CURRICULUM FRAMEWORK FOR POST GRADUATE PROGRAMME IN ELECTRONICS

AS PER NATIONAL EDUCATION POLICY (NEP)-2020

RAJIV GANDHI UNIVERSITY - A CENTRAL UNIVERSITY

M.Sc. PROGRAMME IN ELECTRONICS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RONO HILLS, DOIMUKH

ARUNACHAL PRADESH-791 112

WITH EFFECT FROM ACADEMIC YEAR: 2024-25

1.1 About the Programme

Overview

The Post Graduate Programme in Electronics, offered by the Department of Electronics and Communication Engineering at Rajiv Gandhi University, Rono Hills, is structured under the aegis of the Faculty of Engineering and Technology. This program is meticulously designed in accordance with the National Education Policy (NEP) 2020, emphasizing a holistic and flexible education framework.

Objectives and Design

The primary goal of the programme is to cultivate competent and self-reflective learners. This is achieved by providing a balanced mix of academic and professional skills that enable students to contribute significantly to the field of Electronics. The curriculum is tailored to foster not only theoretical understanding but also practical application, ensuring that students are well-prepared for both academic pursuits and industry demands.

Significance of Electronics

Electronics as a discipline holds increasing academic and practical importance. The program recognizes this significance and aims to harness the potential of electronics to contribute to human welfare. As a technological science, electronics encompasses various aspects, including:

Electronic Technology: Understanding and applying the principles of electronic devices and systems.
Innovation: Encouraging creativity and the development of new electronic technologies and applications.
Skills Development: Equipping students with the necessary skills to excel in the electronics industry.
Employability: Preparing students for successful careers in various sectors by aligning the curriculum with industry needs.

Theoretical and Practical Understanding: Balancing theoretical knowledge with hands-on experience to ensure a comprehensive understanding of the subject.
NEP-2020 Alignment

The programme is crafted in line with the NEP-2020, which emphasizes:

Flexibility: Offering a curriculum that allows for interdisciplinary learning and choice-based credit systems.
Holistic Development: Focusing on the overall development of students, including critical thinking, problem-solving, and communication skills.
Skill Enhancement: Integrating skill-based education to enhance employability and entrepreneurial abilities.
Innovative Pedagogy: Adopting innovative teaching methods to make learning more engaging and effective.

Contribution to Human Welfare

The field of electronics is pivotal to numerous aspects of modern life and technological advancements. By advancing knowledge and skills in electronics, the programme aims to contribute to various sectors, including healthcare, communication, entertainment, and environmental sustainability. The advancements in electronic technologies play a crucial role in improving the quality of life and addressing global challenges.

The Postgraduate Programme in Electronics at Rajiv Gandhi University is designed to produce graduates who are not only knowledgeable in their field but also equipped with the skills to innovate and excel in a rapidly evolving technological landscape. By adhering to NEP-2020 norms, the programme ensures

that students receive a contemporary education that is relevant, flexible, and geared towards both personal and professional growth.

Programme Duration and Structure

The Electronics programme offers multiple pathways and exit points, each leading to a specific certification based on the duration and credits completed:

1. One Year Post Graduate Diploma (PG Diploma): Duration: 1 year (2 semesters)
2. Two Year PG Research (PG Research): Duration: 2 years (4 semesters)

Semester Structure

The course consists of both theories, practical or research courses. This ensures that students not only gain theoretical knowledge, practical experience with research knowledge, which is essential for a comprehensive understanding of Electronics.

The Electronics programme at Rajiv Gandhi University is designed to be highly flexible and comprehensive, adhering to UGC guidelines and NEP-2020 norms. It offers multiple exit points, allowing students to get certificate at various stages of their education, which provides flexibility in career planning. The curriculum is multidisciplinary, skill-enhancing, and tailored to prepare students for both academic and professional success in the field of Electronics.

The evaluation and examination procedures shall be as per the regulations and guidelines imbibed in the Rajiv Gandhi University examination ordinance.

1.2 Programme Educational Objectives (PEOs) for the Postgraduate Programme in Electronics

The PEOs of the Post Graduate programme in Electronics are as follow:

PEO1: Competent Professional Skills
Equip graduates with a solid foundation in Electronics principles, enabling them to analyze, design, and implement solutions in various subfields such as communication systems, embedded systems, and power electronics.

PEO2: Innovative and Critical Thinking
Foster innovation and critical thinking in graduates by encouraging them to engage in continuous learning and research, thereby contributing to advancements in electronic technologies and related interdisciplinary areas.

PEO3: Effective Communication and Teamwork
Develop effective communication skills and the ability to work collaboratively in multidisciplinary teams. Graduates should be able to articulate technical information clearly and contribute to team-oriented projects.

PEO4: Ethical and Social Responsibility
Instill a sense of ethical responsibility and social awareness in graduates, ensuring they understand the impact of their work on society and the environment. Graduates should adhere to professional ethics and contribute positively to community and industry.

PEO5: Lifelong Learning and Adaptability
Encourage lifelong learning and adaptability in graduates, preparing them to stay abreast of emerging technologies and evolving industry requirements. Graduates should be equipped to pursue advanced studies and adapt to changing technological landscapes.

PEO6: Practical and Hands-On Experience
Provide extensive practical and hands-on experience through laboratories, internships, and industry projects. This ensures that graduates have the necessary skills to apply theoretical knowledge in real-world scenarios.

1.3 Programme Outcomes (POs) for the Postgraduate Programme in Electronics

The POs of the Post Graduate programme in Electronics are as follow:

PO1: Engineering Knowledge
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems in the field of electronics.
PO2: Problem Analysis
Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/Development of Solutions
Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PO4: Conduct Investigations of Complex Problems
Use research-based knowledge and research methods including the design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern Tool Usage
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
PO6: The Engineer and Society
Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7: Environment and Sustainability
Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO8: Ethics
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and Team Work
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

1.4 PROGRAMME SPECIFIC OUTCOMES (PSOs)

The PSOs of the Post Graduate programme in Electronics are as follow:

PSO1: Application of Core Concepts
Graduates will be able to apply the core concepts of electronics and communication engineering to analyze, design, and develop solutions for complex engineering problems in areas such as analog and digital electronics, signal processing, communication systems, and embedded systems.
PSO2: Proficiency in Modern Tools
Graduates will demonstrate proficiency in using modern engineering tools and techniques necessary for the design, simulation, and analysis of electronic systems. This includes the use of software and hardware tools for circuit design, microcontrollers, VLSI design, and communication technologies.
PSO3: System Design and Implementation
Graduates will have the ability to design and implement electronic systems and components that meet desired specifications and functionality. They will be capable of conducting experiments, interpreting data, and synthesizing information to provide viable solutions in real-world applications.
PSO4: Innovation and Research
Graduates will be able to engage in research and development activities to innovate and contribute to advancements in the field of electronics. They will be equipped to pursue higher education and participate in collaborative projects, leading to the creation of new technologies and solutions.

