errors.	3	1
2	Introduction to Programming		12Hrs	
	2.1	Introduction to C Programming: Character Set, Structure of a 'C' Program, Identifiers and keywords, Data Types, Variables, Constants, Operators, Expressions.	8	2
	2.2	Input and Output in C – Formatted functions, unformatted functions, commonly used library functions.	4	2
3	Control Flow Structures and Data Structures		18Hrs	
	3.1	Decision Statements- If, if-else, nested if-else, if-else-if ladder. Multi Branching Statement (Switch), Break and Continue, Unconditional Branching (Go to Statement).	6	3

	3.2	Loop control- for loops, nested for loops, while loops, do while loop. Nested Looping statements.	6	3
	3.3	Arrays: Declaration and Initialization of one and two-dimensional arrays, Strings.	3	3
	3.4	Functions: Definition-Declaration-Prototypes and Function call- actual and formal arguments.	3	3
4	Lab Practice		30Hrs	
	4.1	Simple C programs	5	4
	4.2	Program to illustrate control statements, Switch statement	5	4
	4.3	Program to illustrate looping statements	10	4
	4.4	Program to illustrate arrays	5	4
	4.5	Program to illustrate functions and user-defined functions	5	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. 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. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Mark

REFERENCES

1. Balagurusamy, E. (2019), "Programming in ANSI C" (8th ed.), Tata McGraw Hill.
2. Hanly J. R. and Koffman E. B. (2007), "Problem Solving and Program Design in C" (7th ed.), Pearson Education.

SUGGESTED READINGS

1. Gottfried, B. S. (2018). "Programming with C" (4th ed.). Schaum's Outline Series, TMH.

Pradeep K. Sinha and Priti Sinha (2004), "Computer Fundamentals -Concepts, Systems & Applications", 8th Edition, BPB Publications.

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Computer Fundamentals					
Type of Course	DSC B					
Course Code	MG1DSCECC102					
Course Level	100					
Course Summary	This course covers fundamental concepts of computers including their basics, organization, types of memory and storage devices and different input and output devices Students will gain basic knowledge of a computer system with practical implementation.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamental concepts of computers with their organization and architecture.	U	1
2	Acquire knowledge of different types of memory and storage devices.	U	1
3	Understand various input and output devices	U, A	2
4	Analyse different parts of the computer system and its installation.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	**Basic computer system**		15 Hrs	
	1.1	**Introduction to computer** -definition, uses of computer, advantages and disadvantages of computers with examples	3	1
	1.2	**Classification of computer**-Based on operating principles-Based on Applications-Based on size and capability	2	1
	1.3	**The computer system and its applications-** input process output concept, components of computer hardware -Software -Data - People. Applications-Education-Business-Communication-Science - - Engineering- Entertainment- Banking- Health-Government.	4	1
	1.4	**Computer Organization and Architecture-**Central Processing Unit, Arithmetic unit, Logic unit, Main memory unit, Cache memory, Registers. Internal Communications- Processor to memory communication-processor to I/O devices communication.	4	1
	1.5	**Machine cycle**- instruction cycle-execution cycle. The Bus and Instruction set- Data Bus, Address Bus, Complex Instruction set, Reduced Instruction Set	2	1
2	**Memory and Storage devices**		12Hrs	
	2.1	**Primary Memory Representation and Types-** RAM- Static RAM, Dynamic RAM. ROM-Programmable ROM, Erasable PROM, Electrically Erasable PROM-Flash ROM.	5	2
	2.2	**Storage systems and types**- Magnetic Storage Systems-, Magnetic Disks. Optical Storage systems - Only Optical disks-Write Once, Read Many Disks-Magneto Optical Systems-Principle used in recording data-Architecture	4	2

	2.3	**Solid State storage devices and Storage evaluation criteria** of SSD, Advantages of SSD, Disadvantages of SSD.	3	2
3	**Input /Output Devices**		18 Hrs	
	3.1	**Introduction** – Use of input and output devices- types of Input devices -types of output devices	2	3
	3.2	**Keyboard and Pointing devices**- Mouse, Trackball, LightPen, Joystick, Touchscreen	4	3
	3.3	**Scanning Devices and Optical Recognition Devices-** Handheld scanners, Flatbed scanners, Drum scanners, and Slide scanners. OCR-OMR-MICR-Barcode Reader	4	3
	3.4	**Special Input devices-**Digital Camera-Voice recognition systems-data acquisition sensor-Media Input Devices.	4	3
	3.5	**Output devices** - Impact printers-non-impact printers. Plotters-Voice output systems-Projectors-Terminals	4	3
4	**Lab Practice**		30 Hrs	
	4.1	Familiarization with computer components	2	4
	4.2	Assembling of a computer	8	4
	4.3	Hard disk Partitioning and formatting	8	4
	4.4	OS installation	3	4
	4.5	Installation of drivers and utilities	4	4
	4.6	Computer Networking	5	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 ● Lab exercises

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** 1. Written test 2. Assignments 2. Seminar 3. MCQ Test **CCA for Practical: 15 Marks** 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. 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. Theory & Procedure - 10 Marks 2. Conduction- 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Mark

REFERENCES

1 Anita Goel," Computer Fundamentals ", Pearson Education India, 2010

2 E. Balaguruswamy,"Fundamentals of Computers",Tata McGraw Hill Publishing

SUGGESTED READINGS

1 Pradeep K. Sinha and Priti Sinha (2004), "Computer Fundamentals -Concepts, Systems & Applications", 8th Edition, BPB Publications.

2 V.Rajaraman,"Fundamentals of computers",6th Edition.

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Creative Robotics					
Type of Course	MDC					
Course Code	MG1MDCECC100					
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	Open to all plus two level streams					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO 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	Hrs	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	2.1	Overview of ultrasonic sensor, Distance measurement using ultrasonic sensor	4	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
3		Practical (Any 4)	15	
	1.	Write a program to Turn On and Turn OFF LED		1
	2.	Write a program to create an SOS signal using LED		1
	3.	Controlling of LED with LDR.		1,2
	4.	Set up a Light-controlled Buzzer operation system.		1,2
	5.	Design a parking Indicator using ultrasonic sensor		1,2,4
	6	Create a smoke and fire alarm system		1,2,4
	7	Assemble a robocar using geared DC motors and a Driver module.		1,2,3
	8	Design a line follower robot Project.		1,2,3
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

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

1.Richardd. Klafter," Robotic Engineering"'phi,1996

2.Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu:

3. Arduino Cookbook by Michael Margolis, O'reilly

SEMESTER: 2

Mahatma Gandhi University

Kottayam

Department	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Essential Concepts in Digital Electronics					
Type of Course	DSC A					
Course Code	MG2DSCECC100					
Course Level	100-199					
Course Summary & 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						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domain	PSO 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

Module		Course description	Hrs	CO No.

1	1.1	Overview of Digital Electronics, Definition and significance of digital electronics, Distinction between digital and analog signals	4	CO1
	1.2	Introduction to Number Systems, Positional and non-positional number systems, Binary, decimal, octal, and hexadecimal systems overview	4	CO1
	1.3	Binary Arithmetic, Rules for binary addition, subtraction, multiplication, and division, 1's and 2's complements, conversion techniques	4	CO1
	1.4	Signed Numbers: Sign-Magnitude, 1's complement, and 2's complement forms, signed arithmetic	3	CO1
2	2.1	Boolean Algebra, Commutative, associative and distributive laws, De-Morgan's Theorem	4	CO2
	2.2	Introduction to Logic Gates, AND, OR, NOT, NAND, NOR, XOR, XNOR, Truth tables and logic gate symbols	3	CO2
	2.3	Boolean expressions and its simplification, Standard forms of Boolean Expressions: SOP and POS, K-Map simplification	5	CO2
	2.4	Building logic circuits from Boolean expressions, Universal property of NAND and NOR gates	3	CO2
3	3.1	Combinational logic circuits, Half Adders and Full Adders, Multiplexers and De-Multiplexers (4 to 1 & 1 to 4)	4	CO3
	3.2	Sequential logic circuits, SR Latch and SR Flip-flop, JK and D Flip-flops	5	CO3
	3.3	(Detail Study not required) Registers: Serial in Serial out Shift registers , Serial in Parallel out Shift Registers	2	CO3
	3.4	(Detail Study not required) Counters : Ring counter, 2 bit Synchronous counter	4	
4		Practical		
		Lab Experiment using Trainer Kit: (Any Seven) 1. Familiarization of Logic Gates 2. SR Flip Flop 3. JKFlip-flops 4. D Flip-flops 5. Half Adder 6. Full adder 7. Multiplexer 8. Demultiplexer 9. Serial in Serial out Shift registers 10. Serial in Parallel out Shift Registers 11. 2 bit synchronous counter Familiarize simulation tool.(Tinkercard/ any open source)	30	CO4

		Introduction, Setting up, Component and tool familiarization, Building and verifying AND, OR, NOT gates, Building a binary-to-decimal converter.(Not Mandatory)		
5	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, Industrial Visit (In order to motivate students in various electronics field, Industrial visit is recommended after the end of second semester examination. Industrial Visit (IV) reports should be submitted)
Assessment Types	**MODE OF ASSESSMENT (Internal Evaluation)** **C. 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.
	D. Semester End examination 1 Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) 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) – 2 Hour (Duration of Examination) j. Viva k. Lab report a. 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

