Chhatrapati Shahu Ji Maharaj University, Kanpur

Uttar Pradesh State University (Formerly Kanpur University, Kanpur)

Master of Technology (M. TECH)

Electronics and Communication Engineering

Course Structure & Syllabus for the Program

(As per the Ordinances of Master of Technology)

(Effective from the Session: 2023-24)

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

- To provide affordable quality education at par with global standards of academia and serve society with harmonious social diversity
- To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem
- To practice and encourage high standards of professional ethics and accountability among students

Master of Technology in Electronics & Communication Engineering

Program Outcomes (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles 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 the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including 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 the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the 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 teamwork:** 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.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context to technological change.

Program Specific Outcomes (PSOs)

PSO-1	Enable students to get deep knowledge in the specialisation of Communication Engineering or VLSI Design and able to solve complex problems in the field of Electronics and Communication.
PSO-2	Enable students to carry out research work in emerging technologies and pursuing careers in MNCs, private or public sector, or becoming entrepreneurs.

Program Educational Outcomes (PEOs)

PEO-1	To provide quality education in Electronics & communication engineering for making the students competent to enter into the industry as well as in the field of Research.
PEO-2	To develop an ability to analyze the problem, understand the technical requirements, design and deliver engineering solutions and create effective product designs.
PEO-3	To inculcate soft skills along with hard skills in our students to help them grow professionally in this digital world.
PEO-4	To imbibe high standard of ethical and professional conduct, positive attitude, team spirit, and societal responsibilities.
PEO-5	To equip our students to effectively communicate technical and non-technical information in speech, presentation, and in writing.

विभाग

पत्रावली संख्या.....

टिप्पणी तथा आज्ञाएँ :

25 June 2023

To,
The Dean (Academics)
CSJMU Kanpur

Subject: Proposal to introduce a new programme "**M.Tech. in Electronics & Communication Engineering**" in Electronics and Communication Engineering Department, UIET, School of Engineering and Technology.

Madam,

The Department of Electronics and Communication Engineering, UIET, School of Engineering and Technology proposes to introduce a new programme "Master of Technology (M.Tech.) in Electronics & Communication Engineering" from the academic session 2023 – 2024, with a vision to create competent and skilled Electronics and Communication Engineers with sound technical knowledge and innovativeness. The details of the proposed programme are as follows:

Duration: 2 Years (4 semesters)
Number of seats: 30 (Thirty)
Minimum Qualification: B.Tech./B.E in Electronics, Electronics & Communication, Electronics & Electrical, Electronics & Instrumentation, Electronics & Telecommunication Engineering **OR** M.Sc. in Electronics or Physics (specialization in Electronics)
Proposed Fees: Rs. 69200 /= i.e. Tution Fees Rs. 65000/- Per Year + Examination Fees Rs.4000 per year + Enrolment Fees* (200/-) (* - one time payable)

Diverse job opportunities exist for M.Tech. in Electronics & Communication Engineering in Research, Government as well as in the Private sector. It is one of the highly demanded Master's Programme which will let the student lead away. M.Tech. in Electronics & Communication Engineering will provide an opportunity to clear any competitive exam where master's is the minimum qualification. It covers a wide area of sub-fields including electronics, digital computers, power engineering, telecommunications, control systems, RF engineering, and signal processing.

Permission may please be accorded, for running this programme in the ECE Department, of UIET after approval from the Academic Council of the University.

- Syllabus Enclosed

(Dr. Vishal Awasthi)
Coordinator, ECE Department
UIET, CSJM Universit, Kanpur

U.I.E.T. No. 23/4793 Date 13/07/23 Sign. C.S.J.M. University, Kanpur

Forwarded
25/6/23
Dr. Brishti Mitra
Director
UIET, CSJM University
Kanpur - 208024

छत्रपति शाहू जी महाराज
विश्वविद्यालय, कानपुर

Department of Electronics & Communication engineering
School of Engineering and Technology (U.I.E.T.)
C.S.J.M. University Kanpur

Minutes of the Meeting

Board of Studies, Department of Electronics & Communication Engineering

A meeting of the Board of Studies of the Department of Electronics & Communication Engineering (ECE), School of Engineering and Technology (U.I.E.T.) was held on 19.06.2023 at 11:00 pm in the Department of ECE to open a new programme "Master of Technology (M.Tech.) in Electronics and Communication Engineering", with a vision to create competent and skilled Electrical Engineers with sound technical knowledge and innovativeness.

Following members attended the meeting.