1.5 Other Key Criteria for PG Programme

Research at Programme: Student are compulsory for to do Research Work in Post Graduate Program, as per NEP-2020.

1.6. Structure of the Two-Year Postgraduate Programme in Electronics

***1 Credit for Lecture** = 15 hours in a Semester
****1 Credit for Tutorial** = 15 hours in a Semester
*****1 Credit for Practicum** = 30 hours in a Semester

CREDIT SYSTEM FOR PG PROGRAMME IN ELECTRONICS (as per NEP-2020)

NCrf Credit Level		Major		Minor (Only for students other than Electronics Major)		Multidisciplinary Course (MDC- Only for students other than Electronics Major)		Ability Enhancement Compulsory Course (AECC)		Skill Enhancement Course (SEC)		Value-added Courses (VAC)		Total Credit/Sem
	Sem	Course Code & Name	Credit	Course Code & Name	Credit	Course Code & Name	Credit	Course Code & Name	Credit	SEC Course Code & Name	Credit	VAC Course Code & Name	Credit	
6.0	I	ECE-102-CC-1110-Control System ECE-102-CC-1110(P)-Control System Lab	4	ECE-102-RC-1110-Research Methodology, / MOOCs	4									20
		ECE -102-CC-1120-8086 Microprocessor ECE -102-CC-1120 (P)-8086 Microprocessor Lab.	4											
		ECE-102-CC-1130-Satellite Communication	4											
		ECE-102-CC-1140- Modern Communication	4											20
	II	ECE-102-CC-1210-C++ Programing ECE-102-CC-1210(P)-C++ Programing Lab	4	ECE-102-RC-1210-Research and Publication Ethics / MOOCs	4									
		ECE-102-DE-12220- 8051 Microcontroller ECE-102-DE-12220(P)- 8051 Microcontroller Lab	4											
		ECE-102-DE-12230-Embedded System ECE-102-DE-12230(P)-Embedded System Lab												
		ECE-102-DE-12240-Digital Signal Processing	4											
		ECE-102-DE-12250-Biomedical Signal Processing	4											
		ECE-102-DE-12260-Microwave Devices ECE-102-DE-12270- Opto-Electronic Devices												40
		Total Credit (Fourth Year)	32		8									
		Two Years PG with Research in ELECTRONICS on completion of courses equal to a minimum of 80 Credit												
6.5	III		0		0		0		0		0	ECE-102-DC-2180-Dissertation-I	20	20
	IV		0		0		0		0		0	ECE-102-DC-2280-Dissertation-II	20	20
		Total Credit (Eighth Sem)	0		0		0		0		0		40	40

Two Years PG with Course Work and Research in ELECTRONICS on completion of courses equal to a minimum of 80 Credit													
6.5	III	ECE-102-CC-2110- Industrial Instrumentation And Automation	4		0		0		0		0	ECE-102-DC-2160- Dissertation-I	12	20
		ECE-102-CC-2110- Material Science	4											
	IV		0		0		0		0		0	ECE-102-DC-2280- Dissertation-II	20	20
		Total Credit (Eighth Sem)	**8**		**0**		**0**		**0**		**0**		**32**	**40**

NOTE: The three course of credit 4 (total 12 credit) are converted into Dissertation I in 2nd Year (3rd Semester) with 12 credit.

*Students can opt from the bouquet of courses offered by the University/Departments from time to time.
#Summer Internship: 8 Weeks Summer Internship should be completed by students who opt for UG Certificate programme.
Abbreviations: VAC- Value Added Course; MDC-Multi-Disciplinary Course; AECC-Ability Enhancement Compulsory Course; SEC- Skill Enhancement Course; MOOC's- Massive Open Online Courses.

Programme Code and Subject Code Schema: ABC-DDD-CT-YSPR

ABC:	Discipline Code (viz. CSE: Computer Science and Engineering, SOW: Social Work etc.)
DDD (e.g. 102)	DDD-The unique number for each programme like B.A.-001, B.Sc.-002 etc. 102=Programme Code for M.Sc.
CT:	Course Type (Viz. CC: Core Course, DE: Department Elective, RC: Research Course, CW: Coursework)
YSPR:	Year-Semester-Paper Serial-Sequence of Revision (currently zero)

STRUCTURE FOR TWO YEAR POSTGRADUATE PROGRAMME IN ELECTRONICS

SEMESTER I

Paper Code Paper Title	Credit Distribution L: T: P	Total Credits	ContactHours
ECE-102-CC-1110-Control System ECE-102-CC-1110(P)-Control System Lab	3:0:1	4	75
ECE -102-CC-1120- 8086 Microprocessor ECE -102-CC-1710 (P)- 8086 Microprocessor Lab.	3:0:1	4	75
ECE-102-CC-1130-Satellite Communication	0:0:2	2	60
ECE--102-CC-1140- Modern Communication	3:1:0	4	60
ECE-102-RC-1110-Research Methodology, / MOOCs	3:1:0	4	-

The title of the courses will be adopted from the pool of papers provided by the University/Other Departments.

