SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with "A" Grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.
Phone: 044 - 2450 3150 / 51 / 52 / 54 / 55 Fax: 044 - 2450 2344
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BOARD OF STUDIES

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VENUE: CENTRE FOR EXCELLENCE IN EMBEDDED AND IoT
Date: 30.03.2019

Time: 3.30 PM

Minutes of Meeting

Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society.

- Dr.T,Ravi, Head Department of Electronics and Communication started the meeting by welcoming both the external and the internal numbers to the Board of Studies meeting.
- The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS.
- The external members also ratified the decision to revise the syllabus under the mentioned guidelines.
- Initial discussion was started with course outcome and it has been assessed that COs could be modified slightly and need not be confined to six in number. It can also be reduced as per the content of syllabus. All the framed COs has to be matched with the PO for attainment. Engineering Graphics, Indian culture related more courses have to be included. Reference text books and edition has to be modified. It is decided to have the electives exclusively for school of EEE. Curriculum could be restricted to 3 pages. Include standard authors in references.
- Dr.M.Sumathi presented the changes incorporated in 'Digital Logic Circuits'. Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested.
- Dr.Sivakumaran, Prof., NIT, Trichy accepted the changes proposed in 'Analog Communication' suggested by Dr.P.Chitra.

4 units and 5th unit may be taken as case studies related to the course. This would enhance the student community to have a clear picture about the course opted.

- Dr.Sivakumaran suggested that have Machine learning technique could be added as replacement of Neural and Fuzzy Logic Systems and Deep Learning algorithms as replacement of Artificial Intelligence . Dr.T.Ravi putforth the introduction of new courses such as Machine Learning, Wireless sensor network, MEMS and its Applications, Optical Networks, Python Programing and Biomedical Signal Processing.

- Dr.T.Ravi also presented the new course introduced for PG courses are Industry 4.0 and Gateway Design for IoT Devices. The Syllabus Revision carried out in PG courses is Network Oriented OS.

- Dr.Sivakumaran also suggested that replacement of Fundamentals of Fuzzy logic and neural networks for EIE and also discussed to have two units of neural network, two units of Fuzzy logic and one unit of Genetic Algorithm. Followed by his suggestion Dr.R.Ramadevi suggested the course as Soft computing Techniques.

- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering put forth about the Breakup of credits (15) for Project and Professional Training before the board of members.
- Professional Training 1, which is to be taken up at the end of 4th semester and before commencement of 5th semester would be allotted 2 credits. This credit would be reflected in 5th sem mark sheet.
- The Professional Training 2 as per Regulations 2015 would be modified as Minor Project, should be carried out during 6th semester. This would carry a credit of 3, which would be reflected in 6th semester mark sheet.
- The Phase 2 would be carried out in 8th semester, allotted a credit of 7, to be reflected in 8th semester marks sheet.

- The Phase 2 would be carried out in 8th semester, allotted a credit of 7, to be reflected in 8th semester marks sheet.
- The students would have to take seminar on a turn basis every week. The seminar would be evaluated and added with CAE1 and CAE2 marks. No credits for Placement training
- The board of members appreciated the breakup credits given for professional training and Project phase
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Mr.Barnabas, Faculty/EEE to put revision of the courses Basic Electrical and Electronics Engineering, Circuit Theory & Network Analysis. Dr.G.T.Sundar Rajan, Faculty /EEE proposed the revision of PG "Power Electronics and Drives" courses "Embedded Systems, Power Electronics in Power Systems, Special Machines and Their controller, & Modeling and Simulation in power Electronics Systems". The new syllabus presented before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Rameshbabu, Faculty/EEE to put forth the syllabus of the new courses, 'Embedded Systems and IoT' for the approval of the board. Dr. A. Amalin Prince approved the Syllabus for this new course.

The following internal members were present in the meeting.

INTERNAL MEMBERS SIGNATURE

1. Dr.N.M.Nandhitha
2. Dr.T.Ravi
3. Dr.V.Sivachidambaranathan
4. Dr.V.Vijaya Baskar
5. Dr.M.Sumathy

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6. Dr.S.Lakshmi
7. Dr.P.Chitra
8. Dr. P. Kavipriya
9. Dr.S.Barani
10. Mrs.K.Srilatha
11. Mrs.L.Magthelin Therase
12. Mrs.S.Yogalakshmi
13. Mrs.K.Sujatha
14. Dr.R.Ramadevi
15. Dr.Susitra

External Members

Dr.N.Shivakumaran
Professor
Dept. of I& C
NIT, Trichy.

30/3/19.

Dr.M.D.Selvaraj
Associate Professor
IIITDM, kancheepuram.

30/3/19.