1. Dr Ashutosh Singh (Professor), Electronics Engineering Department, H.B.T.U., Kanpur
2. Dr Vishal Awasthi, (Coordinator ECE Department) UIET, CSJM University, Kanpur
3. Er. Ajeet Srivastava, (Assistant Professor) UIET, CSJM University, Kanpur
4. Dr Ajay Tiwari, UIET, (Assistant Professor) CSJM University, Kanpur
5. Er. Anand Kumar Gupta, (Convener) UIET, CSJM University, Kanpur

Committee discussed the following points to open a new programme **in BOS:**

- Opening a new **2-year (Four Semesters) "M.Tech. in Electronics and Communication Engineering"** programme under the Department of Electronics & Communication Engineering (ECE).
- Syllabus of the Proposed programme **"M.Tech. in Electronics and Communication Engineering".**

Committee concluded with the following suggestion & Recommendations:

- It is advised by the Board of studies that the **2-year (Four Semesters) "M.Tech. in Electronics and Communication Engineering"** programme should be streamlined and the syllabus must be updated according to the present scenario.
- After studying the common minimum syllabus for All India Council for Technical Education (AICTE), New Delhi for two years of Master Programme in Electronics and Communication Engineering, the enclosed syllabus for the **M.Tech. in Electronics and Communication Engineering** programme under the Department of Electronics & Communication Engineering (ECE), has been proposed by the members of Board of Studies.

Dr. Ashutosh Singh
(Professor) & Member of BOS
H.B.T.U., Kanpur

(Dr. Vishal Awasthi)
Coordinator (ECE Department)
& Member of BOS

(Dr. Ajay Tiwari)
Member of BOS

(Er. Ajeet Kumar Srivastava)
Member of BOS

(Er. Anand Kumar Gupta)
Convener, BOS (ECE)

Chhatrapati Shahu Ji Maharaj University, Kanpur

Semester-wise Course Structure

First Year, Semester-I

S. No.	Course Code	Subject	Periods			Credit
			L	T	P	
1.	MECE 101	Advanced Semiconductor Devices (Core)	3	0	3	5
2.	MECE 102	Advanced Communication Systems (Core)	3	1	0	4
3.	MECE 01..	Departmental Elective I [1] Wireless Sensor Networks [2] Advance Microprocessor and Microcontroller [3] Random Processes	3	1	0	4
4.	MECE 02..	Departmental Elective II [1] IOT & Application [2] Optical Networks [3] Low-Power VLSI Design	3	1	0	4
5.	AUD-01..	Audit course **	2	0	0	No Credit
		Total	14	0	3	**17**

** Interdisciplinary/MOOC

First Year, Semester-II

S. No.	Course Code	Subject	Periods			Credit
			L	T	P	
1.	MECE 201	Wireless and Mobile Communication (Core)	3	0	3	5
2.	MECE 202	Antennas and Radiating Systems (core)	3	1	0	4
3.	MECE 03..	Departmental Elective III: [1] Communication Network [2] Nano-materials and Nano-technology [3] Detection and Estimation Theory	3	0	0	3
4.	MECE 04..	Departmental Elective IV: [1] Advanced Digital Signal Processing [2] Fundamentals of Machine Learning [3] Research Methodology and IPR**	3	0	0	3
5.	MPT-01	Mini Project/ Training			3	2
		Total	**14**	**0**	**6**	**17**

Second Year, Semester-III

S. No.	Course Code	Subject	Periods			Credit
			L	T	P	
1.	MECE 301	Analog and Digital CMOS VLSI Design	3	0	0	3
2.	MECE 05..	**Open Elective**: (CBCS)** [1] Digital Image Processing [2] Artificial Intelligence [3] RF and Microwave Circuit Design	3	0	0	3
3.	DECE 301	Dissertation I	0	0	20	10
		Total				16

Second Year, Semester-IV

S.No.	Course Code	Subject	Periods			Credit
			L	T	P	
1.	DECE 401	Dissertation II	0	0	36	18
		Total				18

** **Interdisciplinary/MOOC**

Semester I

Course Code: MECE – 101 **Breakup: 3 – 0 – 0 – 3**
Course Name: Advanced Semiconductor Devices

Advanced Semiconductor Devices

Course Outcomes:

At the end of this course, students will be able to

- Understand the details of operation of the advanced semiconductor electronic devices.
- know the parameters of electronic devices that govern their performance and limitations.
- Be familiar with tendency in contemporary microelectronics and principles of the nano-scale electronic devices.
- Justify the choice/selection of components from the design aspects.

Syllabus Contents:

Unit 1: Analog Circuits -Overview of analog devices: Bipolar junction transistors, FET devices. Linear integrated devices: operational amplifiers and its characteristics, Op-amp applications, timer ICs.