L=Lecture, T=Tutorial, P=Practical

SEMESTER II

Paper Code Paper Title	Credit Distribution L: T: P	Total Credits	Contact Hours
ECE-102-CC-1210-C++ Programing ECE-102-CC-1210(P)-C++ Programing	3:0:1	4	60
ECE-102-DE-12220- 8051 Microcontroller ECE-102-DE-12220(P)- 8051 Microcontroller Lab	3:0:1	4	60
ECE-102-DE-12230- Embedded System ECE-102-DE-12230(P)- Embedded System Lab	3:1:0	4	60
ECE-102-DE-12240-Digital Signal Processing ECE-102-DE-12250-Biomedical Signal Processing	3:1:0	4	60
ECE-102-DE-12260-Microwave Devices ECE-102-DE-12270- Opto-Electronic Devices	3:1:0	4	-
ECE-102-RC-1210-Research and Publication Ethics / MOOCs			

**The title of the courses will be adopted from the pool of papers provided by the University/Other Departments.*

L=Lecture, T=Tutorial, P=Pract

SEMESTER III and IV (2 Year PG with Research)

Title	Credit Distribution L: T:P	Total Credits	ContactHours
ECE-102-DC-2180-Dissertation-I	-	20	400
ECE-102-DC-2280-Dissertation-II	-	20	400

SEMESTER III and IV (2 Year PG with Course Work and Research)

Title	Credit Distribution L: T:P	Total Credits	ContactHours
ECE-102-CC-2110- Industrial Instrumentation and Automation	3:1:0	4	60
ECE-102-CC-2110- Material Science	3:1:0	4	60
ECE-102-DC-2160-Dissertation-I	-	12	400
ECE-102-DC-2280-Dissertation-II	-	20	400

SEMESTER – I

SEMESTER I

ECE-102-CC-1110-Control System

ECE-102-CC-1110(P)-Control System Lab

Learning Objectives

LO1: To be able to obtain a working mathematical model of a system.

LO2: To be able to do time-domain and frequency-domain analyses of the model to predict the system's behavior

Course Outcomes

CO1: Understand the working mathematical model of a system.

CO2: Understand the time-domain and frequency-domain analyses of the model to predict the system's behavior

CO3: Understand the design control systems that meet design specifications.

CO4: Understand the various controller and its stability test.

Course Contents

Unit No.	Content	Contact Hours	CO
1	Mathematical modelling of: electrical systems, mechanical systems, electro-mechanical systems. Laplace transforms, transfer functions, electrical analogues of other dynamical systems. State-space modelling of dynamical systems. Block diagrams, block diagram reductions. Signal flow graph, Mason's gain formula. Linearity, time-invariance versus nonlinearity and time-variance. Linearization. Distributed parameter systems.	15	1
2	Obtaining solutions from mathematical models. Poles and zeros and their effects on solutions. Step response of standard second order systems, time-domain specifications and their formulae. Definition of stability. Routh-Hurwitz test. Basic idea of feedback control systems. Error analysis. P, PI, PD, PID controllers.	15	1,2
3	The root-locus technique, steps in obtaining a root-locus. Design of controllers using root-locus. Pole placement with state feedback, controllability. Pole placement with output feedback, observability, Luenberger observer.Bode plot, Nyquist plot, Nyquist stability criterion, gain and phase margins, robustness.	15	3, 4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	1	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	1	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	-	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	0.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Franklin G.F., Powell J.D., Emami-Naeini A., Feedback Control of Dynamic Systems,Pearson, Upper Saddle River, New Jersey, 5th edition, 2006.
2. Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000.
3. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, 1991.

SEMESTER I

ECE -102-CC-1120-8086 Microprocessor

ECE -102-CC-1120 (P)-8086 Microprocessor Lab

Learning Objectives

LO1: To be able to understand the 8086 microprocessor and its system.

LO2: To be able to understand the programming of the 8085 system.

Course Outcomes

CO1: To learn the architecture and pin configuration of 8086 Microprocessor.

CO2: To write assembly language programs using 8086 microprocessors.

CO3: To interface 8086 Microprocessors with peripheral devices

CO4: To understand the various Microprocessor based system.

Course Contents

Unit No.	Content	Contact Hours	CO
1	Introduction to 8086 – architecture – pin description – External memory interfacing – bus cycle –some important companion chips - Maximum mode bus cycle-memory interfacing - Minimum mode System configuration- Maximum mode system configuration – Interrupts processing – 8087 Numeric data processor - data types – architecture - instruction set.	15	1
2	Addressing modes – Instruction set and assembler directives – Assembly language programming using MASM – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros– Byte and String Manipulation. Assembly language program using 8086 MASM software and 8086 microprocessor kitAddition,subtraction,multiplication,division,sorting,searching, string manipulation, code conversion, matrix operation.	15	1,2
3	I/O interfacing – Parallel communication interface – Keyboard /display controller - Timer -D/A and A/D Interface -Serial communication interface —Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller. Assembly language program using 8086 kit, for interfacing with 8255, 8253, ADC and DAC,8251.	15	3, 4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	1	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	1	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	-	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	0.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Krishna Kant, "Microprocessors and Microcontrollers", Prentice Hall of India, 2013.
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007
3. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata Mc GrawHill, 2012.

SEMESTER I

ECE-102-CC-1130-Satellite Communication

Learning Objectives

LO1: To understand the Historical Context and Fundamentals and Orbital Mechanics

LO2: To understand the Satellite Subsystems and Control..

Course Outcomes

CO1: Identify and explain the various satellite frequency bands and their specific applications.

CO2: Understand and describe the process of placing and maintaining a satellite in a geostationary orbit.

CO3: Design and evaluate satellite power systems and communication subsystems, including satellite antenna equipment.

CO4: Analyze the effects of atmospheric absorption, cloud attenuation, tropospheric and ionospheric scintillation, and rain-induced phenomena on satellite signals.

Course Contents

Unit No.	Content	Contact Hours	CO
1	Orbit and Description: A brief History of Satellite Communication, Satellite Frequency bands, Satellite Systems, Applications, Orbital Period and Velocity, Effects of Orbital inclination, Azimuth and Elevation, Coverage and Slant range, Eclipse, Orbital perturbations, Placement of a Satellite in a Geo-Stationary Orbit.	15	1
2	Altitude and orbit control system, TT&C Sub-System, Altitude control Sub-System, Power Systems, Communication Subsystems, Satellite antenna Equipment. Basic transmission theory, system noise temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite links for specified C/N, (with and without frequency Re-use), Link Budget.	15	1,2
3	Propagation effects: Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospheric Scintillation and Low angle fading, Rain Induced attenuation, rain induced cross polarization interference. Multiple Access: Frequency Division Multiple Access (FDMA), Intermodulation, Calculation of C/N. Time Division Multiple Access(TDMA), Frame structure, Burst structure, Satellite Switched TDMA Onboard processing, Demand Assignment Multiple Access (DAMA) – Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.	15	3, 4
4	Earth Station Technology: Transmitters, Receivers, Antennas, Tracking systems, Terrestrial Interface, Power Test methods, Lower Orbit Considerations. Satellite Navigation & Global Positioning Systems: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers, GPS C/A code accuracy, Differential GPS.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	1	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	1	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	-	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	0.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Satellite Communications- Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003, John Wiley & Sons.
2. Satellite Communication Engineering- Wilbur L. Pritchand, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications.
3. Digital Satellite Communications-Tri. T.Ha, 2nd Edition, 1990, Mc. Graw Hill.