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DNV·GL
ISO 9001

BOARD OF STUDIES

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VENUE:CENTRE FOR EXCELLENCE IN EMBEDDED AND IoT **Date: 30.11.2019**

Time: 3.30 PM

Minutes of Meeting

- Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society. The meeting was convened by the Dr.N.Shivakumaran, Prof / NIT, Trichy. The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS. The external members also ratified the decision to revise the syllabus under the mentioned guidelines. The Board discussed the matters as per the agenda.
- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr P.Chitra in the subject' Digital communication. Dr.N.Shivakumaran also accepted the inclusion of error control coding in the course.
- Dr.T.Ravi discusses the syllabus of Machine learning, Industry 4.0 are discussed with the members.
- Dr.N.Shivakumaran Suggested to include the following topics in Signal and System course such as modelling of signal, speech signal processing, analysis and modelling of system and application of Fourier Transform.
- Dr.T.Ravi also presented the new course introduced for PG courses are Advanced Wireless Sensor Networks and Security in IoT.
- The Syllabus Revision carried out in PG courses is SCADA System Application.
- Dr M D Selvaraj suggested to Remove first unit in Digital Signal Processing course and include DSP processor in the fifth unit. Since first unit is the review of signals and system and to include industrial topic. Include Signal Conditioning, generation and detection for real time applications, DSP Hardwares, FPGA, ARM Processor with DSP Extension in Digital Signal Processing.

- Dr M D Selvaraj Suggested to update the fifth unit of programming in HDL with FPGA Design Flow , Architecture of Xilinx Artix7 FPGA , Configurable Logic Blocks (CLB),
- Dr.N.Shivakumaran Suggested to include applications in FPGA and Case Study: study of protocols I2C, SPI and UART in microprocessor and microcontroller course.
- Dr.T.Ravi put forth the new courses introduced such as Artificial Intelligence, Rf IC Design, Soft Computing Techniques and Cryptography and Network security
- Dr.R.Ramadevi proposed the introduction of new Elective 'Instrumentation in Aerospace and Navigation'. Dr.Sivakumaran suggested to incorporate more topics related to instrumentation.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Susitra, Faculty/EEE to put forth revision of the course DC Machines and Transformer and Digital Signal Processing and its Applications. The new syllabus presented before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Rameshbabu, Faculty/EEE to put forth the syllabus of the new courses, 'Computer Aided Electrical Drawing' for the approval of the board. Dr. A. Amalin Prince approved the Syllabus for this new course.

The next BOS meeting may be scheduled on April 2020 to review and finalize the syllabus revision process.

Faculty Head, Dr. T.Ravi proposed vote of thanks and the Board of Meeting ended by 4.30 PM on 30.11.2019.

The following internal members were present in the meeting.

INTERNAL MEMBERS	SIGNATURE
1. Dr.N.M.Nandhitha	
2. Dr.T.Ravi	

3. Dr.V.Sivachidambaranathan
4. Dr.V.Vijaya Baskar
5. Dr.M.Sumathy
6. Dr.S.Lakshmi
7. Dr.P.Chitra
8. Dr. P. Kavipriya
9. Dr.S.Barani
10. Mrs.K.Srilatha
11. Mrs.L.Magthelin Therase
12. Mrs.S.Yogalakshmi
13. Mrs.K.Sujatha
14. Dr.R.Ramadevi
15. Dr.Susitra

External Members

Dr.N.Shivakumaran
Professor
Dept. of I& C
NIT, Trichy.

30/11/19

Dr.M.D.Selvaraj
Associate Professor
IIITDM, kancheepuram.

30/11/19.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NEW COURSES(2019-2020)

SL.NO	COURSE CODE	COURSE NAME
1.	SAIC4001	INDUSTRY 4.0
2.	SECA3001	CRYPTOGRAPHY AND NETWORK SECURITY
3.	SECA3005	BIOMEDICAL SIGNAL PROCESSING
4.	SECA3007	MEMS AND ITS APPLICATIONS
5.	SECA3008	WIRELESS SENSOR NETWORKS
6.	SECA3010	RF IC DESIGN
7.	SECA3011	ARTIFICIAL INTELLIGENCE
8.	SECA3017	OPTICAL NETWORKS
9.	SEIA3004	SOFT COMPUTING TECHNIQUES
10.	SCSA1601	MACHINE LEARNING
11.	SCSA1102	PYTHON PROGRAMMING

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	0	0	2	100

UNIT 1 ADVANCED TECHNOLOGY AND MATERIALS **7 Hrs.**

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING **7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics - Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Case studies - Intellectual Property rights infringement in Biology.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT **7 Hrs.**

Introduction - Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) - Unmanned Aerial Vehicles, sensors - Additive manufacturing in construction - Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal, public health issues-improving water management in surface and overhead irrigation- Integration of energy, water and environmental systems for a sustainable development.