Unit 2: Microwave and Antenna -Microwave components, amplifier design, plane waves at a media interface, waveguides, dielectric wave guide, radiation, arrays, propagation of radio waves, microwave antenna, antenna measurement.

Unit 3: Deep Submicron VLSI Design

Deep Submicron Transistor Models, Effect of Leakage, Deep Submicron Fabrication Technology, Design for Low Power, Silicon-on-Insulator Circuit Design.

Unit 4: Digital systems: Review of Boolean algebra, logic technology, minimization techniques, combinational and sequential circuits, multiplexers, de-multiplexers and their applications, Memory devices, clock generators, error detection and correction circuits, PLDs, FPGAs, CPLDs, ADCs, DACs .

Unit 5: Embedded Systems and Processors

Review of 32/64 bit processors, DSP processors, IoT enable processors (architecture, memory management, cache and core management, programming).

References:

1. Operating Amps and Linear Integrated Circuits by Ramakant A. Gayakwad (PHI)
2. Integrated Electronics: Analog and Digital Circuits and Systems. by Millman and Halkias (Tata McGraw Hill)
3. Neil Weste, David Harris, CMOS VLSI Design: A circuit and system perspective, 4th edition, Person Publication.
4. Liao SY, Microwave Devices and Circuits, Prentice Hall of India
5. Miligan TA, Modern Antenna Design, Jun 2005, 2nd Ed, McGraw Hill
6. Frank Vahid and Tony Givargis, Embedded system design: unified hardware/software Introduction, John Wiley & Sons

Course Code: MECE – 102 **Breakup: 3 – 1 – 0 – 4**
Course Name: Advanced Communication Systems

Advanced Communication Systems

Course Outcomes:

At the end of this course, students will be able to

- Interpret, Analyze and Process the communication signals, data using appropriate modern techniques and tools.
- Analyze, evaluate a given communication network and suggest enhancements.
- Select modulation and detection techniques for a given communication link.
  Design and operate Software Defined Radio systems.
- Understand advanced concepts in Communication Networking.
- Design and develop protocols for Communication Networks.
- Understand the mechanisms in Quality of Service in networking.
- Optimize the Network Design.

Syllabus Contents:

Unit-1: Ultra-wideband (UWB) communication systems: UWB concepts, advantages and challenges, single band versus multiband, FCC emission limits, UWB applications.

Uniit-2: UWB sources and antennas: UWB pulse generation, UWB antennas;

Unit-3: Pulse-detection and multiple-access techniques: Conventional pulse-detection techniques, pulse modulation, and detection techniques, UWB multiple-access techniques;

Unit-4: Interference issues: Interference with WLAN, cellular & GPS. Multiple-Input, Multiple-Output (MIMO) wireless communication: Basic MIMO model, MIMO capacity in fading channels, Diversity multiplexing trade off, Space-time code for MIMO wireless communication.

Unit-5: Software Define Radio (SDR): Characteristics and benefits of a software radio, design principles of software radio, enhanced flexibility with software radios, receiver design challenges.

References:

[1] K. Siwiak and D. McKeown, Ultra-Wideband Radio Technology, John Wiley and Sons Limited, 2004.
[2] S. Haykin and M. Moher, Modern Wireless Communication, Pearson Education, 2005.
[3] Jeffrey H. Reed, Software Radio: A Modern Approach to Radio Engineering, Prentice Hall, May 2002
[4] Faranak Nekoogar, Ultra-Wideband Communications: Fundamentals and Applications, Prentice Hall, 2005.
[5] C. Oestges and B. Clerckx, MMIO Wireless Communications, 1st Ed, 2007.
[6] Paul Burns, Software Defined Radio for 3G, Artech House Inc., 2003.

Course Code: MECE – 011 **Breakup: 3 – 0 – 0 – 3**
Course Name: Wireless Sensor Networks

Program Elective I: [MECE 011] Wireless Sensor Networks

Course Outcomes:

At the end of this course, students will be able to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network-based systems and applications.
- Use operating systems and programming languages for wireless sensor nodes, the performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

Syllabus Contents:

Unit 1: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Unit 2: Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT; Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 3: Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 4: Overview of sensor network protocols (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit 5: Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Unit 6: Specialized features: Energy preservation and efficiency; security challenges; fault- tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms, coverage issues, sensor Web, sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

References:

[1] H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.

[2] C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.

[3] F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.

[4] Yingshu Li, My T. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

Course Code: MECE – 012 **Breakup: 3 – 1 – 0 – 4**
Course Name: Advance Microprocessor and Microcontroller

Program Elective II: Advance Microprocessor and Microcontroller

Course Outcomes:

- **CO1**: Ability to understand microprocessor basics.
- **CO2**: Ability to understand and analyse different microprocessor architectures.
- **CO3**: Ability to familiarize Instruction sets.
- **CO4**: Ability to develop Programming skills.
- **CO5**: Ability to understand microcontroller architecture.