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Python Programming					
Type of Course	DSC B					
Course Code	MG2DSCECC101					
Course Level	100-199					
Course Summary	This course aims to provide students with a well-rounded understanding of Python programming, empowering them to tackle a variety of programming challenges and laying the groundwork for more advanced programming endeavours.					
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 fundamental concepts of Python programming language	U	1
2	Apply Python control structures in programming	A	2
3	Apply Python data structures in programming	A	2
4	Develop Python programs demonstrating control flow structures and data structures	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	Hrs	CO No.
1	Introduction to Python Programming		12	
	1.1	Python features, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity	6	1
	1.2	Data types-Numbers, Boolean, Strings, None-Indentation, Comments, Reading Input, Print Output, Type Conversions	6	1
2	Python Control Structures		15	
	2.1	Decision Control Flow Statements – if, if-else, if-elif-else, nested if- Example python scripts	7	2
	2.2	Iterative statements - while, for, Nested loops, break and continue statements- Example python scripts	8	2
3	Python Data Structures		18	
	3.1	Lists: Creating Lists, Basic List Operations. list() function, Indexing and Slicing, Built-in-functions, List Methods, del statement.	3	3
	3.2	Tuples: Creating Tuples, Basic Tuple Operations, tuple() function, Indexing and Slicing, Built-in-functions on Tuples, Tuple methods, zip() Function.	3	3
	3.3	Dictionaries: Creating Dictionary, Accessing, and modifying, dict() function, Built-in-functions, Dictionary methods, del statement.	3	3
	3.4	Sets: Creating sets, Set methods	3	3
	3.5	Functions: Built-in-functions, User defined functions, Function Calls, The return Statement and void Function	3	3
	3.6	Files: Opening a file – Modes for opening a file and Attributes of file object, Closing a file, Writing to a file, Reading from a file, Renaming a file, Deleting a file	3	3
4		Lab Practice 1. Basic programs in Python: Display the use of variables and basic expressions, demonstrate arithmetic operators and data type conversions, create a Python script that involves working with numbers, floats, and string operations. 2. Programs Using Control structures:	30	4

		Logical operators and control flow using if-else statements, while and for loops in Python. 3. Programs Using Data structures: Manipulate lists, tuple, dictionary and sets- Programs demonstrating different data structure methods. 4. Programs using function: Python script incorporating basic in-built functions and demonstrating their usage. Implementation of user-defined functions, function calls, and parameterized function calls. 5. Programs using Files: Python scripts to open, read, and write to files, renaming and deleting files, illustrating file handling concepts in Python.		
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 ● 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. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. Gowrishankar S, Veena A., "Introduction to Python Programming.", CRC Press, Taylor & Francis Group, 2019.

SUGGESTED READINGS

1. David I. Schneider, "An Introduction to Programming Using Python", Global Edition, Pearson Education Limited, 2015.
2. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 2nd Edition, No starch Press, 2019.
3. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.

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Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Fundamentals of OS and Linux					
Type of Course	DSC B					
Course Code	MG2DSCECC102					
Course Level	100-199					
Course Summary	This course covers fundamental concepts of operating system and their various functions. It also covers basic commands of the Linux operating system. Students will gain basic knowledge of operating system with practical implementation.					
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	Understand the operating system functions and its structure	U	1
2	Understand basic concepts of process management, different CPU scheduling techniques and deadlocks	U	1
3	Describe different storage management techniques and file system.	U	2
4	Analyse different commands of the Linux operating system.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	**Overview**		10 Hrs	
	1.1	**Introduction**-Definition- -Evolution of operating systems-Types of Operating system-Functions.	5	1
	1.2	**Operating system structures**- Operating system components-System calls-System programs.	5	1
2	**Process management**		17Hrs	
	2.1	**Process concept-** Introduction --process state-Process Control Block	3	2
	2.2	**Process scheduling** -scheduling Queues-Schedulers.	4	2
	2.3	**CPU Scheduling** - Scheduling Criteria-Scheduling Algorithms-FCFS, SJF, Priority, Round Robin	6	2
	2.4	**Deadlocks**-Definition-Characterization-Resource Allocation Graph-Introduction to Methods for Handling Deadlocks	4	2
3	**Storage Management**		18 Hrs	
	3.1	**Memory Management**-swapping-contiguous memory allocation-memory allocation methods, fragmentation - Paging-Basic Method- Segmentation -Basic method	6	3
	3.2	**Virtual Memory**-Demand Paging-Basic concepts-Page replacement-Basic concepts, FIFO, Optimal Page replacement, LRU	5	3
	3.3	**File system-**File concept-File Attributes-File Operations-File types-Access Methods	4	3
	3.4	**File System Implementation-**Directory structure- File allocation-	3	3
4	**Linux Lab Practice**		30 Hrs	
	4.1	**Linux Directory Commands**:pwd,mkdir,rm -rf, ls,cd,cd/ cd~	2	4
	4.2	**Linux File Commands**- touch, cat, cat> ,cat>> ,rm, cp ,mv,rename	4	4

	4.3	**Linux Permission Commands**-su, id, useradd, passwd,groupadd,chmod,groupdel,chmod,groupdel,chown,chgrp	5	4
	4.4	**Linux File Content &Fliter Commands**- head, tail, tac, more, less, grep, cut, comm, sed, tee, tr,uniq,wc, od, sort, diff.	3	4
	4.5	**Linux Utility Commands-** find, bc, locate, date, cal, sleep, time, df, mount, exit, clear, gzip, gunzip.	4	4
	4.6	**Linux Networking Commands** - ip, ssh, mail, ping, host.	4	4
	4.7	**Edit Crontab File**- to wall message on the system at a particular time automatically.	3	4
	4.8	**Vi editor** - Create File, edit, save and quit. Highlighting the searched term within a file, cut, yank, undo	5	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 ● 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 AnswerQuestions(4 out of 6 Questions) - (4*5=20 Marks) Part C: EssayQuestions(2 out of 3 Questions) - (2*10=20 Marks) **ESE for Practical: 35 Marks (1.5 Hrs)** 1. Writing steps for command execution- 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Mark

REFERENCES

1. A Silberschatz,P.B. Galvin, G.Gagne,"Operating systems Concept" ,8th Edition,John Wiley Publications.
2. A.S. Tanenbaum," Modern Operating Systems ", 3rd Edition, Pearson Education.
3. Sumitabh Das ," Linux"
4. Petersen," Linux The Complete Reference ",6th Edition

SUGGESTED READINGS

1. Dr. Rajiv Chopra," Operating System ", A practical approach
2. Milan Milenkovic," Operating System Design and Concepts'
3. W.Stallings, " Operating Systems, Internals & Design Principles" , 8th Edition, Pearson Education.
4. Christopher Negus," Linux Bible"

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	IoT based smart farming					
Type of Course	MDC					
Course Code	MG2MDCECC100					
Course Level	100-199					
Course Summary & 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	Hrs	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)**	30	
		1. Vertical farms / Hydroponics / Aquaponics.(Case study/Field visit)		2
		2.Smart regulation of soil moisture using integration of soil moisture sensors and irrigation Pump, mediated by ESP32.(Case study/Field visit)		2, 3
		3. Concept of agriculture drone (Case study/Field visit)		3, 4
		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)		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 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.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.

SEMESTER: 3

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Analog Electronics					
Type of Course	DSC A					
Course Code	MG3DSCECC200					
Course Level	200-299					
Course Summary & 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	Hrs	CO
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	
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	Analog Integrated Circuits			
	3.1	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 .		
	3.4	Non linear Applications - Comparator Introduction to NE555, Astablemultivibrator using 555.	4	3
	Practical			
4	4.1	Practical using simulation software 1. RC Coupled Amplifier 2.RC phase shift Oscillator 3.Zero-crossing detector 4. Triangular Waveform generator **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 Mini project using simulation software **(Not Mandatory)**	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)- 1 Hour 30 Minutes(Duration of Examination) l. MCQ - 10 Marks (Answer all - 10x1=10 Marks) m. Short answer questions (4 out of 6 questions)-4x5=20 marks n. 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. 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.SergioFranco,?Design with operational amplifiers and Analog Integrated circuits?, Tata McGraw Hill 3rd Edition 2002.
4.RonManchini, “Op-Amps for Everyone“, Design Reference-Texas Instruments, August 2002.
5. S.Salivahanan and V.S. KanchanaBhaaskaran, “Linear Integrated Circuits”, 6th Edition, Tata McGraw-Hill, 2011.