UNIT 4 SMART MANUFACTURING **8 Hrs.**

Smart factories and interconnection, Smart Manufacturing - automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones - unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots - Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies - Frugal Innovations - Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD **8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS **8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS

1. William D. Callister,"Materials Science and Engineering, An Introduction", John Willey and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice", Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103,pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 11 Questions of 2 marks each-No choice **22 Marks**

PART B: 2 Questions from each unit with internal choice; each carrying 13 marks **78 Marks**

SECA3001	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand OSI security architecture and classical encryption techniques.
- Acquire fundamental knowledge on the concepts of finite fields and number theory.
- Understand various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.
- To provide basic concept of network and security system.

UNIT 1 FUNDAMENTALS **9 Hrs.**

The OSI security architecture-Network security model-Principles of Security - Confidentiality, Authentication, Integrity, Nonrepudiation, Access Control, Availability: Types of Attacks - Active and Passive: Classical Encryption Techniques: Substitution Cipher - Caesar Cipher, Play Fair Cipher, Hill cipher, One Time Pad: Transposition Cipher - Rail Fence and Simple Columnar Techniques.

UNIT 2 SYMMETRIC KEY CRYPTOGRAPHY **9 Hrs.**

Symmetric Key Cryptosystems: Comparison of Stream Ciphers and Block Ciphers: Feistel Block Cipher: Block Cipher Modes of Operation: Data Encryption Standard - Details of one round in DES: Advanced Encryption Standard.

UNIT 3 PUBLIC KEY CRYPTOGRAPHY **9 Hrs.**

Modular Arithmetic: Euclidean Algorithm: Fermat's and Euler's Theorem; Chinese Remainder Theorem: Principles of Public Key Cryptosystems; Key Management - Distribution of Public Keys, Use of Public Key Encryption to Distribute Secret Keys: RSA Algorithm, Diffie-Hellman Key Exchange; Concepts of Elliptic Curve Cryptography.

UNIT 4 SECURITY FUNCTIONS AND APPLICATIONS **9 Hrs.**

Authentication Requirements: Message Authentication Codes - Requirements for MAC, Basic Uses of MAC:Hash Functions HMAC - Requirements for a Hash function, MD-5 SHA 1 Kerberos: X.509 Authentication Service - Certificate: E-Mail Security - Pretty good Privacy, S/MIME.

UNIT 5 NETWORK AND SYSTEM SECURITY **9 Hrs.**

IP Security - IP Security Architecture, Authentication Header, Encapsulating Security Payload, Benefits, Applications; Web Security - Secure Socket Layer, Secure Electronic Transaction -SSL Vs SET,Firewalls -Design Principles, Characteristics, Types of Firewalls: Virus and Antivirus approaches.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
CO2 - Identify the security issues in the network and resolve it.
CO3 - Evaluate security mechanisms using rigorous approaches, including theoretical.
CO4 - Compare and Contrast different IEEE standards and electronic mail security.
CO5 - Understand the various symmetric key cryptographic techniques.
CO6 - Apply the various cryptographic algorithm for emails and web security.

TEXT / REFERENCE BOOKS

1. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill Education Pvt.Ltd., New Delhi, 2011.
2. William Stallings, "Cryptography and Network Security - Principles and Practices", 4th Edition, Prentice-Hall of India Pvt.Ltd., New Delhi, 2006.
3. Behrouz A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
4. Niels Ferguson and Bruce Schneier, "Practical Cryptography", John Wiley and Sons, 2003.
5. Niels Ferguson, Bruce Schneier, Tadayoshi Kohno, "Cryptography Engineering- Design Principles and PracticalApplications", Wiley Publishing, Inc, Indiana, 2010.
6. Douglas R Simson "Cryptography - Theory and practice", 1st Edition, CRC Press, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SECA3005	BIOMEDICAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and gain complete knowledge about the fundamentals of biomedical signal processing.
- To develop a theoretical foundation of biomedical signal processing techniques.
- To provide analytic skills to process the ECG and EEG.

UNIT 1 INTRODUCTION **9 Hrs.**

Biomedical Signals - Sources, Properties, Objectives and Difficulties in Biomedical Signal Analysis, Filtering for removal of artifacts - Time domain filters, Frequency domain filters, Optimal filtering.

UNIT 2 MODELLING BIOMEDICAL SYSTEMS **9 Hrs.**

Pont process, Parametric System Modeling, All Pole Modeling, Pole-Zero Modeling, Spectral Modeling, Applications.