Syllabus Contents:

Unit 1: Design of basic microprocessor architectural Concepts : Microprocessor architecture, word Lengths, addressable memory, Register structure, ALU, Bus Organization, internal data bus. Architecture of 16 bit and 32 bit Microprocessor: Internal organization of 8086, Bus interface unit, Execution unit, Register organization.

Unit 2: CPU Module Design: Signal Description of pins of 8086 and 8088, Clock generation, Address and data bus Demultiplexing, Buffering memory organization, Read and Write cycle Timings, Interrupt structures, Minimum Mode CPU Module, Maximum Mode Operation (Coprocessor configuration) Features of Numeric processor 8087, Floating point representation, range resolution, normalization, representation of zero, unused codes, parity bit and error detection.

Unit 3: Assembly Language Programming: Addressing modes, Data transfer instructions, Arithmetical and logical instructions, Program control Instructions (jumps, conditional jumps and subroutine calls), Loop and string instructions, Assembler Directives. Parameter passing and recursive procedures.

Unit 4: Basic of Interfacing: Programmed I/O, Interrupt driven I/O, Parallel I/O (8255-PPI), Serial I/O (8251, RS-232 standard) 8259 Programmable Interrupt Controller, 8257-DMA Controller, 8253 Programmable Timer/Counter,(8279) Keyboard and display interface, ADC and DAC interfacing.

Unit 5: An Introduction to Microcontroller 8051 : The 8051 Architecture, Instruction set, Basic Assembly language programming concept.

Text Books:

[1] C.M. Gilmore, "Microprocessors Principals and Application", MGH
[2] Rajkamal, "Embedded System, Architecture &Programming",TMH

Reference Books:

[1] Berry B. Berry, " Inter Series of microprocessors", PHI
[2] D. V. Hall, "Microprocessor &Interfacing", TMH
[3] Peatman, "Microprocessor Based System Design", Pearson

Course Code: MECE – 013 **Breakup: 3 – 1 – 0 – 4**
Course Name: Random Processes

Program Elective I: [MECE 013] Random Processes

Course Objectives:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

Syllabus Contents:

UNIT I

Probability – Axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III

Classification – Stationary process – Markov process – Markov chain – Poisson process – Random telegraph process.

UNIT IV

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

References:

[1] Hsu, "Schaums Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

[2] Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.

[3] Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

[4] Kolman. B. Hill. D.R., Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint, 2009.

[5] Kumaresan. S., Linear Algebra – A Geometric Approach, Prentice – Hall of India, New Delhi, Reprint, 2010.

[6] Strang. G., Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi, 2005.

Course Code: MECE – 021 **Breakup: 3 – 0 – 0 – 3**
Course Name: IOT and Applications

Program Elective II: IOT and Applications

Course Outcomes:

At the end of this course, students will be able to

- Understand the concept of IOT and M2M
- Study IOT architecture and applications in various fields
- Study the security and privacy issues in IOT.

Syllabus Contents:

Unit 1

IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues,

Unit 6

Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

References:

[1] Vijay Madisetti and Arsh deep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

[2] Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1stEdition, A press Publications, 2013.

[3] CunoPfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.

Course Code: MECE – 022 **Breakup: 3 – 1 – 0 – 4**
Course Name: Optical Networks

Program Elective I: [MECE 012] Optical Networks

Course Outcomes:

At the end of this course, students will be able to

- Contribute in the areas of optical network and WDM network design.
- Implement simple optical network
- Understand further technology developments for future enhanced network.

Syllabus:

Unit 1: SONET/SDH: optical transport network, IP, routing, and forwarding, multiprotocol label switching.
Unit 2: WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross-connects.
Unit 3: Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, and optical safety.
Unit 4: Network Survivability: protection in SONET/SDH & client layer, optical layer protection schemes
Unit 5: WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models.
Unit 6: Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

References:

[1] Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3 rd edition, 2010.

[2] C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

Course Code: MECE – 023 **Breakup: 3 – 0 – 0 – 3**
Course Name: Low Power VLSI Design

Program Elective II : [MECE 023] Low Power VLSI Design

Course Outcomes:

At the end of the course, students will be able to:

- **CO1:** Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
- **CO2:** Characterize and model power consumption & understand the basic analysis methods.
- **CO3:** Understand leakage sources and reduction techniques.

Syllabus Contents:

Unit 1: Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd & Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

Unit 2: Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high-performance approaches.