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Programming in C					
Type of Course	DSC A					
Course Code	MG3DSEECC200					
Course Level	200-299					
Course Summary & 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	Hrs	CO.
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)**	30	4
		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		
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)- 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 d. Viva e. Lab report f. 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Database Management Systems					
Type of Course	DSC B					
Course Code	MG3DSCECC201					
Course Level	200					
Course Summary	This course provides a comprehensive exploration of fundamental concepts in database management. The course delves into the Relational Model, Entity-Relationship Modelling, SQL, normalization. The course also covers transaction processing, desirable properties of transactions.					
Semester	3	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	Understand the fundamental concepts of database systems.	U	1
2	Analyse Relational database model	An	1
3	Apply SQL queries to create and manipulate relational databases.	A	1,2
4	Apply DDL Commands to manage Database operations.	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	Hrs	CO No.
1	1.1	Introduction to database, database management systems, functions of DBMS, characteristics of database approach.	2	1
	1.2	Database users- database administrator, database designers, end users. Advantages of using DBMS approach.	2	1
	1.3	Database system Concepts and Architecture - Data model, schema, instance, and categories of data model, data independence- physical and logical data independence, three-schema architecture.	2	1
	1.4	Database system environment- DBMS component modules	2	1
	1.5	Conceptual data modelling using Entity Relationship model- main phases of database design.	2	1
	1.6	Entity type, entity set, attributes, types of attributes, domain of attributes, keys- super key, candidate key, primary key	2	1
	1.7	Relationship Types, Relationship Sets, Roles, and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.	3	1
2	2.1	Relational Data Model- Domains, Attributes, Tuples and Relations-Characteristics of Relations –Relational Model Constraints and Relational Database Schemas: Domain Constraints, Key Constraints, Relational Database Schemas, Entity Integrity, Referential Integrity, and Foreign Keys.	7	2
	2.2	Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms: First Normal Form, Second Normal Form, Third Normal Form – General Definitions of Second and Third Normal Forms – Boyce-Codd Normal Form.	8	2
3	3.1	Structured Query Language-DDL,DML,DCL commands	1	3

	3.2	Basic data types in SQL, Data Definition commands : CREATE, ALTER,DROP - Adding constraints in SQL	2	3
	3.3	Basic SQL Queries : INSERT ,SELECT ,DELETE, UPDATE, Substring comparison using LIKE operator, BETWEEN operator	3	3
	3.4	Ordering of rows – SQL set operations :UNION, EXCEPT, INTERSECT	2	3
	3.5	Nested queries , EXISTS and UNIQUE functions, Renaming of attributes	2	3
	3.6	Joining of tables, Aggregate functions ,GROUP BY, Managing Views	2	3
	3.7	Transaction-state, desirable properties of transaction	3	3
4	4.1	• Creating and altering the structure of a table in the database using DDL commands • Inserting rows to the table using INSERT command • Modifying data in the table using UPDATE and DELETE • Basic querying using SELECT	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 • 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. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. RamezElmasri and Shamkant B. Navathe (2010). Database Systems (6th Edition). Pearson Education.

SUGGESTED READINGS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill
2. C.J Date- An Introduction to Database Systems, Eighth edition, Pearson Education,2003.
3. ReghuRamakrishnan and Johannes Gehrke- Database Management Systems, Third edition, Mc Graw Hill International Edition.
4. Dipin Desai, An Introduction to Database Systems, First Edition, Galgotia Publications.

	Mahatma Gandhi University **Kottayam**
Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)
Course Name	Networking Fundamentals
Type of Course	DSC B
Course Code	MG3DSCECC202
Course Level	200-299
Course Summary	This course provides a comprehensive overview of computer networks, covering data and signals, transmission impairments, network models, bandwidth utilization, switching methods, the data link layer, network and transport layers, application layer protocols, and network security.

Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO):

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand and analyse network fundamentals, including data and signals, transmission impairments, data communication protocols, and the OSI and TCP/IP models.	U, An	1,2
2	Understand and apply concepts of bandwidth utilization, transmission media and various switching methods.	U, A	1,2
3	Understand data link layer concepts, wired LAN standards and wireless LAN technologies.	U,A	1,2
4	Understand network and transport layer components, application layer protocols and network security fundamentals	U	1

**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	1.1	Introduction to Networks, Data and signals-analog and digital, periodic analog signals, digital signals, bitrate, baud rate, bandwidth.	5	1
	1.2	Transmission impairments- attenuation, distortion and noise. Data communication protocols and standards	5	1
	1.3	Network models - OSI model-layers and their functions.TCP/IP protocol suite	5	1
2	2.1	Bandwidth utilization Multiplexing: FDM, TDM, spread spectrum.	5	2
	2.2	Transmission Media- guided media and unguided media.	5	2
	2.3	Switching: message, Circuit and packet switched networks, datagram networks, virtual- circuit networks.	5	2
3	3.1	Data link layer: Error Detection and Correction, Framing, flow and error control.	5	3
	3.2	Protocols – Noiseless channels (Simplest, Stop and Wait) and Noisy channels (Stop and Wait and Piggy Backing). Multiple Access Protocols.	5	3
	3.3	Random Access-ALOHA, CSMA. Wired LANs-IEEE standards, wireless Lans-Bluetooth, Cellular Telephony	5	3
4	4.1	Network layer and Transport layer: Repeaters, Bridges, Gateways and routers. Logical addressing – IPV4and IPV6 addressing, Internet protocol - IPV4 and IPV6.	5	4
	4.2	Connectionless and Connection Oriented Services: UDP and TCP. Congestion Control, Quality of Service.	5	4
	4.3	Application layer: HTTP, FTP, SMTP, DNS. Network security: Common Threats- Firewalls (advantages and disadvantages), Cryptography.	5	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • ICT enabled Lecture • Interactive sessions • Class discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** 1. Written tests 2. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks (2 Hrs)** **Written Test (70 Marks)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. B. A. Forouzan - Data communication and Networking, Fourth edition-,TMH

SUGGESTED READINGS:

2. Andrew S Tanenbaum - Computer Networks, Fourth Edition, Prentice Hall of India.

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Cloud Computing Essentials					
Type of Course	MDC					
Course Code	MG3MDCCSC200					
Course Level	200-299					
Course Summary	This course provides a comprehensive overview of cloud computing, covering its definition, models, architecture, services, applications, virtualization technologies, and a comparative analysis of leading cloud service providers, with a case study on Amazon Web Services.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concept, types, pros and cons of Cloud Computing.	U	1
2	Demonstrate the Cloud architecture and compare and contrast various Cloud service models.	An	1
3	Analyse Abstraction and Virtualization technologies and Compare the features of leading Cloud Service Providers.	An	1

**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	Introduction to Cloud Computing			
	1.1	Defining Cloud Computing, Cloud types- The NIST model, The Cloud Cube model, Deployment models, Service models.	10	1
	1.2	Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing.	5	1
2	Cloud Architecture, Services and Applications			
	2.1	Exploring the Cloud Computing Stack, connecting to the Cloud.	5	2
	2.2	Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS).	6	2
	2.3	Identity as a Service (IDaaS), Compliance as a Service (CaaS).	4	2
3	Abstraction and Virtualization			
	3.1	Introduction to Virtualization Technologies, Load Balancing and Virtualization.	4	3
	3.2	Understanding Hyper visors, Understanding Machine Imaging, Porting Applications.	4	3
	3.3	Leading Cloud Service Providers – Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)- Comparative analysis of features and services.	4	3
	3.4	Case study: Using AWS	3	3

4		**Teacher Specific Content**	

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Demonstration through ICT tools
Assessment Types	**MODE OF ASSESSMENT** **A.** **ontinuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** 1. Written test 2.Assignments
	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)

REFERENCES

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", First Edition, John Wiley& Sons, 2011.

SUGGESTED READINGS

1. Sosinsky B., "Cloud Computing Bible", First Edition, Wiley Edition, 2011.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2017.

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Green Electronics					
Type of Course	VAC					
Course Code	MG3VACECC200					
Course Level	200-299					
Course Summary & 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	Hrs	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	5	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)** **B. 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. 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, MajetiNarasimhaVar, MeththikaVithanage, 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)

SEMESTER: 4

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	IoT System Design					
Type of Course	DSC A					
Course Code	MG4DSEECC200					
Course Level	200-299					
Course Summary & 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	Knowledge in Basic Electronics					

COURSE OUTCOMES(CO)

CO No.	**Expected Course Outcome**	Learning Domain	PO No.
1	Summarize the architecture and components of IoT systems	U	1,2,10
2.	Explain the concept of Sensors, Actuators	U	1,2
3	Apply their knowledge of cloud services for IoT	A	1,2,10
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	Hrs	CO
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		Practical	30	4
		IoT System Design (Practical) Experiments to be done with IoT development board ESP8266 (NodeMCU)/ESP32 and Blynk Software: Arduino IDE/ESPID **(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		
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)-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 Hours (Duration of Examinations) g. Viva h. Lab report i. Demonstration

References

1.HakimaChaouchi, — 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.PeterWaher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors OvidiuVermesan
3.Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. Vpt, 2014.
4.Shriram K Vasudevan, AbhishekNagarajan, RMD Sundaram Internet of Things, Wiley India
5.Prof. Satish Jain, ShashiSingh,IoT and its Applications BPB publication