SEMESTER I

ECE--102-CC-1740- Modern Communication

Learning Objectives

LO1: To understand the need for multi-carrier systems in wireless communication

LO2: To describe the background and current scenario of wireless communication technologies.

Course Outcomes

CO1: Able to understand the need for multi-carrier systems in wireless communication.

CO2: Able to understand the importance of diversity techniques in mitigating wireless communication.

CO3: Able Identify future requirements for wireless networks.

CO4: Able to understand the evolution of intelligent vehicular communication.

Course Content

Unit No.	Content	Contact Hours	CO
1	Need for Multi carrier system- Basics of Orthogonal Frequency Division, Multiplexing (OFDM)- Multiple access for OFDM systems- Orthogonal Frequency Division Multiple Access (OFDMA)- Single carrier Frequency Division Multiple Access (SC-FDMA). Cellular concept- path loss and shadowing- Doppler shift- Multipath effect- Significance of diversity in wireless communication sys.	15	1
2	Introduction to current wireless technologies- background and current scenario- future wireless network requirements- IEEE 802.11 (Wi-Fi) standards and applications (IEEE 802.11a/b/g/n/ac/ax)- HiperLAN technology- WPAN (IEEE 802.15.1- IEEE 802.15.3 & IEEE 802.15.4) and WMAN (IEEE 802.16a - WiMAX)-Space time wireless standards- IEEE 802.16 (Wi-Max standard)- 3GPP-LTE standard- Millimeter wave characteristics.Channel performance at 60 GHz-Development of millimeter wave standards- Indoor and outdoor applications for millimeter wave communications.6G Networks – Use Cases and Technologies	15	2
3	Introduction of IoT- characteristics- physical and logical design of IoT- IoT Enabling Technologies – Wireless Sensor networks- Cloud computing. Introduction to IoT- Evolution of IoT- IoT Networking Components. IoT Connectivity Technologies – Zigbee- Wireless HART- RFID- NFC- LoRa- WiFi-Bluetooth. IoT Communication Technologies – Infrastructure Protocols – IPv6-LoWPAN- Data Protocols	15	3
4	Introduction to Intelligent Vehicular Communication – Evolution- Vehicular Networks and ITS- Vehicular Communication Standards/ Technologies – DSRC-IEEE 802.11p WAVE- IEEE 1609- IEEE 802.15.7 - Visible Light Communication (VLC)- 4G/5GDevice to Device (D2D)- 6G Cellular Networks and Connected Autonomous Vehicles Operational Scenario – Collision Avoidance.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	2	3	3	-	3	3	3	3
CO2	3	3	3	-	3	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	3	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	3	2	2	3	3	3	3	3	3	-
Average	3	3	3	1.25	3	1.5	2	3	3	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Satellite Communications- Dennis Roddy, 2nd Edition, 1996, McGraw Hill
2. Digital Satellite Communications-Tri. T. Ha,2nd Ed.,MGH,1990.
3. Fundamental of Satellite Communications- K. N Raja Rao, PHI, 2004

SEMESTER I

ECE-102-RC-1110-Research Methodology

Learning Objectives

1. To understand the meaning of engineering research.
2. To understand the patient and copyright.

Course Outcomes

CO1. To know the meaning of engineering research.
CO2. To know the procedure of Literature Review and Technical Reading.
CO3. To know the fundamental of patient and draft.
CO 4. Understanding the copyright laws and subject matters of copyrights and designs

Course Content

Unit No.	Content	Contact Hours	CO
1	Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	15	1
2	New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.	15	2
3	Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	15	3
4	Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	3	3	-	3	3	3	3
CO2	3	3	3	-	-	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	3	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	-	2	2	3	3	3	3	3	3	-
Average	3	3	3	1.25	0.75	1.5	2	3	3	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Dipankar Deb • Rajeeb Dey, Valentina E. Balas "Engineering Methodology"
2. David V. Thiel "Research Methods for Engineers" Cambridge University Press.
3. Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwa

SEMESTER – II

SEMESTER II

ECE-102-CC-1210-C++ Programming

ECE-102-CC-1210(P)-C++ Programming Lab

Learning Objectives

LO1: To understand programming

LO2: To learn formulation of programming problem and troubleshooting.

Course Outcomes

CO1: Understanding Basic Principles and History of Object-Oriented Programming (OOP).

CO2: Mastering Console I/O Operations

CO3: Developing Skills in Basic Programming Constructs.

CO4: Understanding the Advanced Object-Oriented Features

Course Content

Unit No.	Content	Contact Hours	CO
1	Object Oriented Programming Principles, History, Features, Rules of C++ programming, Structure of C++ program, C++ Tokens, (Identifiers, Keywords, Constants, Operators, Special characters), C++ Data types, Console I/O Statements(cin, cout), Programs to perform various calculations, Operators, Programs to implement various operators	15	1
2	Conditional Control Statements: If-else, switch-case, Loops: While, do while, for, implementing programs on conditional & loops, break, continue, goto keywords, Definition, advantages, Array types, Single dimension, Double dimension, Declaration, accessing array data, Implementation of array operations, Definition, advantages, types of functions, classification, Implementing various kinds of functions, Inline functions	15	2
3	Defining a Class, Creating Objects, Accessing Data Members using objects, Calling Member Functions using objects, Implementing Array of Objects, objects as parameters & return type, new , this operators, Scope resolution operator, access specifiers(private, public, protected), Implementing Static Data Members, Implementing Static Member Functions, Function Overloading, Operator Overloading	15	3

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	2	-	3	-	3	3	3	3
CO2	3	3	3	-	3	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	3	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	3	2	2	2	3	3	3	3	3	-
Average	3	3	3	1.25	3	1.5	2	2	3	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. C++ Programming: From Problem Analysis to Program Design, 6th Edition; D.S. Malik
2. E.Balagurusamy: Object oriented programming with C++
3. K.R.Venugopal: Mastering C++

SEMESTER II

ECE-102-DE-12220- 8051 Microcontroller

ECE-102-DE-12220(P)- 8051 Microcontroller Lab

Learning Objectives

LO1: To gain the knowledge of Assembly Language Programs with Loops and Subroutines

LO2: To know Microprocessors and Microcontrollers.

