

PROGRAMME: B.E.
ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1101	Engineering Mathematics - I	3	*	0	3	50	50	1
2	Theory	SPHA1101	Physics for Engineers	3	1	0	4	50	50	2
3	Theory	SEEA1101	Electrical Technology	3	*	0	3	50	50	4
4	Theory	SCSA1202	Programming in C and C++	3	0	0	3	50	50	5
5	Theory	SECA1101	Electronic Devices	3	0	0	3	50	50	6
6	Theory	SMEA1102	Engineering Drawing	1	0	4	3	50	50	7
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	8
8	Practical	SEEA2101	Electrical Engineering Lab	0	0	4	2	50	50	9
9	Practical	SECA2101	Electronic Devices Lab	0	0	4	2	50	50	10
Total Credits for Semester 1 - 24										
Total Marks for Semester 1 - 850										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SHSA1101	Technical English	3	0	0	3	50	50	11
2	Theory	SMTA1201	Engineering Mathematics - II	3	*	0	3	50	50	14
3	Theory	SCYA1101	Engineering Chemistry	3	1	0	4	50	50	15
4	Theory	SCSA1203	Data structures	3	0	0	3	50	50	17
5	Theory	SBTA1101	Environmental Science and Engineering	2	0	0	-	-	-	18
6	Theory	SECA1201	Digital Logic Circuits	3	0	0	3	50	50	19
7	Practical	SCYA 2101	Engineering Chemistry Lab	0	0	2	1	25	25	20
8	Practical	SCSA2202	Programming in C & Data Structures Lab	0	0	4	2	50	50	21
Total Credits for Semester 2 - 19										
Total Marks for Semester 2 - 650										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1301	Engineering Mathematics - III	3	*	0	3	50	50	22
2	Theory	SEEA1304	Electrical Circuits and Network Analysis	3	*	0	3	50	50	23
3	Theory	SECA1301	Signals and Systems	3	0	0	3	50	50	24
4	Theory	SECA1307	Electronic Circuits - I	3	*	0	3	50	50	26
5	Theory	SEEA1302	Electromagnetic Theory	3	*	0	3	50	50	27
6	Theory	SECA1303	Analog Communication	3	0	0	3	50	50	28
7	Practical	SECA2301	Circuits and Networks Lab	0	0	4	2	50	50	30
8	Practical	SECA2302	Electronic Circuits - I Lab	0	0	4	2	50	50	31
9	Project	S13ADPROJ	Design Thinking				2		100	32
Total Credits for Semester 3 - 24										
Total Marks for Semester 3 - 900										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1401	Engineering Mathematics - IV	3	*	0	3	50	50	32
2	Theory	SECA1401	Electronic Circuits - II	3	*	0	3	50	50	33
3	Theory	SECA1402	Transmission Lines and Wave guides	3	*	0	3	50	50	34
4	Theory	SECA1403	Digital Communication	3	0	0	3	50	50	35
5	Theory		Professional Elective - I	3	0	0	3	50	50	
6	Theory	SAIC4001 / SECA1406	Industry 4.0 Industry 5.0 for Electronics Engineers (From 2020 Batch Onwards)	2	0	0	2	50	50	36
7	Practical	SECA2401	Electronic Circuits - II Lab	0	0	4	2	50	50	37
8	Practical	SECA2402	Communication Engineering Lab	0	0	4	2	50	50	38
9	Theory	SAIC4003	Universal Human Values	2	1	0			100	
Total Credits for Semester 4 - 23										
Total Marks for Semester 4 - 900										

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CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1506	Digital Signal Processing	3	*	0	3	50	50	39
2	Theory	SECA1502	Analog Integrated Circuits	3	0	0	3	50	50	40
3	Theory	SECA1503	CMOS VLSI Design	3	0	0	3	50	50	41
4	Theory	SECA1505	Antennas and Wave Propagation	3	*	0	3	50	50	42
5	Theory		Open Elective I	3	0	0	3	50	50	
6	Theory	SEEA1502	Control Systems	3	*	0	3	50	50	43
7	Practical	SECA2501	Digital Signal Processing Lab	0	0	4	2	50	50	44
8	Practical	SECA2502	Analog Integrated Circuits Lab	0	0	4	2	50	50	45
9	Practical	S13APT	Professional Training	0	0	4	2	50	50	
10	Project	S13AEPICS	Engineering Projects in Community Service						100	
Total Credits for Semester 5 - 24										
Total Marks for Semester 5 - 900										