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Electronics Service Technology					
Type of Course	DSC A					
Course Code	MG4DSCECC200					
Course Level	200-299					
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. This course also inspires the students to explore opportunities for self-employment					
Semester	4	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	Explain thebasic concept of electricity and electrical Safety	U	1,2
2	Classify the tools and equipment for troubleshooting	U	1,2
3	Utilize the testing of electronic components	A	1,2,10
4	Develop the ability to troubleshooting of different issues of electronic equipments	S	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	Hrs	CO No.
1	1.1	Concept of Voltage, Current, Resistance, Power and its measurement, earthing procedure, Testing of line faults	3	1
	1.2	Wiring Color code for domestic and industry, selection of proper wire gauge, Cabling accessories, Concept of FUSE, MCB, RCCB, ELCB and load requirement calculation	4	1
	1.3	Basic Electrical safety rules, Equipment and component level inspection, Overload and short circuit identification, Earthing technique	4	1
	1.4	Prevention of fire, First aid and basic awareness of CPR procedure	4	1
2	2.1	Knowledge of basic tools - screwdriver set, wire cutter, wire stripper, piler, tweezers, allen keys, opening piler	4	2
	2.2	Power tools - Hammer, driller, hack saw blade, jig saw, bench vice, mallet	4	2
	2.3	Mechanical measurement tools - Angular measurements-sine bar, angle gauges, levels, taper gauges	4	2
	2.4	Electrical Measurement tools: Voltmeter, Ammeter, Multimeter (Digital and Analog), Clamp meter, LCR Meter	3	2
3	3.1	Inside Electronic Equipment: Reading Drawings and Schematic Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram.	4	3
	3.2	Introduction to PCB- Types of PCB, Common Problems, PCB Cleaning and protecting solutions, continuity test, PCB inspection	4	3
	3.3	Testing of passive components - Resistor and Capacitor colour coding, Testing of Resistor, capacitor, inductor, Diode and transformer with a multimeter, Testing of fuse and NTC.	4	3
	3.4	Testing of active components: - Transistor and FET Testing with multimeter	2	3
4	4.1	Soldering - Basics of soldering, Soldering equipment, Soldering and desoldering practice, PCB re-touch and repairing.	10	4
	4.2	Home appliances troubleshooting: - Fault finding procedure for Power supply, Home Theatre, LED Bulbs, FAN, Iron Box	8	4
	4.3	Preventive Measures- Protection of electronic circuit boards, shielding, earthing, over voltage and spike protection systems	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. 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) d. Viva e. Lab report f. Demonstration

References

1.Khandpur, R. Troubleshooting electronic equipment. McGraw-Hill, Inc., 2006.
2.Bali, S. P. Consumer Electronics. Pearson Education India, 2007.

Suggested Readings

1.Sinclair, Ian Robertson, and John Dunton. Electronic and Electrical Servicing: Consumer and commercial electronics. Routledge, 2007.
2.Electronic Servicing and repairing - Trevor Linsley
3.Electrical Safety Handbook - John Cadick
4.Engineering Basics: Electrical, Electronics and Computer Engineering By T. Thyagarajan
5.The basics of testing electronic components -Raffiel Kent
6.Electronics Components and Testing - Dr.ShirishBhagwatPatil, .Dr ShaileshShivramDongare, Dr. Vimal Sagar
7.Testing Active and Passive Electronic Components By Richard.F. Powell

	Mahatma Gandhi University **Kottayam**
Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)
Course Name	OOPs Concepts Using JAVA
Type of Course	DSC B
Course Code	MG4DSCECC201
Course Level	200-299
Course Summary	Programming concepts of JAVA language

Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Knowledge about program logic					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply OOP concepts and Java fundamentals to develop robust programs.	A	1,2
2	Analyze class structure, inheritance, method implementation, and array handling in Java.	An	1,3
3	Demonstrate Java packages, exception handling, multithreading, Swing components, and event handling.	A	1,2
4	Demonstrate proficiency in Java programming through practical implementation and problem- solving.	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	Hrs	CO No.
1	1.1	Concepts of Object Oriented Programming, Benefits of OOP,	1	1
	1.2	Features of Java, Java Environment, Java tokens. Constants, variables, data types, operators.	2	1
	1.3	Control statements-branching, looping and jump statements, labelled loops.	7	1
2	2.1	Defining a class, fields declaration, method declaration , creating object, accessing class members	4	2
	2.2	Method overloading, constructors, constructor overloading,	4	2
	2.3	Command line arguments, super keyword, static members,	4	2
	2.4	Inheritance, overriding methods, dynamic method despatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.	4	2
	2.5	Arrays-one dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays. String class.	4	2
3	3.1	Packages:- Java API packages overview(lang, util, io, swing, applet), user defined packages-creating packages, using packages.	3	3
	3.2	Exception handling techniques, Multithreading- creation of multithreaded program-Thread class –Runnable interface-thread life cycle.	4	3
	3.3	Swing components-ImageIcon, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTable, JTabbedPane, JScrollPane,	4	3
	3.4	Event handling –Delegation Event Model-event classes-sources of events-event listeners.	4	3

4		• Implement basic OOP concepts through hands-on exercises. • Develop Java applications demonstrating inheritance and polymorphism • Utilize arrays and strings in practical coding tasks. • Create and use custom packages • Implement exception handling techniques • Build multithreaded Java programs to handle concurrent tasks efficiently. • Design and develop graphical user interfaces using Swing components. • Implement event handling mechanisms to respond to user interactions effectively.	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 • 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. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks

	4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. E. Balagurusamy (2014). Programming with Java (3rd Edition). McGraw Hill Education. (Module 1, 2 and 3)
2. Patrick Naughton (2002). Java 2 The Complete Reference (7th Edition). Osborne/McGraw-Hill.(Module 4 and 5)

SUGGESTED READINGS

1. Cay S. Horstmann& Gary Cornell – Core Java Volume 1 – Fundamentals, Eighth edition.
2. K. Somasundaram – Programming in Java 2 , First edition, Jaico Publishing House.

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Mobile App Development					
Type of Course	DSE					
Course Code	MG4DSEECC201					
Course Level	200-299					
Course Summary	Introduction to mobile application development, user interface designing, data management and core functionalities of mobile applications and web services and develop mobile applications using GUI and Layouts.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the process of developing mobile applications and explore Android development	U	1
2	Apply Android components for UI development, data persistence, and user interaction.	A	1
3	Apply Android content providers for data sharing, SMS messaging, email sending, and location-based services and Utilize HTTP and JSON for consuming web services.	A	1,2
4	Apply essential Android Programming concepts and Develop various Android applications related to layouts	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	Units	Course description	Hrs	CO No.
1	**Introduction to Mobile apps**		10hrs	
	1.1	Mobile Application Development - Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps -Comparing Native vs. Hybrid Applications -The Mobile Application Development Lifecycle-The Mobile Application Front-End-The Mobile Application Back-End	5	1
	1.2	Key Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application	5	1
2	**Android Activities, User Interface, Basic Views, Fragments, and Data Persistence**		20 hrs	
	2.1	Understanding Activities-Linking Activities Using Intents-Fragments-Displaying Notifications	3	2
	2.2	Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes to Screen Orientation	2	2
	2.3	Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications	5	2
	2.4	Using Basic Views-Using Picker Views -Using List Views to Display Long Lists	3	2
	2.5	Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with Views UsingWebView- Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases.	7	2
3	**Sharing Data and Advanced Functionality, Web Services**		15 hrs	
	3.1	Sharing Data in Android-Creating Your Own Content Providers -Using the Content Provider	5	3

	3.2	SMS Messaging -Sending Email-Displaying Maps-Getting Location Data- Monitoring a Location.	5	3
	3.3	Consuming Web Services Using HTTP-Consuming JSON Services	5	3
4	Lab Experiments 1. Develop an application that uses GUI components, Font and Colours 2. Develop an application that uses Layout Managers and event listeners. 3. Develop a native calculator application. 4. Write an application that draws basic graphical primitives on the screen. 5. Develop an application that makes use of RSS Feed. 6. Implement an application that implements Multi-threading 7. Develop a native application that uses GPS location information. 8. Implement an application that writes data to the SD card. 9. Implement an application that creates an alert upon receiving a message.		30 Hrs	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 • 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** **Written Test(50 Marks) (1.5 Hrs)** 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. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Jerome DiMarzio. "Beginning Android Programming with Android Studio"(4thEdition). -Module 1,2
2. Anubhav Pradhan and Anil V Deshpande, Wiley Publications(2014). Composing Mobile Apps : Learn, Explore and Apply using Android. ISBN: 978-81-265-4660-2. - Module 2,3,4
3. Bill Phillips and Chris Stewart, Big Nerd Ranch Guides. Android Programming: The Big Nerd Ranch Guide - Module 5

SUGGESTED READINGS

1. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", 2017.
2. Neil Smyth , "Android Studio 3.0 Development Essentials: Android", 8th Edition.
3. Pradeep Kothari, "Android Application Development (With Kitkat Support)", Black Book 2014.