Course Outcomes

CO1: Understanding Microprocessors and Microcontrollers

CO2: In-depth Knowledge of 8051 Architecture

CO3: Mastering Instruction Set and Addressing Modes.

CO4: Proficiency in Using the 8051 Stack and Subroutine Instructions.

Course Content

Unit No.	Content	Contact Hours	CO
1	Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing	15	1
2	Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.	15	3
3	8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops - Delay subroutine, Factorial of an 8 bit number (result maximum 8 bit), Block move without overlap, Addition of N 8 bit numbers, Picking smallest/largest of N 8 bit numbers. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.	15	2

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	2	3	3	3	3
CO2	3	3	-	3	3	2	2	3	3	2	3	-	3	3
CO3	3	3	-	3	3	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	-	2	2	2	-	2	3	-	3	3
Average	3	3	0.75	3	1.5	1.5	2	2	1.5	2	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C ", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.
3. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005

SEMESTER II

ECE-102-DE-12230- Embedded System
ECE-102-DE-1230(P)- Embedded System Lab

Learning Objectives

LO1: To understand design of embedded system.

LO2: To learn the principles, theories and the requirements embedded system.

Course Outcomes

CO1: Understanding Embedded Systems and General-Purpose Computer Systems.

CO2: Knowledge of Core Components of Embedded Systems

CO3: Knowledge of Embedded Hardware and Memory Management

CO4: Understand the Embedded System Development Environment

Course Content

Unit No.	Content	Contact Hours	CO
1	Introduction : Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems. Core of Embedded Systems : Microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components.	15	1
2	Programming Embedded Systems : Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging. Embedded hardware : Memory map, i/o map, interrupt map, processor family, external peripherals, memory - RAM, ROM, types of RAM and ROM, memory testing, CRC, Flash memory.	15	2
3	Embedded System development environment - IDE, Types of file generated on cross compilation, disassembler / decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.	15	3

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	3	3	-	2	2	3	3	-	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	2	3	3	3	3
CO4	3	3	3	3	-	2	2	2	-	3	3	3	3	3
Average	3	3	3	3	0.75	1.5	2	2	1.5	1.25	3	3	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. January, Michael Barr, O' Reilly Introduction to embedded systems, Shibu K V Tata McGraw-Hill.
2. Embedded Systems, Rajkamal, TataMcGraw-Hill

SEMESTER II

ECE-102-DE-12240-Digital Signal Processing

Learning Objectives

LO1: To conceptualize the various concepts of DSP.

LO2: To understand how various theories and principles of Filter Design.

Course Outcomes

CO1: Understanding the Basic Elements of Digital Signal Processing

CO2: Analysis of Linear Time Invariant (LTI) Systems

CO3: Introduction to the Discrete Fourier Transform (DFT)

CO4: Design of Infinite Impulse Response (IIR) Filters

Course Content

Unit No.	Content	Contact Hours	CO
1	Basic elements of digital signal Processing: Concept of frequency in continuous time and discrete time signals – Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation.	15	1
2	Introduction to DFT: Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.	15	2
3	Structure of IIR: System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.	15	3
4	Symmetric & Anti-symmetric FIR filters: Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows – Frequency sampling techniques – Structure for FIR systems	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	3	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	-	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	3	2	2	2	-	3	3	-	3	3
Average	**3**	**3**	**0.75**	**3**	**1.5**	**1.5**	**2**	**2**	**1.5**	**1.25**	**3**	**0.75**	**3**	**3**

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [**3**: High; **2**: Medium; **1**: Low; **-**: No Correlation]

Books Recommended

1.Oppenheim A V and Sehafer R W, "Discrete Time Signal Processing", Prentice Hall (1989).
2. Proakis J G and Manolakis D G, "Digital Signal Processing", Pearson Education India
3. Sanjit K Mitra "Digital Signal Processing" TMH

SEMESTER II

ECE-102-DE-12250-Biomedical Signal Processing

Learning Objectives

LO1: To understand the biomedical signal processing.

LO2: To understand various techniques involved in biomedical signal processing.

Course Outcomes

CO1: To Make Students Understand the Sources, Types & Characteristics of Different Noises and Artifacts Present in Biomedical Signals.

CO2: To Make Students Able to Design Time Domain and Frequency Domain Filters for Noise and Artifact Removal from Biomedical signals.

CO3: To Make Students Able to Understand and Apply Various Methods for Analyzing Biomedical Signal Characteristics.

CO4: To Motivate Students to Explore Alternative Techniques of Analyzing Biomedical Signals in Time and Frequency Domain. Course Content

Unit No.	Content	Contact Hours	CO
1	Basic elements of digital signal Processing: Concept of frequency in continuous time and discrete time signals –Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation.	15	1
2	Removal of Noise and Artifacts from Biomedical Signal Random and Structured Noise, Physiological Interference, Stationary and Nonstationary Processes, Noises and Artifacts Present in ECG, Time and Frequency Domain Filtering.	15	2
3	EEG Signal Processing and Event Detection in Biomedical Signals EEG Signal and Its Characteristics, EEG Analysis, Linear Prediction Theory, Autoregressive Method, Sleep EEG, Application of Adaptive Filter for Noise Cancellation in ECG and EEG Signals; Detection of P, Q, R, S and T Waves in ECG, EEG Rhythms, Waves and Transients, Detection of Waves and Transients, Correlation Analysis Ad Coherence Analysis of EEG Channels.	15	3
4	Analysis of Nonstationary Signals Heart Sounds and Murmurs, Characterization of Nonstationary Signals and Dynamic Systems, Short-Time Fourier Transform, Considerations in Short-Time Analysis and Adaptive Segmentation.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	3	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	-	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	3	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	1.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. Rangayyan, R.M., 2015. Biomedical signal analysis (Vol. 33). John Wiley & Sons.
2. Reddy, D.C., 2005. Biomedical signal processing: principles and techniques. McGraw-Hill

SEMESTER VIII

ECE-102-DE-12260-Microwave Devices

Learning Objectives

LO1: An understanding of microwave waveguides, passive & active devices, tubes and network analysis.