UNIT 3 NEUROLOGICAL SIGNAL PROCESSING **9 Hrs.**

The Brain and its potentials; The Electrophysiology origin of brain waves; the EEG Signal and its characteristics; EEG analysis; Statistical parameter mapping of EEG signal; Linear prediction theory; The autoregressive (AR) method; Wiener filtering problem; Principle of an adaptive filter; Steepest - descent algorithm; Windrow-hoff least -mean-square adaptive algorithm.

UNIT 4 CARDIOLOGICAL SIGNAL PROCESSING **9 Hrs.**

Basic electrocardiography; ECG data acquisition; ECG lead system; ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms, Adaptive noise canceller; Long term continuous ECG recording; The wavelet approximation - Discrete wavelet transform (DWT); Multi-resolution analysis; Pyramid algorithm.

UNIT 5 HRV AND ARRHYTHMIA ANALYSIS **9 Hrs.**

Heart Rate variability; comparison of short-term and long term HRV analysis; Time domain and spectral domain parameters of short term recording.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of biomedical signal processing and filters in time domain and frequency domain.
- CO2 - Model the biomedical systems.
- CO3 - Analyze EEG signals.
- CO4 - Analyze ECG signals.
- CO5 - Apply various algorithms for HRV and Arrhythmia analysis.
- CO6 - Apply the knowledge gained to model, analyse and predict various pathological conditions.

TEXT / REFERENCE BOOKS

1. Rangaraj M.Rangayyan, “Biomedical Signal Analysis”, Wiley, 2015
2. Kayvan Najarian and Robert Splinter, “Biomedical Signal and Image Processing”, 2nd Edition, CRC Press, 2012.
3. Reddy D C. “Modern Biomedical Signal Processing - Principles and Techniques”, TMH, New Delhi, 2005.
4. Arnon Cohen “Biomedical Signal Processing” Crc Pr I Llc; 2nd Edition, May, 2002.
5. Tompkins W J “Biomedical Signal Processing”, Prentice hall of India, New Delhi, 1999.
6. Bronzino J D “The Biomedical Engineering handbook”, CRC and Free press, Florida, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SECA3007	MEMS AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To have adequate knowledge in MEMS and Microsystems.
- To understand the fabrication procedures and have knowledge on MEMS sensors and actuators and their applications.
- To be made aware of the MEMS design procedures and RFMEMS.
- To investigate various applications of MEMS.

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS 9 Hrs.

Definition - historical development - Fundamentals - Properties, Introduction to Design of MEMS and NEMS, MEMS ,Microsystems microelectronics, miniaturization, Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics, MEMS materials: Silicon, silicon compounds, polymers, metals.

UNIT 2 MEMS FABRICATION 9 Hrs.

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology.

UNIT 3 MICROSENSORS AND ACTUATORS 9 Hrs.

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors Vibratory gyroscope, Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Case study-Piezo-resistive pressure sensor, Comb drive actuators.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS 9 Hrs.

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS,- System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes - Design basics, case study - Capacitive RF MEMS switch, Performance issues.

UNIT 5 MEMS PACKAGING AND APPLICATIONS 9 Hrs.

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micromachined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS. Recent trends in MEMS.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basics of MEMS technology and microsystems.
CO2 - Acquire knowledge in the types and procedures involved in MEMS fabrication.
CO3 - Apply the acquired knowledge in understanding MEMS sensors and actuators.
CO4 - Analyse various MEMS design and familiarise with optical RF MEMS.
CO5 - Investigate various applications of MEMS.
CO6 - Develop real time MEMS based devices.

TEXT / REFERENCE BOOKS

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose , “RF MEMS & Their Applications”, John Wiley & Sons, 2003.
2. Tai - Rai Hsu, “MEMS and Microsystems Design and Manufacturing”, Tata MC Graw Hill, New Delhi, Edition 2002.
3. Gabriel M Rebeiz, “RF MEMS - Theory Design and Technology”, John Wiley and Sons, 2003.
4. Nadim Maluf, “An introduction to Micro electro mechanical system design”, Artech House ,2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SECA3008	WIRELESS SENSOR NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of wireless sensor networks, Mobile Adhoc Networks.
- To study about localization and routing protocols.
- To learn the concepts of data management.
- To acquire the knowledge of operating systems and infrastructure establishment in wireless networks.

UNIT 1 INTRODUCTION TO SENSOR NETWORKS 9 Hrs.

Introduction to Sensor Networks, unique constraints and challenges in WSN, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Design principles for WSNs.

UNIT 2 LOCALIZATION AND ROUTING 9 Hrs.

Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, selfconfiguring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MACProtocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

UNIT 3 DATA MANAGEMENT AND MANIPULATION 9 Hrs.

Storage and retrieval in network, compression technologies for WSN, Data aggregation technique, Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Directed Diffusion, Tiny aggregation, greedy aggregation, security in WSN.