WEB REFERENCES:

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https://en.wikipedia.org/wiki/Android_10
Develop App for Free
https://flutter.dev/
http://ai2.appinventor.mit.edu
https://en.wikipedia.org/wiki/Android_version_history
https://aws.amazon.com/mobile/mobile-application-development/ (Unit1)
https://en.wikipedia.org/wiki/Mobile_app_development

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Solar Technology and Applications				
Type of Course	SEC				
Course Code	MG4SECECC200				
Course Level	200-299				
Course Summary & 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					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO 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	Hrs	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 Photovoltaics. 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** **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. 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, ForDummies, 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	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Environmental monitoring using sensors				
Type of Course	VAC				
Course Code	MG4VACECC200				
Course Level	200-299				
Course Summary & Justification	This course provides learners a comprehensive understanding of environmental monitoring using sensors and microcontrollers. The 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
Total Student Learning Time (SLT)	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 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	Hrs	CO No.
1	**Introduction to Environmental Monitoring**			
	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 greenhouse effect, Impact of various greenhouse gases on environment	5	1, 2
	1.3	Air quality index and its importance	5	2, 3
Environmental monitoring using sensors				
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
Trends in Environmental Monitoring				
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)** 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)-1 Hour 30 Minutes(Duration of Examination) 1.MCQ - 35x1= 35 Marks 2.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, VedatOzan. 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.

SEMESTER: 5

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Digital Design Using Verilog					
Type of Course	DSC					
Course Code	MG5DSCECC300					
Course Level	300-399					
Course Summary & 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

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit	Course description	Hrs	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	**Practicals (Any 8)**		30	4
	4.1	Basic Logic Gates		
	4.2	Universal Gates and Implementation using universal gates		
	4.3	Half- Adder and Full-Adder		
	4.4	Half-Subtractor and Full-subtractor		
	4.3	Encoder and Decoder-4 bit		
	4.4	4:1 Mux and 1:4 DeMux		
	4.5	Gray to Binary and Binary to Gray		
	4.6	2 Bit Adder		
	4.7	Flip-Flops- SR, JK, T and D		
	4.8	1-Bit Parity Checker		
	4.9	LIFO and FIFO Registers		
	4.10	Counters- 4 Bit Up-Down and Decade Counter		
	4.11	8-Bit ALU		
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 (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)** **C. 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.
	D. Semester End examination 1.Written Test (50 marks)- 1 Hour 30 Minutes (Duration of Examination) o. MCQ - 10 Marks (Answer all - 10x1=10 Marks) p. Short answer questions (4 out of 6 questions)-4x5=20 marks q. 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. JayaramBhasker 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Artificial Intelligence and Machine Learning				
Type of Course	DSC				
Course Code	MG5DSCECC301				
Course Level	300-399				
Course Summary & 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	Hrs	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 perceptrons	2	1
	3.2	Backpropagation Learning	3	2,3,4
	3.3	CNN architectures	4	2,3,4
	3.4	RNN architectures	4	2,3,4
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)- 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 f. 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Computer Assembling and Maintenance					
Type of Course	DSE					
Course Code	MG5DSEECC300					
Course Level	300-399					
Course Summary & 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	Hrs	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	3	

		Identifying Peripheral Devices, interfacing		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 NeeharikaAdabala. 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.DBalasubramanian 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Industrial Automation					
Type of Course	DSE					
Course Code	MG5DSEECC301					
Course Level	300-399					
Course Summary & 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	PSO 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	Hrs	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,	5	4

		Key characteristics of sensors: - accuracy, precision, sensitivity, and resolution.		
	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 management An overview of Cyber-physical system Security.	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. 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)
Course Name	Software Engineering
Type of Course	DSC
Course Code	MG5DSCECC302
Course Level	300
Course Summary	This course is designed to equip students with the knowledge and skills needed to design, build, and maintain high-quality software systems in a professional environment.

Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Familiarization with Computer Fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe software engineering and the different software process models used in industry.	U	1
2	Explain software requirement analysis and requirement elicitation methods.	U	1
3	Analyse and compare various software design and testing methods.	An	2
4	Develop software project management skills.	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	Hrs	CO No.
1	1.1	**Introduction to Software Engineering** - Definition, Program Vs Software. Software Characteristics, brief introduction to product and process. Software Development Life Cycle (SDLC). Role of a Software Engineer, Ethics in Software Engineering.	3	1
	1.2	Overview of different life cycle models -Waterfall model, Increment process models- Iterative, RADand Evolutionary process models- Prototyping, Spiral, and Agile. Selection of a life cycle model.	9	1
2	2.1	**Requirements Engineering** - Software Requirement Analysis and Specification Requirements Engineering, Type of requirements, Feasibility Studies	6	2
	2.2	Requirement Elicitation – Use Case, DFD, Data Dictionaries, Various steps for requirement analysis	6	2
	2.3	Requirement documentation, SRS, Requirement validation.	6	2
3	3.1	**Software Design & Testing -** Definition, Various types, Objectives and importance of Design phase, Modularity, IEEE recommended practice for software design descriptions SDD.	8	3
	3.2	**Software Testing** - Development testing, Test-driven development, Release testing, User testing.	10	3

4	4.1	**Managing Software Projects** Introduction, Risk Management- Risk identification, Risk analysis, Risk planning, Risk monitoring.	3	4
	4.2	Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation Techniques-COCOMO.	3	4
	4.3	Quality Management - Software Reliability Definition, McCall software quality model, Capability Maturity Model.	3	4
	4.4	Configuration Management- Change Management, Version Management.	3	4
5		(Teacher specific content)		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Classroom Discussions, Case study
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** 1. Written tests 2. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks (2 hrs)** **Written Test(70 Marks)** Part A: Very short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions(6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES:

1. K K Aggarwal, Yogesh Singh - Software Engineering, Third Edition, New Age International Publications.
2. Ian Somerville - Software Engineering, Ninth Edition, Pearson Education.

SUGGESTED READINGS

1. Roger S Pressman - Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill Higher Education.
2. Pankaj Jalote - An Integrated Approach to Software Engineering, Second Edition, Narosa Publishing Company.

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Office Automation and Content Creation					
Course Code	MG5SECECC300					
Type of Course	SEC					
Course Level	300-399					
Course Summary & 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	Lecture	Workshop from expert	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	Hrs	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 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	3	1
	1.3	Creating Tables- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, and Formula, Drawing - Inserting Clip Arts, 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, auto shapes, 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,Mathematicalfunctions,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 Videos , Colour Scheme , Background Action Buttons - Slide Transition - Custom Animation	4	3

	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)- 1 Hour 30 Minutes (Duration of Examination) 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.

SEMESTER: 6

MGU-UGP (HONOURS)

Syllabus

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Computer Networking					
Type of Course	DSC A					
Course Code	MG6DSCECC300					
Course Level	300-399					
Course Summary & 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	Workshop from expert	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.
	E. 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.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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Cloud Computing and IoT					
Course Code	MG6DSEECC300					
Type of Course	DSE					
Course Level	300-399					
Course Summary & 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	Workshop from expert	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	Hrs	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 :	30	

		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		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)** **F. 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.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

IBali, 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 AdithJagadishBoloo
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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Edge Computing					
Type of Course	DSE					
Course Code	MG6DSEECC301					
Course Level	300-399					
Course Summary & 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	Hrs	CO.
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
Module	**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
Module	**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
Module	**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 SatishNarayanaSrirama, 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.

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Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Big Data Analytics					
Type of Course	DSE					
Course Code	MG6DSEECC302					
Course Level	300					
Course Summary	This course introduces Big Data concepts and the Hadoop ecosystem, covering data classification, Hadoop features, HDFS, MapReduce, and frameworks like Pig and Hive for Big Data applications. Students will gain practical experience with Hadoop tools and techniques for processing and analyzing large datasets.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Data Base Management Systems.					

COURSE OUTCOMES (CO):

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental characteristics of big data,and differentiate between structured, semi-structured, and unstructured data.	U	1
2	Explain the advantages and features of Hadoop technology.	A	1,2
3	Understand and implement MapReduce programming, including job execution, handling failures, and optimizing performance.	U,A	1,2
4	Compare and contrast Pig and Hive for big data processing	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	Hrs	CO No.
1	**Introduction to Big Data**			
	1.1	Classification of digital data - structured, semi structures, unstructured data-Characteristics of data- Definition of big data-evolution, challenges with big data	8	1
	1.2	Three Vs of big data- Other characteristics. -Business Intelligence versus Big Data-Hadoop Environment-why big data.	7	1
2	**Introduction to Hadoop**			
	2.1	Features of Hadoop-Key Advantages of Hadoop-Versions of Hadoop-Overview of Hadoop Ecosystems-Hadoop Distributions-Hadoop versus SQL-RDBMS versus- Hadoop	7	2
	2.2	Hadoop Overview-Hadoop Use case-Managing Resources with YARN Hadoop Distributed File System(HDFS)-HDFS Daemons-Anatomy of File Read and Write-Working with HDFS Commands-Special Features of HDFS	8	2
3	**Processing Data with Hadoop**			
	3.1	MapReduce Daemons-Working-Example.MapReduce Programming-Mapper,Reducer, Combiner, Partitioner	8	3
	3.2	Anatomy of a Map Reduce Job runFailures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Input-Output Types and Formats- Map Reduce Features.	7	3
4	**Frameworks**			
	4.1	Applications on Big Data Using Pig- Pig Latin Overview-Operators-Data Types- Pig Latin Running Modes-Relational Operators-AVG, MAX, COUNT- Complex Data Types-Word Count example using Pig.	8	4