LO2: An ability to design microwave matching networks

Course Outcomes

CO1: Explain different types of waveguides and their respective modes of propagation.

CO2: Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.

CO3: Design microwave matching networks using L section, single and double stub and quarter wave transformer

CO4: Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.

Unit No.	Content	Contact Hours	CO
1	Distributed elements concept, Telegrapher's equations, lossless and lossy lines, line impedance and junction, Smith Chart. General solutions for TEM, TE and TM waves. Rectangular, circular, coaxial cable and modes of propagation. Introduction to stripline and microstripline	15	1
2	N-port microwave networks, impedance, admittance, transmission and scattering matrix representations, reciprocal and lossless networks, network matrices transformations. L-section impedance matching, single and double stub matching, Quarter wave transformer.	15	2
3	Waveguide cavity resonators. Principles of E-plane Tee, Hplane Tee, hybrid Tee, isolator, circulator, directional couplers, attenuators and phase shifters. Microstrip: Design of Wilkinson power divider. Limitations of conventional tubes in the microwave frequency ranges. Working principles of Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes.	15	3
4	Characteristics of microwave bipolar transistors and FET, GUNN Diode, IMPATT Diode, PIN Diode.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	3	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	-	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	3	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	1.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. D. M. Pozar; Microwave Engineering, 3rd Ed.; John Wiley & Sons Inc
2. R. E. Collin; Foundations for Microwave Engineering, 2nd Ed; Wiley-IEEE Press
3. Merill Skolnik; Introduction to Radar Systems, 3rd Edition; Tata McGraw Hill

Learning Objectives

LO1: An understanding of Wave Nature of Light.

LO2: An Understanding the Optical Fibers and Waveguides

Course Outcomes

CO1: Understanding the Wave Nature of Light

CO2: Introduction to Optical Communication Systems.

CO3: Understanding the Optical Fibers and Waveguides

CO4: Photodetectors and Their Applications

Unit No.	Content	Contact Hours	CO
1	**Wave Nature of Light – Conceptual Overview** Wave Equation, Refractive index, group and phase velocity, Pointing vector, Snell's law, Fresnel's equations, Optical Resonators, Optical Tunneling, Coherence, Diffraction **Optical communication systems and devices needs** Optical fiber, Optical waveguides, Optical amplifiers, Optical sources, Optical detectors.	15	1
2	**Light Emitting Diodes (LED)** Science and engineering of light emitting diodes **Stimulated Emission Devices** Laser Diodes, Vertical Cavity Surface Emitting Lasers (VCSELs), Quantum well devices, Semiconducting Laser Amplifiers.	15	2
3	**Photodetectors** pn junction, photodiode science and operation, avalanche and heterojunction photodiodes, phototransistors, photoconductive gain, CCD and CMOS sensors, sensing and imaging in different electromagnetic spectrum. **Polarization and Modulation of light** Polarization, propagation in anisotropic media, birefringent devices, integrated optical modulators, acousto-optic modulators, magneto-optic modulators, nonlinear effects.	15	3
4	**Display devices (If time permits)** LCD and LED display devices, three-dimensional and light-field displays, MOEMS and MEMS display	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	-	3	3	2	2	3	3	-	3	-	3	3
CO3	3	3	-	3	-	2	2	3	3	2	3	-	3	3
CO4	3	3	-	3	3	2	2	2	-	3	3	-	3	3
Average	3	3	0.75	3	1.5	1.5	2	2	1.5	1.25	3	0.75	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books Recommended

1. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Prentice Hall, 2001.
2. Shun Lien Chuang , Physics of optoelectronic devices, Wiley, 1995
3. John Wilson and John Hawkes, Optoelectronics, an introduction - 3rd Edition, Prentice Hall 1998.

SEMESTER II

ECE-102-RC-1210-Research and Publication Ethics

Learning Objectives

LO1: To bring awareness about the publication ethics and publication misconducts.

LO2: To know the basics of philosophy of science and ethics, research integrity, publication ethics.

LO3: To identify research misconduct and predatory publications.

Course Outcomes

CO1: To orient students towards the philosophy of ethics and misconducts.

CO2: Develop understanding about research integrity and publication guidelines

CO3: Understand various guidelines and regulation in publication ethics

CO4: Identifying research misconduct.

Course Content

Unit No.	Content	Contact Hours	CO
1	**Ethics and Publication** 1.1 Introduction to Philosophy: Definition, Nature and Scope, Concept, Branches. 1.2 Ethics: Definition, Moral Philosophy, Nature of Moral Judgements and Reactions	15	1
2	**Scientific Conduct** 2.1 Ethics with Respect to Science and Research. 2.2 Intellectual Honesty and Research Integrity. 2.3 Scientific Misconducts: Falsification, Fabrication, and Plagiarism (FFP).	15	2
3	**Publication Ethics** 3.1 Publication Ethics: Definition, Introduction and Importance. 3.2 Best Practices / Standards Setting Initiatives and Guidelines: COPE, WAME, etc. 3.3 Conflicts of Interest.	15	3
4	**Publication Misconduct** 4.1 Definition, Concept, Problems That Lead to Unethical Behavior and Vice-Versa, Types. 4.2 Violation of Publication Ethics, Authorship and Contributorship. 4.3 Identification of Publication Misconduct, Complaints and Appeals.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	3	-	-	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	-	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	1	2	2	2	-	3	3	3	3	-
Average	3	3	3	1.25	0.2 5	1.5	2	2	1.5	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books/Journal Articles Recommended

1. Bird, A. (2006). *Philosophy of Science.* Routledge.
2. MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
3. P. Chaddah, (2018) *Ethics in Competitive Research: Do not get scooped; do not get plagiarized,* ISBN:9789387480865.