UNIT 4 OPERATING SYSTEMS FOR WIRELESS NETWORKS 9 Hrs.

Introduction - Operating System Design Issues - Examples of Operating Systems - TinyOS - Mate - MagnetOS - MANTIS - OSPM - EYES OS - SenOS - EMERALDS - PicOS - Introduction to Tiny OS - NesC - Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

UNIT 5 INFRASTRUCTURE ESTABLISHMENT 9 Hrs.

Topology Control, controlling topology in flat networks, Hierarchical networks, Clustering, Time Synchronization, Sensor Tasking and control.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the concepts of Wireless sensor networks and MANET.
CO2 - Categorize the Localization Techniques and Routing Techniques.
CO3 - Store and retrieve the data management systems.
CO4 - Identify the basic types and detail of data aggregation.
CO5 - Know the Implementation of wireless networks using various operating systems.
CO6 - Study about the infrastructure establishment of wireless sensor networks.

TEXT / REFERENCE BOOKS

1. HolgerKerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", JohnWiley and Sons, 2005 (ISBN:978-0-470-09511-9).
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network",Springer 1st Edition. 2004 (ISBN:978-4020-7883-5).
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Edition. 2004 (ISBN: 13- 978-1-55860-914-3).
4. Kazem, Sohraby, Daniel Minoli, TaiebZanti, "Wireless Sensor Network: Technology, Protocolsand Application", John Wiley and Sons 1st Edition., 2007 (ISBN: 978-0-471-74300-2).
5. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press.
6. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

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BOARD OF STUDIES
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VENUE:CENTRE FOR EXCELLENCE IN EMBEDDED AND IoT **Date: 30.11.2019**
Time: 3.30 PM

Minutes of Meeting

- Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society. The meeting was convened by the Dr.N.Shivakumaran, Prof / NIT, Trichy. The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS. The external members also ratified the decision to revise the syllabus under the mentioned guidelines. The Board discussed the matters as per the agenda.
- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr P.Chitra in the subject' Digital communication. Dr.N.Shivakumaran also accepted the inclusion of error control coding in the course.
- Dr.T.Ravi discusses the syllabus of Machine learning, Industry 4.0 are discussed with the members.
- Dr.N.Shivakumaran Suggested to include the following topics in Signal and System course such as modelling of signal, speech signal processing, analysis and modelling of system and application of Fourier Transform.
- Dr M D Selvaraj suggested to Remove first unit in Digital Signal Processing course and include DSP processor in the fifth unit. Since first unit is the review of signals and system and to include industrial topic. Include Signal Conditioning, generation and detection for real time applications, DSP Hardwares, FPGA, ARM Processor with DSP Extension in Digital Signal Processing.
- Dr M D Selvaraj Suggested to update the fifth unit of programming in HDL with FPGA Design Flow , Architecture of Xilinx Artix7 FPGA , Configurable Logic Blocks (CLB),
- Dr.N.Shivakumaran Suggested to include applications in FPGA and Case Study: study of protocols I2C, SPI and UART in microprocessor and microcontroller course.
- Dr.T.Ravi put forth the new courses introduced such as Artificial Intelligence, Rf IC Design, Soft Computing Techniques and Cryptography and Network security

The next BOS meeting may be scheduled on April 2020 to review and finalize the syllabus revision process.

Faculty Head, Dr. T.Ravi proposed vote of thanks and the Board of Meeting ended by 4.30 PM on 30.11.2019.

The following internal members were present in the meeting.

Internal Members

1. Dr.N.M.Nandhitha
2. Dr.T.Ravi
3. Dr.M.Sumathy
4. Dr.M.R Jebarani
5. Dr.S.Lakshmi
6. Dr.P.Chitra
7. Dr.P.Kavipriya
8. Dr.S.Barani
9. Ms.Annadevi
10. M.G.Yogalakshmi

External Members

Dr.N.Shivakumaran
Professor
Dept. of I& C
NIT, Trichy

Dr.M.D.Selvaraj
Associate Professor
IIITDM, kancheepuram.

SECA3010	RF IC DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with the behaviour of passive and active electronic components at Radio frequencies.
- To familiarize on the principle of operation of various building blocks of RF transceivers.
- To understand the functional design aspects of LNAs , Mixers and VCO and Cadence simulation tools.

UNIT 1 RF BEHAVIOUR OF PASSIVE ELECTRONCIC COMPONENTS 9 Hrs.

Introduction to Radio frequency models of resistors, capacitors and Inductors. Integrated inductors, resistors, Capacitors, tunable inductors and transformers. Design of RF lumped element lowpass and high pass filters -Introduction to Richards Transformations and Kuroda Identities (definition only)-Design of stepped impedance distributed element lowpass and high pass filters.