	4.2	Introduction to Hive-Architecture- Data Types- File Formats- HiveQL Difference between RDBMS and Hadoop, MapReduce versus Pig, Pig versus Hive	7	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • ICT enabled Lecture • Interactive sessions • Class discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** 1. Written tests 2. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks (2 Hrs)** **Written Test (70 Marks)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. SeemaAcharya, SubhasiniChellappan(2015). "Big Data Analytics". Wiley. (Module I,2,3,4).
2. Tom White(2012). “Hadoop: The Definitive Guide”(Third Edition). O’reilly Media. (Module 3)

SUGGESTED READINGS:

1. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
3. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
4. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	CCTV Installation and Maintenance					
Course Code	MG6SECECC300					
Type of Course	SEC					
Course Level	300-399					
Course Summary & 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	Total Hours:
Total Student Learning Time (SLT)	Learning Approach	Lecture	Workshop from expert	Practical	Others	
	Interactive learning approach	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 hard Disk Add Camera Assign Recording type Assign Frame Rate Assign Video Compression Set Bandwidth Create Backup Video Playback Audio Integration	8	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. 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. 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

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Environmental Awareness and Human Rights				
Type of Course	VAC				
Course Code	MG6VACECC300				
Course Level	300-399				
Course Summary & 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	PSO 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	Hrs	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 Land resources: Land as a resource, land degradation	5	1
	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** 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. 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.

SEMESTER: 7

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	PyTorch for Deep Learning					
Type of Course	DCC					
Course Code	MG7DCCECC400					
Course Level	400-499					
Course Summary & 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	Hrs	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)** **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. 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.FrancoisChollet - Deep Learning with Python, Second Edition,Manning; 2nd edition (December 21, 2021)

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Laser and its Applications					
Type of Course	DCE					
Course Code	MG7DCCECC401					
Course Level	400-499					
Course Summary & 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 Electromagnetic, 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	Hrs	CO No.
1	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, mono chromaticity, 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.RMMeasures,Laser Remote Sensing: Fundamentals and Applications,. John Wiley

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	RFID and Applications					
Type of Course	DCE					
Course Code	MG7DCCECC402					
Course Level	400-499					
Course Summary & 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. ZhiNing 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Wireless Network Security				
Type of Course	DCE				
Course Code	MG7DCEECC400				
Course Level	400-499				
Course Summary & 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	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Project	60
		4				
Pre-requisites	Basic knowledge of Computer Networks, Information Theory				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PSO 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.
Tyler Wrightson, 'Wireless Network Security – A Beginner's Guide', Tata McGraw Hill, 2012.

Suggested Reading

1.Behrouz A. Forouzan; DebdeepMukhopadhyay, 'Cryptography and Network Security', 3rd Edition, Tata McGraw Hill, 2015.
2.PallapaVenkataram, SatishBabu: '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.TomKarygiannis and Les Owens, 'Wireless Network Security 802.11, Bluetooth and Handheld Devices', NIST 2008.
5.KavehPahlavan and Prashant Krishnamurthy, 'Principles of Wireless Networks', Prentice Hall, 2006.
6.LeventeButtyán, 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Deep Learning					
Type of Course	DCE					
Course Code	MG7DCEECC401					
Course Level	400-499					
Course Summary & 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,MachineLearning,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, YoshuaBengio, 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, ShailendraKadre, Machine Learning and Deep Learning Using Python and TensorFlow, McGraw Hill, 2021
3.John Paul Mueller, Luca Massaron, Deep Learning For Dummies, 2019
4.OvidiuCalin, 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	MEMS & NEMS					
Type of Course	DCE					
Course Code	MG7DCEECC402					
Course Level	400-499					
Course Summary & 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	Micro system 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 (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Advanced Operating System Concepts					
Type of Course	DCE					
Course Code	MG7DCEECC403					
Course Level	400-499					
Course Summary	To provide a comprehensive understanding of advanced topics and prepare students for research, development, or advanced system administration roles and to introduce students to the Mobile application development ecosystem.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Operating System concepts.					

COURSE OUTCOMES (CO):

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze distributed, database, and multiprocessor operating systems intricacies.	An	1,2
2	Evaluate real-time systems applications and justify design choices.	E	1,2,3
3	Compare and contrast Linux and Windows operating systems.	U	1
4	Develop proficiency in Android operating system.	A	1

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	**Distributed, Database & Multiprocessor operating systems**		20 hrs	
	1.1	Distributed Operating Systems: System Architectures Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms Distributed Deadlock detection.	6	1
	1.2	Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives Concurrency control algorithms.	7	1
	1.3	Multiprocessor Operating Systems: System Architectures Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation memory management.	7	1
2	**Real Time & Mobile Operating Systems**		15 hrs	
	2.1	Basic Model of Real Time Systems – Characteristics- Applications of Real Time Systems – Real Time Task Scheduling Handling Resource Sharing.	7	2
	2.2	Mobile Operating Systems –Microkernel Design Client Server Resource Access – Processes and Threads Memory Management File system.	8	2
3	**Case study on Linux OS and Windows OS**		15 hrs	
	3.1	Case Study on Linux: History of Unix and Linux, Linux Overview, Processes in Linux, Memory management in Linux, I/O in Linux, Linux file system, security in Linux.	8	3
	3.2	Case Study on Windows: History of windows through Windows 10, programming windows, system structure, processes and threads in windows, memory management, caching in windows, I/O in windows, Windows NT file system, Windows power management, Security in	7	3

		windows.		
4	**Android OS**		10hrs	
	4.1	History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture	5	4
	4.2	Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating an android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.	5	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: 30 Marks** 1. Written tests 2. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks (2 Hrs)** **Written Test (70 Marks)** Part A:Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) -

	(6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. MukeshSinghal, Niranjan G.(2001). Shivaratri Advanced Concepts In Operating Systems: Distributed Database And Multiprocessor Operating Systems. Tata McGrawHill Edition,. (Module 1)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne(2018). Operating System Concepts(10th Edition). John Wiley & Sons. ISBN: 9781118063330.(Module 2)
3. Sheusi, J. C. (2013). *Android Application Development for Java Programmers*. Cengage Learning. - Module-4
4. Stevens, W. R., &Rago, S. A. (2013). *Advanced Programming in the UNIX® Environment* (3rd ed.). Addison-Wesley. - Module 3
5. John A.(2020).Understanding Windows Operating Systems". TechPress. - Module 3

SUGGESTED READINGS

1. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
3. W. Stallings, Operating Systems, Internals & Design Principles , 5th Edition, Prentice Hall of India. 2008.
4. Pradhan, A., &Deshpande, A. V. (2014). *Composing Mobile Apps: Learn, Explore and Apply using Android*. Wiley Publications. ISBN: 978-81-265-4660-2. Pradhan, A., &Deshpande, A. V. (2014). *Composing Mobile Apps: Learn, Explore and Apply using Android*. Wiley Publications. ISBN: 978-81-265-4660-2.

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Digital Image Computing					
Type of Course	DCE					
Course Code	MG7DCEECC404					
Course Level	400-499					
Course Summary	The course imparts a comprehensive knowledge about the digital image processing techniques					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze digital images, processing steps, acquisition, sampling, quantization, color models.	An	1,2
2	Apply spatial domain techniques for image enhancement effectively.	A	2
3	Analyze and utilize frequency domain transformations for image enhancement.	An	2
4	Implement image restoration and segmentation techniques proficiently.	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	Hrs	CO No.
1	**Introduction to Digital Image Processing**			
	1.1	Digital Image and Digital Image Processing	2	1
	1.2	Fundamental steps in Digital Image Processing	1	1
	1.3	Components of Image Processing system	2	1
	1.4	Image sensing and acquisition	2	1
	1.5	Image sampling and quantization	2	1
	1.6	Relationships between pixels	2	1
	1.7	Color image fundamentals	2	1
	1.8	Color Models-RGB, CMY, HSI	2	1
2	**Image Enhancement in spatial domain**			
	2.1	Basic Intensity transformation functions - Image Negatives, Log Transformations, Power Law Transformations, Piecewise Linear Transformations	3	2
	2.2	Histogram processing	3	2
	2.3	Spatial filtering – Spatial correlation and convolution	3	2
	2.4	Smoothing Spatial Filters	3	2
	2.5	Sharpening Spatial Filters - Laplacian Filter - Unsharp masking - High Boost Filter. Gradient operators	3	2
3	**Image Enhancement in Frequency domain**			
	3.1	Introduction to Fourier transform: 1- DFT, 2 –D DFT and its Inverse Transform,	3	3

	3.2	Properties of 2-D DFT	3	3
	3.3	2-D Convolution theorem	3	3
	3.4	Filtering in the frequency domain	3	3
	3.5	Image Smoothing and Sharpening using Frequency Domain Filters- Ideal, Butterworth and Gaussian filters	3	3
4	**Image Restoration and segmentation**			
	4.1	Noise models-Gaussian Noise, Rayleigh Noise, Gamma Noise, Exponential Noise, Impulse Noise	2	4
	4.2	Restoration using Mean Filters, Order Statistics filters, Adaptive filters	2	4
	4.3	Edge models	2	4
	4.4	Edge Detection - Gradient operator, canny edge detector	3	4
	4.5	Thresholding- Global Thresholding using otsu's method	3	4
	4.6	Region based segmentation – Region growing, Region splitting and merging, watershed segmentation	3	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ● Lecturing ● Collaborative learning ● Self-directed learning
Assessment Types	**MODE OF ASSESSMENT** **A.Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** 1. Written tests

	2. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks (2 Hrs)** **Written Test (70 Marks)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions)- (2*10=20 Marks)

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods(2010). Digital Image Processing(Third Edition), Pearson.