SEMESTER – III & IV

PG DEGREE

(WITH RESEARCH)

SEMESTER III and IV
ECE-102-DC-2180-Dissertation-I
ECE-102-DC-2280-Dissertation-II

Background

They will do research project work or dissertation under the guidance of a faculty member of the Department of Electronics The project work/dissertation will be in the major discipline.

Course Outcomes

CO1: The post-graduates would be able to demonstrate the ability to apply knowledge, understanding, and/or skills with an appropriate degree of independence relevant to the level of the qualification.

CO2: The post-graduates would work independently, identify appropriate resources required for a project, and manage a project through to completion.

CO3: The post-graduates would exercise responsibility and demonstrate accountability in applying knowledgeand/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces.

CO4: The post-graduates should be able to demonstrate the capability to participate in community-engaged services/ activities for promoting the well-being of society.

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	2	-	-	-	3	3	3	3
CO2	3	3	3	3	-	2	2	3	3	-	3	3	3	3
CO3	3	3	3	3	-	2	2	3	3	2	3	3	3	3
CO4	3	3	3	3	0	2	2	2	-	3	3	3	3	3
Average	3	3	3	3	0.75	1.5	2	2	1.5	1.25	3	3	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Norms

1. The project work/dissertation will be on a topic in the disciplinary programme of study or an interdisciplinary topic.
2. The students are expected to complete the Project in the six semesters. The research outcomes of their project work may be published in peer-reviewed journals or may be presented inconferences /seminars or may be patented.
3. Students may be permitted to carry out a project work or dissertation in another department of RGU or another institution provided the required facilities are available.

Learning Assessment

Evaluation will be based on continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study. Research Project work inElectronics discipline would generally be carried out under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. The 3rd and 4th semester will be devoted toseminar presentation, preparation, and submission of project report/dissertation.

SEMESTER – III & IV

PG DEGREE

(WITH COURSE WORK AND RESEARCH)

SEMESTER III

ECE-102-CC-2110- Industrial Instrumentation and Automation

Learning Objectives

LO1: To understand to elect instruments and transducers for various physical variables.

LO2: To understand an insight on data acquisition, processing and monitoring system

Course Outcomes

CO1: Able to select instruments and transducers for various physical variables.

CO2: To get an insight on data acquisition, processing and monitoring system

CO3: Able to design various signal conditioning systems for transducers

CO4: To able to analyze dynamic responses of various systems.

Course Content

Unit No.	Content	Contact Hours	CO
1	Introduction to Process Control - block diagram of process control loop, definition of elements. Sensor time response - first and second order responses. Review of Transducers: Characteristics and Choice of transducer factors influencing choice of transducer	15	1
2	Applications of Transducers Displace measurement: Resistance potentiometer, Capacitive and Inductive. Capacitive differential pressure measurement Torsional, shearing stress and rotating shaft Torque measurement using strain gauge. Flow measurement: Hotwire anemometer, constant resistance Constant current type Eddy current sensors, Variable reluctance tachometers Phase measurement: Analog and digital phase detectors Nano Instrumentation	15	2
3	Signal conditioning circuits-Instrumentation amplifiers Unbalanced bridge. Bridge linearization using op amp Precision rectifiers, Log amplifiers, Charge amplifiers, Isolation amplifier, switched capacitor circuits, Phase sensitive detectors, Noise problem in instrumentation and its minimization	15	3
4	Overview of Automation System - Architecture of Industrial Automation Systems, Different devices used in Automation Actuators, definition, types, selection. Pneumatic, Hydraulic, Electrical, Electro-Pneumatic and valves, shape memory alloys, Introduction to Sequence Control, PLCs - Working, Specifications of PLC Onboard/Inline/Remote IO's, Comparison of PLC & PC,	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	3	-	-	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	-	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	1	2	2	2	-	3	3	3	3	-
Average	3	3	3	1.25	0.2 5	1.5	2	2	1.5	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books/Journal Articles Recommended

1. Curtis D Johnson ," Process Control Instrumentation Technology", PHI, 1986
2. Doeblin E.O, 'Measurement Systems: Application and Design, Fourth Edition, McGraw Hill.
3. DVS. Murty, 'Transducers and Instrumentation' Second Edition, PHI Learning Pvt Ltd New Delhi ,2013.

ECE-102-CC-2110- Material Science

Learning Objectives

LO1: To understand to elect instruments and transducers for various physical variables.

LO2: To understand an insight on data acquisition, processing and monitoring system

Course Outcomes

CO1: Able to select instruments and transducers for various physical variables.

CO2: To get an insight on data acquisition, processing and monitoring system

CO3: Able to design various signal conditioning systems for transducers

CO4: To able to analyze dynamic responses of various systems.

Course Content

Unit No.	Content	Contact Hours	CO
1	Introduction to Process Control - block diagram of process control loop, definition of elements. Sensor time response - first and second order responses. Review of Transducers: Characteristics and Choice of transducer factors influencing choice of transducer	15	1
2	Development of micro structure-equilibrium and non-equilibrium cooling. Time- temperature transformation curves and their applications. Mechanical properties of materials: elasticity, elastic and plastic behaviour, stress-strain relationship, fatigue and creep, strengthening mechanisms and fracture. Thermal properties: heat capacity, thermal expansion, thermal conductivity and thermal stresses.	15	2
3	Electrical properties of materials: Electron energy band structures for solid materials, conduction in terms of band and atomic bonding models. Intrinsic and extrinsic semiconductors, the temperature variation of conductivity and carrier concentration. Electrical properties of polymers. Dielectric behaviour, Ferro electricity and Piezoelectricity.	15	3
4	Magnetic properties, diamagnetic, paramagnetic, Ferromagnetic, anti-ferromagnetic, ferromagnetic materials and their applications. Influence of temperature on magnetic characteristics of materials. Superconductivity in materials Optical properties of materials: Absorption, transmission, refraction, reflection; opacity and translucency in materials Absorption, transmission, refraction, reflection; opacity and translucency in materials. Mechanism of photon absorption. Environmental effect on materials.	15	4

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	2	-	-	-	3	3	3	3
CO2	3	3	3	-	-	2	2	3	3	-	3	3	3	-
CO3	3	3	3	-	-	2	2	3	3	2	3	3	3	-
CO4	3	3	3	3	1	2	2	2	-	3	3	3	3	-
Average	3	3	3	1.25	0.2 5	1.5	2	2	1.5	1.25	3	3	3	0.75

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Books/Journal Articles Recommended

1. Callister W.D.,Materials Science and Engineering: An introduction, 6th Edition, John Wiley &Sons Inc.,
2. Raghavan V. Materials Science and Engineering – A first course, 5 th Edition, Prentice Hall.
3. Van Vlack, LH, Elements of Materials Science and Engineering, 6 th Edition, Addison – Wesley Singapore.