Unit 3: Low Power Clock Distribution: Power dissipation in clock distribution, single driver versus distributed buffers, buffers & device sizing under process variations, zero skew Vs. tolerable skew, chip & package co-design of clock network.

Unit 4: Logic Synthesis for Low Power estimation techniques: Power minimization techniques, low power arithmetic components- circuit design styles, adders, multipliers.

Unit 5: Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

Unit 6: Low Power Microprocessor Design System: power management support, architectural tradeoffs for power, choosing the supply voltage, low-power clocking, implementation problem for low power, comparison of microprocessors for power & performance.

References:

[1] P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer Academic, 2002
[2] Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sons Inc.,2000.
[3] J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.
[4] A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995
[5] Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

AUDIT COURSES

Course Code: AUD – 011 **Breakup: 2 – 0 – 0 – 0**
Course Name: PEDAGOGY STUDIES

AUD-011: PEDAGOGY STUDIES

Course Objectives:

- Students will be able to:
- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Syllabus

Units	Content	Hours
1	**Introduction and Methodology:** • Aims and rationale, Policy background, Conceptual framework and terminology • Theories of learning, Curriculum, Teacher education. • Conceptual framework, Research questions. • Overview of methodology and Searching.	4
2	• **Thematic overview:** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	2
3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow-up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4

5	• Research gaps and future directions • Research design • Contexts • Pedagogy • Teacher education • Curriculum and assessment • Dissemination and research impact.	2

Suggested reading

[1] Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

[2] Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

[3] Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

[4] Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

[5] Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

[6] Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Course Code: AUD-012 **Breakup: 2 – 0 – 0 – 0**
Course Name: STRESS MANAGEMENT BY YOGA

AUD-012: STRESS MANAGEMENT BY YOGA

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes:

Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

Syllabus

Unit	Content	Hours
1	• Definitions of Eight parts of yog. (Ashtanga)	8
2	• Yam and Niyam. Do`s and Don't's in life. ➢ Ahinsa, satya, astheya, bramhacharya and aparigraha ➢ ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	• Asan and Pranayam ➢ Various yog poses and their benefits for mind & body ➢ Regularization of breathing techniques and its effects-Types of pranayam	8

Reference:

[1] 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

[2] "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Code: AUD-013 **Breakup: 2 – 0 – 0 – 0**

Course Name: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

AUD-013: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes

Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

Syllabus

Unit	Content	Hours
1	• Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, • Chapter 18-Verses 45, 46, 48.	8
3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	8

Reference:

[1] "Srimad Bhagavad Gita" by Swami Swarupananda.Advaita Ashram (Publication Department), Kolkata

[2] Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Code: AUD – 014 **Breakup: 2 – 0 – 0 – 0**
Course Name: VALUE EDUCATION

AUD-014: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgments	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism. Love for nature ,Discipline	6
3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
4	• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence, Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	6

Suggested reading

[1] Chakrabarti, S.K. "Values and Ethics for organizations Theory and practice". Oxford UniversityPress, New Delhi

Course Code: AUD-015 **Breakup: 2 – 0 – 0 – 0**
Course Name: ENGLISH FOR RESEARCH PAPER WRITING

AUD-015: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:
Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first time submission

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedgingand Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Reference:

[1] Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
[2] Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
[3] Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
[4] Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Code: AUD-016 **Breakup: 2 – 0 – 0 – 0**
Course Name: SANSKRIT FOR TECHNICAL KNOWLEDGE

AUD-016: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjectsenhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore thehuge knowledge from ancient literature

Course Outcome:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

Unit	Content	Hours
1	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	8
2	• Order • Introduction of roots • Technical information about Sanskrit Literature	8
3	• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

References:

[1] "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

[2] "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

[3] "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Semester II

Course Code: MECE – 201 **Breakup: 3 – 0 – 0 – 3**
Course Name: Wireless and Mobile Communication

Wireless and Mobile Communication

Course Outcomes:

At the end of this course, students will be able to

- Design appropriate mobile communication systems.
- Apply the frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
- Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.
- Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.
- Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology
- Understanding upcoming technologies like 3G, 4G etc.

Syllabus Contents:

Unit 1:Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment's architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS).
2.75 G Standards: EDGE.
Unit 2: Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations)
Unit 3: Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.
Unit 4: Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.
Unit 5: Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.
Unit 6: Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

References:

[1] V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
[2] V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
[3] T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI, 2002.
[4] William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
[5] Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.

Course Code: MECE – 202 **Breakup: 3 – 0 – 0 – 3**
Course Name: Antennas and Radiating Systems

Antennas and Radiating Systems

Course Outcomes:

At the end of this course, students will be able to

- Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
- Estimate the input impedance, efficiency and ease of match for antennas.
- Compute the array factor for an array of identical antennas.
- Design antennas and antenna arrays for various desired radiation pattern characteristics.