UNIT 2 BJT AND MOSFET BEHAVIOR AT RF FREQUENCIES 9 Hrs.

BJT and MOSFET modeling at low frequency and radio frequencies. Radio frequency SPICE models of BJT and MOSFETs. Noise performance and limitations of MOSFETs-Introduction to Cadence Simulation tool.

UNIT 3 INTRODUCTION TO TRANSCEIVER ARCHITECTURES 9 Hrs.

RF Receiver (front end) Architectures- Basic and Modern Heterodyne Receiver - Direct-Conversion Receiver - Low-IF Receiver - Transmitter Architectures - Direct-Conversion Transmitters and Heterodyne Transmitters.

UNIT 4 RF CMOS AMPLIFIERS 9 Hrs.

RF Amplifier Parameters-Low noise Amplifier (LNA) topologies- Design aspects of Common gate (CG) and Common Source CMOS LNA- Introduction to CMOS RF Power Amplifier Design.

UNIT 5 RF CMOS MIXERs AND VCOs 9 Hrs.

Introduction to Frequency Mixer and its parameters-single balanced and double balanced active Mixer- Gilbert Mixer Circuit-Basics of Voltage Controlled Oscillators(VCO)- VCO using MOS varactors- Design of LC VCOs.

Introduction to Frequency Mixer and its parameters-single balanced and double balanced active Mixer- Gilbert Mixer Circuit-Basics of Voltage Controlled Oscillators(VCO)- VCO using MOS varactors- Design of LC VCOs.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand a range of technologies used for passive and active RF circuit implementation.
CO2 - Understand the principle of operations of Transceiver Systems, noise, linearity, etc.
CO3 - Analyse and design CMOS low noise amplifiers and RF Power Amplifiers.
CO4 - Analyse and design frequency mixers.
CO5 - Analyse and design voltage controlled oscillators.
CO6 - Apply Cadence simulation tools to design and analyze RF circuits.

TEXT / REFERENCE BOOKS

1. B.Razavi ,"RF Microelectronics" , 2nd Edition, Prentice-Hall ,2011.
2. Bosco H Leung "VLSI for Wireless Communication", 2nd Edition, Springer, 2011.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" 2nd Edition, McGraw-Hill, 2017.
4. Jia-sheng Hong, "Microstrip filters for RF/Microwave applications", Wiley, 2nd Edition, 2011.
5. Thomas H.Lee, "The Design of CMOS Radio -Frequency Integrated Circuits", 2nd Edition, Cambridge University Press, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SECA3011	ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of Intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To know about the various applications of AI.

UNIT 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9 Hrs.

Introduction-Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents-Typical Intelligent Agents - Problem Solving Approach to Typical AI problems.

UNIT 2 PROBLEM SOLVING METHODS 9 Hrs.

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems - Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games - Alpha - Beta Pruning - Stochastic Games.

UNIT 3 KNOWLEDGE REPRESENTATION 9 Hrs.

First Order Predicate Logic - Prolog Programming - Unification - Forward Chaining-Backward Chaining - Resolution - Knowledge Representation - Ontological Engineering-Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT 4 SOFTWARE AGENTS 9 Hrs.

Architecture for Intelligent Agents - Agent communication - Negotiation and Bargaining - Argumentation among Agents - Trust and Reputation in Multi-agent systems.

UNIT 5 APPLICATIONS 9 Hrs.

AI applications - Language Models - Information Retrieval- Information Extraction - Natural Language Processing - Machine Translation – Speech Recognition.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the principles of Artificial Intelligence.
CO2 - Use appropriate search algorithms for any AI problem.
CO3 - Represent a problem using first order and predicate logic.
CO4 - Provide the apt agent strategy to solve a given problem.
CO5 - Design software agents to solve a problem.
CO6 - Design applications for NLP that use Artificial Intelligence.

TEXT / REFERENCE BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2009.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; 1st Edition, 2008.
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", 5th Edition, Springer, 2003.
5. Gerhard Weiss, "Multi Agent Systems", 2nd Edition, MIT Press, 2013.
6. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PARTA : 10 Questions of 2 marks each - No choice **20 Marks.**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks.**

SECA3017	OPTICAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with basic optical communication components, topologies and types of networks.
- To familiarize on the principle of optical amplification and coupling.
- To make the students knowledgeable of various optical network topologies operations, limitations and its practical applications.
- To understand the choice of networks in optical communication.

UNIT 1 INTRODUCTION TO OPTICAL FIBRE 9 Hrs.

Ray diagram, different types of optical fibre, step index, graded index. Mode Cut-Off wavelength, Mode-field Diameter, Equivalent Step-Index (ESI) Profile, Dispersion Measurements, Mechanical Strength of Optical Fibre. WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network, OFDM.