EMESTER III and IV
ECE-102-DC-2160-Dissertation-I
ECE-102-DC-2280-Dissertation-II

Background

They will do research project work or dissertation under the guidance of a faculty member of the Department of Electronics The project work/dissertation will be in the major discipline.

Course Outcomes

CO1: The post-graduates would be able to demonstrate the ability to apply knowledge, understanding, and/or skills with an appropriate degree of independence relevant to the level of the qualification.

CO2: The post-graduates would work independently, identify appropriate resources required for a project, and manage a project through to completion.

CO3: The post-graduates would exercise responsibility and demonstrate accountability in applying knowledgeand/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces.

CO4: The post-graduates should be able to demonstrate the capability to participate in community-engaged services/ activities for promoting the well-being of society.

Mapping of POs/PSOs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	2	-	-	-	3	3	3	3
CO2	3	3	3	3	-	2	2	3	3	-	3	3	3	3
CO3	3	3	3	3	-	2	2	3	3	2	3	3	3	3
CO4	3	3	3	3	0	2	2	2	-	3	3	3	3	3
Average	3	3	3	3	0.75	1.5	2	2	1.5	1.25	3	3	3	3

The Mapping Level Contribution between COs-POs/PSOs are Categorized as [3: High; 2: Medium; 1: Low; -: No Correlation]

Norms

1. The project work/dissertation will be on a topic in the disciplinary programme of study or an interdisciplinary topic.
2. The students are expected to complete the Project in the six semesters. The research outcomes of their project work may be published in peer-reviewed journals or may be presented inconferences /seminars or may be patented.
3. Students may be permitted to carry out a project work or dissertation in another department of RGU or another institution provided the required facilities are available.

Learning Assessment

Evaluation will be based on continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study. Research Project work inElectronics discipline would generally be carried out under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. The 3rd and 4th semester will be devoted toseminar presentation, preparation, and submission of project report/dissertation.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION

राजीव गांधी विश्वविद्यालय

Rajiv Gandhi University

रोनो हिल्स, दोइमुख

Rono Hills, Doimukh

Attendance sheet for Board of Studies (BoS) meeting on 12th June, 2024 at 03:00 PM in the Lab - 1 of ECE Department, RGU

Sl. No	Name	Designation	Signature with Date
1	Dr. Maibam Sanju Meetei, Head and Associate Professor	Chairperson	
2	Prof. Utpal Bhattacharjee, Professor	Member	12/6/2024
3	Prof. Sanjeev Kumar, Professor	Member	
4	Dr. Jagdeep Rahul, Associate Professor	Member	12/06/2024
5	Ms. Champa Tanga, Assistant Professor	Member	12/06/24
6	Dr. Kurmendra, Associate Professor, Dept of ECE, RGU	Member	12/06/24
7	Prof. Santanu Sharma, Dept. of ECE, Tezpur University	External Member	Online Mode
8	Prof. Rajesh Kumar, Dept. of ECE, NERIST	External Member	Online Mode

(Dr. Maibam Sanju Meetei)
Head, ECE
Rajiv Gandhi University
राजीव गांधी विश्वविद्यालय

Head / Department
Dept. of Electronics & Communication
Rajiv Gandhi University
Rono Hills, Doimukh (A.P.)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION
राजीवगांधीविश्वविद्यालय
Rajiv Gandhi University
रोनोहिल्स, दोइमुख
Rono Hills, Doimukh

कार्यवृत्त बैठक / Minutes

A meeting of board of studies (BOS) of Department of Electronics And Communication was held on **12th June, 2024 at 03:00 PM** in the Lab - 1 of the Department of Electronics And Communication, Rajiv Gandhi University, to discuss the syllabus of UG, M.Sc. and M.Tech. courses as per NEP 2020 guidelines. Both the experts attended the meeting in the virtual mode. The members discussed and planned for M.Tech. and M.Sc. courses, M.Tech for upcoming session 2024-25. Further the UG Course for Electronics is also designed as instructed by the authority.

1	Dr. Maibam Sanju Meetei, Head and Associate Professor	Chairperson
2	Prof. Utpal Bhattacharjee, Professor	Member
3	Prof. Sanjeev Kumar, Professor	Member
4	Dr. Jagdeep Rahul, Associate Professor	Member
5	Ms. Champa Tanga, Assistant Professor	Member
6	Dr. Kurmendra, Assistant Professor, Dept of ECE, RGU	External Member
7	Prof. Santanu Sharma, Dept. of ECE, Tezpur University	External Member
8	Prof. Rajesh Kumar, Dept. of ECE, NERIST	

The following points were discussed and plan accordingly:

1. The UG program in Electronics will be three and four year program with multiple entries and multiple exit facility. Certificate/Diploma/Degree/Degree with Honours/Degree with Research will be accordingly provided.
2. As par NEP guidelines, a list of multidisciplinary courses were identified that could be offered.
3. The major and minor subjects were enlisted for the first and second year of the UG programme.
4. The members also suggested that the student who opt Major in Electronics may preferably also opt the minor course offered by department of mathematics and physics.
5. The department is designing the UG syllabus that can be used by affiliated colleges to the Rajiv Gandhi University.
6. The PG (M.Sc. and M.Tech) program in Electronics will be two with multiple entry and multiple exit facility.
7. The members also suggested to offer M.Sc. (Course-work with Research) and M.Tech. (Course-work with Research) in the Department of ECE.
8. As the UG and PG Electronics are related to the technical, some coursework credits are converted into project and research dissertation which is reflected in the syllabus.

Prof. Utpal Bhattacharjee,

Prof. Sanjeev Kumar,

Dr. Maibam Sanju Meetei

Dr. Jagdeep Rahul

Ms. Champa Tanga

Dr. Kurmendra 12.06.24