Syllabus Contents:

Unit 1: Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna.
Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.
Unit 2: Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects.
Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non-uniform current.
Unit 3: Linear Arrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.
Unit 4: Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture.
Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.
Unit 5: Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.
Unit 6: Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

References:

1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.
3. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
4. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

Course Code: MECE – 031 **Breakup: 3 – 0 – 0 – 3**
Course Name: Communication Networks

Elective III: [MECE-031] Communication Networks
Course Outcomes: At the end of the course, students will be able to: • Analyze protocols and algorithms, acknowledge tradeoffs and rationale • Use routing, transport protocols for the given networking scenario and application • Evaluate and develop small network applications
Syllabus Contents: **Unit 1**: Introduction: Network Architecture, Performance **Unit 2**: Connecting nodes: Connecting links, Encoding, framing, Reliable transmission, Ethernet and Multiple access networks, Wireless networks **Unit 3:** Queuing models for a) one or more servers b) with infinite and finite queue size c) Infinite population Internetworking: Switching and bridging, IPv4, Addressing, Routing Protocols, Scale issues, Routers - Architecture, IPv6 **Unit 4:** End-to-End Protocols: Services, Multiplexing, De-multiplexing, UDP, TCP, RPC, RTP **Unit 5:** Congestion control and Resource Allocation Issues, Queuing disciplines, TCP congestion control, Congestion Avoidance, QoS Applications: Domain Name Resolution, File Transfer, Electronic Mail, WWW, Multimedia Applications **Unit 6**:Network monitoring – Packet sniffing tools such as Wireshark Simulations using NS2/OPNET
References: 1. Larry L. Peterson, Bruce S, Devie, "Computer Networks" , MK, 5th Edition

Course Code: MECE – 032 **Breakup: 3 – 0 – 0 – 3**
Course Name: Nanomaterials and Nanotechnology

Elective III: [MECE-032] Nanomaterials and Nanotechnology
Course Outcomes: • At the end of the course, students will be able to: • To understand the basic science behind the design and fabrication of nano scale systems. • To understand and formulate new engineering solutions for current problems and competing technologies for future applications. • To be able make inter disciplinary projects applicable to wide areas by clearing and fixing the boundaries in system development. • To gather detailed knowledge of the operation of fabrication and characterization • Devices to achieve precisely designed systems.
Syllabus Contents: **Unit 1**:Nanomaterials in one and higher dimensions, **Unit 2**: Applications of one and higher dimension nano-materials. **Unit 3**: Nano-lithography, micro electro-mechanical system (MEMS) and nano-phonics. **Unit 4**:carbon nanotubes – synthesis and applications **Unit 5**: Interdisciplinary arena of nanotechnology.
References: [1] Nanoscale Materials in Chemistry edited by Kenneth J. Klabunde and Ryan M. Richards, 2ndedn, John Wiley and Sons, 2009. [2] Nano crystalline Materials by A I Gusev and A ARempel, Cambridge International Science Publishing, 1st Indian edition by Viva Books Pvt. Ltd. 2008. [3] Springer Handbook of Nanotechnology by Bharat Bhushan, Springer, 3rdedn, 2010. [4] Carbon Nanotubes: Synthesis, Characterization and Applications by Kamal K. Kar, Research Publishing Services; 1stedn, 2011, ISBN-13: 978-9810863975.. [5] Aaron Kershenbaum, "Telecommunication Network Design Algorithms", MGH, International Edition 1993. [6] Vijay Ahuja, "Communications Network Design and Analysis of Computer Communication Networks", MGH, International Editions. [7] Douglas E. Comer, "Internetworking with TCP/IP", Pearson Education, 6th Edition

Course Code: MECE – 033 **Breakup: 3 – 0 – 0 – 3**
Course Name: Detection and Estimation Theory

Elective III: [MECE-033] Detection and Estimation Theory

Course Outcomes:

At the end of the course, students will be able to:

- Understand the mathematical background of signal detection and estimation.
- Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.
- Derive and apply filtering methods for parameter estimation.

Syllabus Contents:

Unit 1: Review of Vector Spaces: Vectors and matrices: notation and properties, orthogonally and linear independence, bases, distance properties, matrix operations, Eigen values and eigenvectors.

Unit 2: Properties of Symmetric Matrices: Diagonalizationof symmetric matrices, symmetric positive definite and semi definite matrices, principal component analysis (PCA), singular value decomposition..

Unit 3: Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

Unit 4: Detection Theory: Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes' criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters.

Unit 5: Estimation Theory: Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms..