UNIT 2 OPTICAL NETWORKING COMPONENTS / BUILDING BLOCKS 9 Hrs.

Advantages of optical network, telecom network overview and architecture, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network. Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodectors, tunable and fixed optical filters, channel equalizers, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, various Switching elements, OADM, OXC, CLOS architecture, MEMS, wavelength convertors.

UNIT 3 NETWORK TOPOLOGIES 9 Hrs.

Robust networks, Line and path protection switching, Types of topology, Point to point topology, bi-directional line-switched ring (BLSR), meshed topology, Passive optical networks, Metro optical networks 28 MPLS and Optical Networks: IS label switching, Forwarding equivalence class (FEC), Types of MPLS nodes, Label distribution and binding, label swapping and traffic forwarding, MPLS support of Virtual Private Networks (VPN), MPLS traffic engineering, Multi-protocol Lambda switching (MPIS).

UNIT 4 SINGLE AND MULTIHOP NETWORKS 9 Hrs.

Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks, Experimental single hop networks: LAMBDANET, STARNET, SONATA, Rainbow, experimental multi-hop networks: Shuffle net, De Bruijn Graph, Hypercube.

UNIT 5 OPTICAL ACCESS AND METRO NETWORK 9 Hrs.

Introduction to access network, PON, EPON and WDN EPON: overview, principal of operation, architecture; dynamic wavelength allocation, STARGATE: overview, need, architecture, operation and application, gigabit Ethernet, radio over fiber network. Introduction to metro network, overview of traffic grooming in SONET ring, traffic grooming in WDM ring, Interconnected WDM networks, packet communication using tunable WADM, RINGOSTAR: architecture, proxy stripping, protect oration and network lifetime.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Identify the various causes for signal degradation and estimate the different types of losses occurring in transmission of energy.
CO2 - Illustrate the necessity of using couplers and connectors in energy transmission.
CO3 - Explain the Wavelength Division Multiplexing. (WDM) principles and concepts and apply the principles to advanced devices.
CO4 - Analyse the optical communication link using various types of network topologies.
CO5 - Evaluate the dynamic wavelength allocation for Access networks.
CO6 - Perform characteristics of optical metro networks like SONET ring and RINGOSTAR.

TEXT/REFERENCE BOOKS

1. Olivier Bouchet, HerveSizun, Christian Boisrobert and Frederique De Forne, "Free-Space Optics: Propagation and Communication", John Wiley and Sons, 2010.
2. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks - Practical Perspective", 3rd Edition, Morgan - Kaufmann Publishers.
3. Larry Peterson and Bruce Davie, "Computer Networks, A Systems Approach", 5th Edition, 2011, Morgan Kaufmann.
4. B. Mukherjee, "Optical WDM Networks," Springer, 2006.
5. R. C. Sivamurthy, G. Mohan, "WDM Optical Networks: Concepts, Design And Algorithms," PHI Learning Pvt Ltd, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2marks each-No choice **20 Marks**

PARTB: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SEIA3004	SOFT COMPUTING TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the key aspects of Neural networks, Fuzzy logic components and building block hypothesis of Genetic algorithm.
- To adopt these techniques in solving problems in the real world.

UNIT 1 INTRODUCTION TO SOFT COMPUTING AND ARTIFICIAL NEURAL NETWORKS 9 Hrs.

Evolution of Computing - Soft Computing Constituents - From Conventional AI to Computational Intelligence - Machine Learning Basics, Fundamentals of ANN - Biological Neurons and Their Artificial Models - Types of ANN - Properties - Different Learning Rules - Types of Activation Functions - Training of ANN - Hebb learning - Perceptron Model (Both Single and Multi Layer) - Training Algorithm - Problems Solving Using Learning Rules and Algorithms - Linear Separability - Limitation.

UNIT 2 DETERMINISTIC AND STATISTICAL NETWORKS 9 Hrs.

Back Propagation Training Algorithm - Practical Difficulties - Counter Propagation Network - Structure & Operation - Training of Kohonen and Grossberg Layer - Applications of BPN & CPN - Statistical Method - Training Application - Boltzman Training - Cauchy Training - Hop Field Network and Boltzman Machine - Speed Energy Function - Network Capacity - RBF Network, BAM, Architecture of SOM, ANN based water level controller.

UNIT 3 FUZZY LOGIC 9 Hrs.

Introduction to Fuzzy Set Theory - Basic Concepts of Fuzzy Sets - Classical Set Vs Fuzzy Set - Properties of Fuzzy Set - Fuzzy Logic Operation on Fuzzy Sets - Fuzzy Logic Control Principles - Fuzzy Relations - Fuzzy Rules - Defuzzification - Fuzzy Inference Systems - Fuzzy Expert Systems - Fuzzy Decision Making.