SUGGESTED READINGS

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.
2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. William K. Pratt, Digital Image Processing, John Wiley, Fourth Edition, New York, 2002.
4. Milan Sonka et al, Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, Fourth edition, 2007.
5. AzrielRosenfield, Avinash C. Kak, "Digital Picture Processing", Morgan Kaufmann, 2nd Ed., 1982.
6. Bernd Jahne, “Digital Image Processing”, Springer, 6th Ed., 2005.

	Mahatma Gandhi University **Kottayam**
Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)
Course Name	Big Data Management Using R
Type of Course	DCE
Course Code	MG7DCEECC405
Course Level	400-499
Course Summary	The course provides a comprehensive exploration of big data analytics, covering fundamental concepts, the data analytics lifecycle, advanced tools, and practical skills in R programming for data analysis and visualization. Students will gain a deep understanding of the analytics process, from discovery to project operationalization, and develop proficiency in utilizing key technologies and methodologies in the field.

Semester	7	**Credits**			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand big data analytics fundamentals, ecosystems, and key roles for successful analytics projects.	U	1
2	Navigate through the data analytics lifecycle, from discovery to operationalizing projects.	A	1,2
3	Describe the fundamental concepts and functionalities in R programming.	U	2
4	Illustrate various data visualization techniques in R.	U	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	Hrs	CO No.
1	1.1	Introduction to Big Data Analytics: Big Data Overview – Data Structures - Analyst Perspective on Data Repositories - State of the Practice in Analytics	5	1
	1.2	BI versus Data Science - Current analytical architecture - Emerging big data Ecosystem - Key Roles for the New Big Data Ecosystem.	5	1
2	2.1	Data Analytics Lifecycle: Data Analytics Lifecycle Overview – Key roles for a successful Analytics project	5	2
	2.2	Background and overview of data analytics life cycle. Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize. (Phases in detail by including all sub topics.)	10	2
3	3.1	Introduction to R – Basics - RStudio - R Data Types - Operators - Basic Read and Write functions	5	3
	3.2	R Objects: Vector, Matrix, Array, Data Frame, Factor, List ()– Decision Making Statements – Control Structures	5	3
	3.3	Functions - Import and export Data into and from R: CSV, Text file, Excel file	5	3
	3.4	Exception Handling – Progress and Timing	5	3
4	4.1	Data Visualization in R: Scatter Plot, Boxplot, Bar Chart, Histogram, Box and Whiskers plot	5	4
	4.2	Using plots with Coordinate vector – Graphical Parameters – Adding Points, Lines and Text to an existing plot	5	4
	4.3	The ggplt2 package - R dplyr package - Data Manipulation commands: select, filter, arrange.	5	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ● Lecturing ● Collaborative learning ● Self-directed learning

Assessment Types	**MODE OF ASSESSMENT** **A.Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** 1. Written tests 2. Assignments
	B.Semester End Examination **ESE for Theory: 70 Marks(2 Hrs)** **Written Test (70 Marks)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. EMC Education Services. “Data Science and Big Data Analytics”, WILEY
2. Tilman M. Davies.(2016). “ The Book of R”. No Starch Press
3. SeemaAcharya.(2018). “Data Analytics Using R”. McGraw Hill Education
4. "R for Data Science" by Hadley Wickham and Garrett Grolemund.

SUGGESTED READINGS

1. "Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett.
3. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel.
4. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services.
5. "Hands-On Programming with R: Write Your Own Functions and Simulations" by Garrett Grolemund

SEMESTER: 8

Mahatma Gandhi University Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Digital Signal Processing				
Type of Course	DCC				
Course Code	MG8DCCECC400				
Course Level	400-499				
Course Summary & 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	Hrs	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

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Natural Language Processing with Transformers in Python				
Type of Course	DCC				
Course Code	MG8DCCECC401				
Course Level	400-499				
Course Summary & 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	Hrs	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) a. Viva b. Lab report c. 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.

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Java Programming				
Type of Course	DCE				
Course Code	MG8DCEECC400				
Course Level	400-499				
Course Summary & 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	10	

		constructor, Method Overriding		
	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

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

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Digital Image Processing					
Type of Course	DCE					
Course Code	MG8DCEECC402					
Course Level	400-499					
Course Summary & 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	Hrs	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.

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Machine Learning from Scratch					
Type of Course	DCE					
Course Code	MG8DCEECC402					
Course Level	400-499					
Course Summary & 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.	*Upon completion of this course, students will be able to;*	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	Hrs	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 c. 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

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Neural Networks and Deep Learning					
Type of Course	DCE					
Course Code	MG8DCEECC403					
Course Level	400-499					
Course Summary	Neural Networks and deep learning course covers fundamental concepts and practical skills in neural networks, CNNs, RNNs, GANs, and reinforcement learning using TensorFlow and PyTorch. Participants will gain hands-on experience in image processing, NLP, generative models, and unsupervised learning, fostering the ability to apply deep learning to real-world problems.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Programming Knowledge, Basic Understanding of Artificial Intelligence and machine Learning					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand neural networks, activation functions, and backpropagation.	U	2,3
2	Design and implement CNN and RNN, apply transfer learning techniques, and utilize reinforcement learning algorithms for	A, An	1,2,3

	complex tasks.		
3	Understand and apply GANs, including DCGAN and WGAN, as well as clustering and dimensionality reduction techniques.	U,A	1,2,3
4	Design and implement neural networks, CNNs, GANs, reinforcement learning algorithms, clustering algorithms, and dimensionality reduction techniques.	A	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	Hrs	CO No.
1	1.1	Basics of Neural Networks:-Neurons and their mathematical representation.	2	1
	1.2	Activation functions (e.g., sigmoid, ReLU). Feedforward process and the role of weights and biases.	2	1
	1.3	Backpropagation algorithm for training neural networks.	2	1
	1.4	Deep Learning Frameworks:-Introduction to TensorFlow and PyTorch.	2	1
	1.5	Setting up the development environment, Overview of basic operations and syntax.	2	1
2	2.1	Convolution and Pooling Layers:-Understanding convolutional and pooling operations. Stride, padding, and filter design. CNN Architectures:- In-depth study of popular architectures (LeNet, AlexNet, VGG, ResNet). Parameters and design choices.	7	2
	2.2	Transfer Learning:-Leveraging pre-trained models for specific		2

		tasks. Fine-tuning models for custom datasets.	6	
	2.3	Basics of Recurrent Neural Networks:-Concept of sequential data processing. Vanishing gradient problem and solutions. LSTM and GRU:- In-depth study of advanced RNN architectures, Handling long-term dependencies.	6	2
	2.4	Basics of Reinforcement Learning:-Markov Decision Processes (MDPs), Exploration-exploitation trade-off. Q-Learning and DQN:-Core algorithms for reinforcement learning, Deep Q Networks for handling complex state spaces.	6	2
3	3.1	Introduction to GANs:-Generative models and their applications, Understanding adversarial training. GAN.	5	3
	3.2	Architectures:- DCGAN (Deep Convolutional GAN), WGAN (Wasserstein GAN). Exploring variations and improvements. Unsupervised Learning:-Clustering algorithms (e.g., K-Means).Dimensionality reduction techniques (e.g., PCA).	5	3
4	4.1	Practical: 1. Implementing a basic neural network using TensorFlow or PyTorch. 2. Image Classification using CNNs, Generating Synthetic Images with GANs, Implementing RL algorithms on simple environments. 3. Implementing k-mean Clustering Algorithm, Apply PCA for a sample dataset and classify.	30	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture Presentations Demonstration Discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** 1. Written test 2. Assignments 3. Quiz 4. Viva **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. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville;[Module1]
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.[Module 1]
3. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani;[Module2]
4. "Deep Reinforcement Learning" by Pieter Abbeel and John Schulman.[Module 3]
5. "Generative Deep Learning" by David Foster; [Module4]
6. "Unsupervised Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.[Module 4]

SUGGESTED READINGS

1. “Deep Learning with Python" by François Chollet.
2. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto;