References:

[1] 1 Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory", Prentice Hall, 1993

[2] Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: Detection Theory", 1st Edition, Prentice Hall, 1998

[3] Thomas Kailath, BabakHassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall, 2000.

[4] H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition, Springer, 1998.

Course Code: MECE – 041 **Breakup: 3 – 0 – 0 – 3**

Course Name: Advanced Digital Signal Processing

Advanced Digital Signal Processing
Course Outcomes: At the end of this course, students will be able to • To understand theory of different filters and algorithms • To understand theory of multirate DSP, solve numerical problems and write algorithms • To understand theory of prediction and solution of normal equations • To know applications of DSP at block level.
Syllabus Contents: **Unit 1** Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR. **Unit 2** Multi-rate DSP, Decimators, and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding. **Unit 3** Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.
Unit 4 Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm **Unit 5** Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum- Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation. **Unit6** Application of DSP & Multi-rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications
References: [1] J.G.Proakis and D.G.Manolakis" Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007. [2] N. J. Fliege, "Multirate Digital Signal Processing Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999. [3] Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997. [4] M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002. [5] S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001. [6] D.G. Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Course Code: MECE – 042 **Breakup: 3 – 0 – 0 – 3**
Course Name: Foundations of Machine Learning

Program Elective IV: Foundations of Machine Learning
Course Outcomes: At the end of this course, students will be able to • Apply structured thinking to unstructured problems. • Understand a very broad collection of machine learning algorithms and problems. • Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory. • Develop an appreciation for what is involved in learning from data.
Syllabus Contents: **Unit 1** Introduction Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **Unit 2** Neural Networks and Genetic Algorithms- Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evalution and Learning. **Unit 3** Bayesian and Computational Learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **Unit 4** Instant Based Learning K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning. **Unit 5** Advanced Learning Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning. "Current Streams of Thought".

References:

[1] Marco Gori, Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017
[2] Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016
[3] Ryszard, S., Michalski, J. G. Carbonell and Tom M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Volume 1, Elsevier. 2014 ,
[4] Stephen Marsland, Taylor & Francis 2009. Machine Learning: An Algorithmic Perspective.

Course Code: MECE – 043 **Breakup: 3 – 0 – 0 – 3**

Course Name: Research Methodology and IPR

Research Methodology and IPR

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about. economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for the research problem, data collection, analysis, interpretation. Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics

Unit 3: Effective technical writing, how to write a report/ Paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade, and Copyright. Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Code: MPT-01 **Breakup: 0 – 0 – 3 – 3**
Course Name: Mini Project/ Training

Mini Project
Course Outcomes: At the end of this course, students will be able to • Understand of contemporary / emerging technology for various processes and systems. • Share knowledge effectively in oral and written form and formulate documents.,
Syllabus Contents: The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class

Course Code: MECE – 201 LAB **Breakup: 0 – 0 – 3 – 2**
Course Name: Wireless and Mobile Communication Lab

MECE 201 LAB: Wireless and Mobile Communication	
Lab work : 3 hrs/week	

Course Outcomes:

At the end of this course, students will be able to

- Understanding Cellular concepts, GSM and CDMA networks
- To study GSM handset by experimentation and fault insertion techniques
- Understating of 3G communication system by means of various AT commands usage in GSM
- Understanding CDMA concept using DSSS kit
- To learn, understand and develop concepts of Software Radio in real time environment

List of Assignments:

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.
2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release, Security and Power Control, Handoff Process and types, Rake Receiver etc.
3. Study of GSM handset for various signaling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
4. To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
5. To study various GSM AT Commands their use and developing new application using it. Understating of 3G Communication System with features like; transmission of voice and
6. Video calls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.
7. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.
8. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De- Interleaver.
9. To study and analyze different modulation techniques in time and frequency domain using SDR kit.

Semester III

Course Code: MECE – 301 **Breakup: 3 – 0 – 0 – 3**
Course Name: Analog and Digital CMOS VLSI Design

Analog and Digital CMOS VLSI Design

Course Outcomes:

At the end of this course, students will be able to

- Analyze, design, optimize and simulate analog and digital circuits using CMOS constrained by the design metrics.
- Connect the individual gates to form the building blocks of a system.
- Use EDA tools like Cadence, Mentor Graphics and other open source software tools like Ngspice.

Syllabus Contents:

Technology Scaling and Road map, Scaling issues, Standard 4 mask NMOS Fabrication process

Digital CMOS Design:

Unit 1: Review: Basic MOS structure and its static behavior, Quality metrics of a digital design: Cost, Functionality, Robustness, Power, and Delay, Stick diagram and Layout, Wire delay models. Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their evaluation, Dynamic behavior, Power consumption.