UNIT 4 FUZZY LOGIC CONTROLLER & ITS APPLICATION 9 Hrs.

Fuzzy Logic Controller - Fuzzification Interface - Knowledge Base- Decision Making Logic - Defuzzification Interface- Application of Fuzzy Logic to Water Level Controller - Temperature Controller - Control of Blood Pressure during Anaesthesia.Introduction to Neuro - Fuzzy Systems - Fuzzy System Design Procedures - Fuzzy Sets and Logic Background - Fuzzy / ANN Design and Implementation.

UNIT 5 GENETIC ALGORITHMS 9 Hrs.

Introduction - Robustness of Traditional Optimization and Search Techniques - The goals of optimization - Survival of the Fittest - Fitness Computations - Cross over - Mutation -Reproduction- Rank method- Rank space method.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of this course, student will be able to

CO1 - Understand the concept of ANN, Fuzzy Logic, Genetic Algorithm.
CO2 - Illustrate the types of ANN, fuzzification and defuzzifiction techniques.
CO3 - Select the appropriate techniques for applications.
CO4 - Compare the different techniques.
CO5 - Judge the various techniques in different types of applications.
CO6 - Plan for implementation of ANN, FL, GA based control.

TEXT / REFERENCE BOOKS

1. Laurene Fausett, " Fundamentals of Neural Networks: Architectures, Algorithms and Applications" 2008.
2. Timothy J. Ross , “Fuzzy Logic with Engineering Applications”, McGraw - Hill International Editions,2004.
3. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and soft computing", Pearson Education,2003.
4. Rajasekaran. S, Pai. G.A.V. “Neural Networks, Fuzzy Logic and Genetic Algorithms”, Prentice Hall of India, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each-No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SCSA1601	MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the construction and study of algorithms that can learn from data.
- To emphasize on the logical, knowledge-based approach.
- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

UNIT 1 INTRODUCTION TO MACHINE LEARNING 9 Hrs.

Machine learning - examples of machine learning applications - Learning associations - Classification -Regression - Unsupervised learning - Supervised Learning - Learning class from examples - PAC learning -Noise, model selection and generalization - Dimension of supervised machine learning algorithm.

UNIT 2 DECISION THEORY 9 Hrs.

Bayesian Decision Theory- Introduction- Classification - Discriminant function-Bayesian networks-Association rule - Parametric Methods - Introduction - Estimation -Multivariate methods-Data Parameter estimation-Dimensionality Reduction- PCA-Linear discriminant analysis.

UNIT 3 CLUSTERING & REGRESSION 9 Hrs.

Clustering - Mixture densities - k-means clustering - Supervised Learning after clustering - Hierarchical clustering - Nonparametric Methods - Density estimation - Generalization of multivariate data - Smoothing models -Decision Trees - Univariate trees - Multivariate trees - Learning rules from data - Linear Discrimination-Gradient Descent

UNIT 4 MULTILAYER PERCEPTRONS 9 Hrs.

Structure of brain - Neural networks as a parallel processing - Perceptron - Multilayer perceptron - Back propagation - Training procedures - Tuning the network size - Learning time.

UNIT 5 LOCAL MODELS 9 Hrs.

Competitive learning - Adaptive resonance theory - Self organizing map -Radial Basis functions - Bagging- Boosting- Reinforcement Learning.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand complexity of Machine Learning algorithms and their limitations;
CO2 - Understand modern notions in data analysis oriented computing;
CO3 - Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
CO4 - Be capable of performing distributed computations;
CO5 - Can demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO6 - Gain ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems

TEXT / REFERENCE BOOKS

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, 2004.
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997.
3. Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 12 marks **80 Marks**

SCSA1102	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION **9 Hrs.**

History of Python- Introduction to the IDLE interpreter (shell) -Expressions - Data Types - Built-in function - Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements - Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING , MODULES, PACKAGES **9 Hrs.**

File Operations -Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT 3 GUI PROGRAMMING **9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts - Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK **9 Hrs.**

Database (using NoSQL): Connector Module -Cursor - Statements - Exceptions in database.
Network connectivity: Socket module - Client - Server - Email - URL Access.

UNIT 5 CASE STUDY **9 Hrs.**

Web Programming using Python Image Processing - Facebook Analysis - Twitter Analysis.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
CO2 - Do the decision Making and write functions in Python.
CO3 - Explain how to design GUI Applications in Python and evaluate different database operations.
CO4 - Design and develop Client Server network applications using Python.
CO5 - Ability to design real life situational problems and think creatively about solutions of them.
CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT BOOKS / REFERENCES

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science Using Python 3", Pragmatic Bookshelf, 2nd Edition, 2014.
3. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 12 marks **80 Marks**