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Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)					
Course Name	Pattern Recognition					
Type of Course	DCE					
Course Code	MG8DCEECC404					
Course Level	400-499					
Course Summary	Pattern recognition course provides a comprehensive exploration of fundamental concepts, including Bayesian Decision Theory, linear discriminant functions, and nonparametric techniques. Students will develop practical skills in applying these principles to real-world problems, mastering Bayesian parameter estimation, support vector machines, and stochastic/nonmetric methods for effective pattern recognition.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Prerequisites, if any	Must know programming, Basic Mathematics, fundamental knowledge of machine learning					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand Pattern Recognition Fundamentals and the principles of Bayesian Decision Theory.	U	2,3
2	Analyse Bayesian Parameter Estimation and Nonparametric techniques.	An	1,2,3

3	Implement and analyze linear discriminant functions, support vector machines, multilayer neural networks, and various stochastic and nonmetric methods for classification and inference.	A,An	1,2,3
4	Implement Pattern Recognition techniques for solving Real World Problem.	C	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	Hrs	CO No.
1	1.1	Pattern recognition systems: – The design cycle, Learning and Adaptation.	2	1
	1.2	Bayesian Decision theory:- two-category classification ,Minimum error rate classification.	2	1
	1.3	Classifiers, Discriminant functions and Decision Surfaces , The normal density.	2	1
	1.4	Discriminant Functions for the Normal Density, Error probabilities and Integrals, Discrete Features, Missing and Noisy Features.	3	1
2	2.1	**Bayesian Parameter estimation and Nonparametric Techniques:-** Maximum likelihood estimation, Bayesian estimation,	3	2
	2.2	Bayesian Parameter Estimation: Gaussian case and general theory.	3	2
	2.3	Nonparametric techniques: – Density estimation, Parzen Windows,	3	2
	2.5	k_n-Nearest Neighbour Estimation, Nearest-Neighbour Rule, Fuzzy Classification.	4	2

3	3.1	**Linear Discriminant Functions:** - Linear discriminant functions and decision surfaces.	2	3
	3.2	Generalized linear discriminant functions, Two-category linearly separable case.Non-separable behaviour, Linear programming algorithms, Support vector machines.	5	3
	3.3	Multilayer neural networks :– Feedforward operation and classification. Backpropagation algorithm, Error surfaces, Backpropagation as feature mapping.	7	3
	3.4	**Stochastic methods and Nonmetric methods**: – Stochastic search, Boltzmann learning.	4	3
	3.5	Nonmetric methods: - Decision trees ,CART, Other tree methods(ID3,C4.5) - Grammatical methods, Grammatical inference.	5	3
4	4.1	Practicals **Implement following Pattern Recognition Methods** 1. Bayesian Decision Theory 2. Bayesian Parameter Estimation 3. Nearest Neighbour Rule 4. Fuzzy Classification 5. Support Vector Machine 6. Multilayer Neural Networks 7. Boltzmann Learning 8. Decision Trees 9. CART 10. ID3,C4.5	30	4
5		**(Teacher specific content)**		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture Demonstration Presentation discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)**

	CCA for Theory: 25 Marks 1. Written test 2. Assignments 3. Quiz 4. Viva **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. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

References

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, Second edition, John Wiley, 2006

SUGGESTED READINGS

1. S Thodoridis,K Koutroumbas, Pattern Recognition,Fourth Edition, ELSEVIER Publication.

2. Gonzalez R.C. & Thomson M.G., Syntactic Pattern Recognition - An Introduction, Addison Wesley.

3. Fu K.S., Syntactic Pattern Recognition And Applications, Prentice Hall

4. RajanShinghal, Pattern Recognition: Techniques and Applications, Oxford University Press, 2008.

Mahatma Gandhi University
Kottayam

Programme	BSc (Hons) Electronics with Computer Technology and Computer Science (Double Major Programme)				
Course Name	Generative AI				
Type of Course	DCE				
Course Code	MG8DCEECC405				
Course Level	400				
Course Summary	This course introduces students to the dynamic field of Generative Artificial Intelligence (Generative AI), covering foundational concepts, model architectures, and practical applications. The curriculum is structured into four modules, each addressing key aspects of Generative AI.				
Semester	8	Credits		4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others
		3	0	1	75
Prerequisites, if any	Basic knowledge of machine learning.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe generative models' ethical usage, including bias and fairness.	U	1
2	Apply GANs and VAEs: Implementing architectures, training models, and exploring applications.	A	2
3	Explore recent advances in generative AI:	An	2
5	Apply generative models (GANs, VAEs) using Python/TensorFlow.	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	Hrs	CO No.
1	1.1	Overview of Generative Models, Introduction to generative models and their role in artificial intelligence. Understanding the difference between generative and discriminative models	4	1
	1.2	Types of Generative Models, Probabilistic models: Gaussian Mixture Models (GMM), Hidden Markov Models (HMM).Variational AutoEncoders (VAEs) and their applications.	3	1
	1.3	Introduction to Generative Adversarial Networks (GANs). Applications, Ethical Considerations and Privacy concerns related to generative models. Understanding bias and fairness in generative AI. Responsible use of generative models in various domains.	3	1
2	2.1	Introduction to GANs Core concepts of GANs: generator, discriminator, adversarial training. Historical development and key milestones in GAN research.	2	2
	2.2	Architectures and Variants of GANs, DCGAN, WGAN, and other variants. Conditional GANs and their applications.	3	2
	2.3	Training and Stability Issues: Techniques for stable GAN training. Dealing with mode collapse and other common issues.	3	2
	2.4	Applications of GANs: Image-to-image translation using GANs. Super-resolution and style transfer.	3	2
	2.5	Introduction to VAEs: Understanding the encoder-decoder architecture. The role of variation inference in VAEs.	3	2
	2.6	Training VAEs:The reparameterization trick and back propagation. Comparing VAEs to traditional auto encoders.	3	2
	2.7	Applications of VAEs: Image generation and reconstruction. Latent space exploration and manipulation. VAEs in semi-supervised learning.	3	2
3	3.1	Advanced Topics and Future Directions: Recent Advances in Generative AI Attention mechanisms in generative models. Self-supervised learning and its application in generative tasks.	4	3
	3.2	Generative AI in Industry, Use cases and applications in various	4	3

		industries. Challenges and opportunities in deploying generative models.		
	3.3	Research Trends and Future Directions, Cutting-edge research in generative AI.Potential breakthroughs and challenges on the horizon.	4	3
	3.4	Final Project and Capstone, Students work on a generative AI project of their choice. Presentation and discussion of project outcomes.	3	3
4		1: Introduction to Python and TensorFlow: Setting up TensorFlow environment, Basic operations in TensorFlow. 2: Fundamentals of Generative Models: Implementing basic probabilistic models (Gaussian Mixture Models, Hidden Markov Models) using Python. Hands-on exercise on Variational Autoencoders (VAEs). 3: Introduction to Generative Adversarial Networks (GANs): Building a simple GAN model for generating synthetic data.Understanding the generator and discriminator networks.Training a GAN on a small dataset. 4: Advanced GANs and Applications: Implementing conditional GANs for specific tasks. Exploring image-to-image translation using Pix2Pix or CycleGAN. Applying GANs in medical imaging or other domains. 5: Variational Autoencoders (VAEs) in Depth: Building a VAE for image generation. Understanding the concept of latent space. Exploring applications in semi-supervised learning. 6: Attention Mechanisms and Self-Supervised Learning: Implementing attention mechanisms in generative models.Hands-on with self-supervised learning techniques.	30	4
5		Teacher specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • ICT Enabled lecture • Interactive sessions • Class discussions • Lab exercise
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** 1. Written test 2. Assignments 3. Quiz 4. Viva **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. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Mark

REFERENCES

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville(2016) . Deep Learning" . MIT Press
2. David Foster(2019)."Generative Deep Learning". O'Reilly Media
3. "Hands-On Generative Adversarial Networks with Keras" by Rajalingappaa Shanmugamani

SUGGESTED READING:

1. Generative Adversial Networks(GANs):"GANs in Action" by Jakub Langr and Vladimir Bok
2. "Generative Adversarial Networks: Building Intelligent Applications" by Kailash Ahirwar Variational Autoencoders(VAEs):
3. "Autoencoder and Variational Autoencoder (VAE) Tutorial" by Ian Goodfellow (Chapter 14 of the "Deep Learning" textbook mentioned above).
4. "Understanding Variational Autoencoders (VAEs)" by Carl Doersch.

Ethics In AI

5. "Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell
6. "AI and Machine Learning for Everyone" by Jeff Heaton

Advanced Topics:

7. "Attention Is All You Need" by Ashish Vaswani et al. (for attention mechanisms).
8. "Self-Supervised Learning" by Philip Bachman et al.

Generative AI in industry:

9. "AI Superpowers: China, Silicon Valley, and the New World Order" by Kai-Fu Lee
10. Industry reports and case studies from organizations like OpenAI, Google AI, and Microsoft Research.

Research Trends:

11.Read papers from top conferences like NeurIPS, ICML, and CVPR for the latest research

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**

(Semester 8) **Research Project / Dissertation Evaluation: 12 Credits with 200 marks**	
Continuous Comprehensive Assessment (CCA)	
Synopsis	10 marks
Relevance of the research	5 marks
Literature Review	15 marks
Punctuality	10 marks
Project Content	20 marks
Total	**60 marks**
End Semester Evaluation (ESE)	
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**