Unit 2: Physical design flow: Floor planning, Placement, Routing, CTS, Power analysis and IR drop estimation-static and dynamic, ESD protection-human body model, Machine model.

Combinational logic: Static CMOS design, Logic effort, Ratioed logic, Pass transistor logic, Dynamic logic, Speed and power dissipation in dynamic logic, Cascading dynamic gates, CMOS transmission gate logic.

Unit 3: Sequential logic: Static latches and registers, Bi-stability principle, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, Concept of pipelining, Pulse registers, Non-bistable sequential circuit.

Advanced technologies: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET etc.

Analog CMOS Design:

Unit 4:Single Stage Amplifier: CS stage with resistance load, Divide connected load, Current source load, Triode load, CS stage with source degeneration, Source follower, Common-
gate stage, Cascade stage, Choice of device models. Differential Amplifiers: Basic difference pair, Common mode response, Differential pair with MOS loads, Gilbert cell.

Unit 5: Passive and active current mirrors: Basic current mirrors, Cascade mirrors, Active current mirrors. Frequency response of CS stage: Source follower, Common gate stage, Cascade
stage and difference pair, Noise

Unit 6: Operational amplifiers: One stage OPAMP, Two stage OPAMP, Gain boosting, Common mode feedback, Slew rate, PSRR, Compensation of 2 stage OPAMP, Other compensation techniques.

References:

1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd Edition.
2. Baker, Li, Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, 2nd Edition.
3. BehzadRazavi , "Design of Analog CMOS Integrated Circuits", TMH, 2007.
4. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
5. R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
6. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rdEdition.

Course Code: MECE – 051 **Breakup: 3 – 0 – 0 – 3**
Course Name: Digital Image Processing

Elective V: Digital Image Processing
Course Objectives: (CO): Objective of the course is: • Describe and explain basic principles of digital image processing. • Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement). • Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation). • Assess the performance of image processing algorithms and systems.
Course Outcomes (CO): After the completion of the course, student will be able to • Demonstrate the components of image processing • Explain various filtration techniques. • Apply image compression techniques. • Discuss the concepts of wavelet transforms. • Analyze the concept of morphological image processing.

Course Details:
UNIT I: Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. Image Enhancement Techniques: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.
UNIT II: Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.
UNIT III: Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.
UNIT IV: Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.
UNIT V: Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction, Classification; Object recognition. Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

[1] Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, (2009)

Reference Books:

[1] Digital Image Processing. John Wiley, Pratt, W. K, (2001)
[2] Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. (2009),Tata

Course Code: MECE – 052 **Breakup: 3 – 0 – 0 – 3**
Course Name: Artificial Intelligence

Elective V: Artificial Intelligence

Course Outcomes:

At the end of this course, students will be able to

- Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues
- Understanding reasoning and fuzzy logic for artificial intelligence
- Understanding game playing and natural language processing.

Syllabus Contents:

Unit 1

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate- And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means- Ends Analysis.

Unit 2

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Unit 3

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, DempsterShafer Theory

Unit 4

Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

Unit 5

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction

Unit 6

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

References:

[1] Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.

[2] Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

Course Code: MECE – 053 **Breakup: 3 – 0 – 0 – 3**

Course Name: RF and Microwave Circuit Design

Program Elective IV: RF and Microwave Circuit Design

Course Outcomes:

At the end of this course, students will be able to

- Understand the behavior of RF passive components and model active components.
- Perform transmission line analysis.
- Demonstrate use of Smith Chart for high frequency circuit design.
- Justify the choice/selection of components from the design aspects.
- Contribute in the areas of RF circuit design.

Syllabus Contents:

Unit 1: Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Unit 2: Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 3: Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Unit 4: Nonlinearity And Time VarianceInter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 5: Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, and HEMT.

Unit 6: Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

References:

[1] Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.

[2] D.M.Pozar, "Microwave engineering" ,Wiley, 4th edition, 2011.

[3] R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.

[4] G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.

[5] S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.

[6] Radmanesh, "RF and Microwave Electronics Illustrated" , Pearson Education, 2004.

Course Code: DECE – 301 **Breakup: 0 – 0 – 20 – 10**
Course Code: DECE – 401 **Breakup: 0 – 0 – 36 – 18**
Course Name: Dissertation I & II

(Dissertation) Dissertation Phase – I (DECE -301) and Phase – II (DECE -401)

Course Outcomes:

At the end of this course, students will be able to

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

- The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following
- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain The student should complete the following:
- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation
- The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:
- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics & Communication):

As per the AICTE directives, the dissertation is a year long activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

- The dissertation may be carried out preferably in-house i.e. department s laboratories and centers OR in industry allotted through department s T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred
- and reported. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed

objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.
- **During phase – II**, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work