SEMESTER 6										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1601	Microprocessors and Microcontrollers	3	0	0	3	50	50	46
2	Theory	SECA1605	Programming in HDL	3	0	0	3	50	50	47
3	Theory	SECA1606	Embedded Systems	3	0	0	3	50	50	48
4	Theory	SECA1604	Computer Networks	3	0	0	3	50	50	49
5	Theory		Open Elective - II	3	0	0	3	50	50	
6	Practical	SECA2601	Microprocessor and Microcontroller Lab	0	0	4	2	50	50	51
7	Practical	SECA2602	VLSI Design Lab	0	0	4	2	50	50	52
8	Project	S13AIPROJ	Interdisciplinary Project	0	0	6	3	50	50	
Total Credits for Semester 6 - 22										
Total Marks for Semester 6 - 800										

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CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 7										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1701	Microwave and Optical Communication	3	0	0	3	50	50	53
2	Theory	SECA1704	Contemporary Wireless Communication	3	0	0	3	50	50	55
3	Theory	SECA1703	Internet of Things	3	0	0	3	50	50	56
4	Theory		Professional Elective II	3	0	0	3	50	50	
5	Theory		Open Elective III	3	0	0	3	50	50	
6	Practical	SECA2701	Microwave and Optical Lab	0	0	4	2	50	50	57
7	Project	S13APROJ1	Project Work (Phase - I)	0	0	6	3	50	50	
Total Credits for Semester 7 - 20										
Total Marks for Semester 7 - 700										

SEMESTER 8										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	58
2	Theory		Professional Elective III	3	0	0	3	50	50	
3	Project	S13APROJ2	Project Work (Phase - II)	0	0	14	7	50	50	
Total Credits for Semester 8 - 13										
Total Marks for Semester 8 - 300										

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CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	6	19	600	3	5	250
2	6	16	600	2	3	150
3	6	18	600	3	6	300
4	7	19	700	2	4	200
5	6	18	600	4	8	400
6	5	15	500	3	7	300
7	5	15	500	2	5	200
8	2	6	200	1	7	100
Overall Total	42	126	4300	18	45	1900

Overall total credits for B.E ECE	169
Overall total marks for B.E ECE	6200

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CAE - CONTINUOUS ASSESSMENT EXAMINATION,

ESE - END SEMESTER EXAMINATION, VIVA - VIVAVOCE

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SECA3001	Cryptography and Network security	3	0	0	3	50	50	59
2	SEIA3001	Measurements and Instrumentation	3	0	0	3	50	50	60
3	SEIA1603	Biomedical Instrumentation	3	0	0	3	50	50	61
4	SECA3025	Telecommunication Systems and Services	3	0	0	3	50	50	62
5	SECA3019	Embedded Processor	3	0	0	3	50	50	63
6	SECA3004	Computer Architecture and Operating System	3	0	0	3	50	50	64
7	SECA3005	Biomedical Signal Processing	3	0	0	3	50	50	65
8.	SECA3006	ASIC Design	3	0	0	3	50	50	66
9.	SECA3007	MEMS and its applications	3	0	0	3	50	50	67
10.	SECA3008	Wireless Sensor Networks	3	0	0	3	50	50	68
11.	SECA3009	Digital Image Processing	3	0	0	3	50	50	69
12.	SEIA3006	Robotics and Automation	3	0	0	3	50	50	70
13.	SECA3010	RF IC Design	3	0	0	3	50	50	71
14.	SECA3011	Artificial Intelligence	3	0	0	3	50	50	72
15.	SECA3012	Cellular Mobile Networks	3	0	0	3	50	50	73
16.	SECA3013	Radar and Navigational Aids	3	0	0	3	50	50	74
17.	SECA3014	Electronic Test Engineering	3	0	0	3	50	50	75
18.	SECA3015	Satellite Communication	3	0	0	3	50	50	76
19.	SECA3016	Mobile Adhoc Networks	3	0	0	3	50	50	77
20.	SECA3017	Optical Networks	3	0	0	3	50	50	79
21.	SECA3018	Nano electronics	3	0	0	3	50	50	81
22.	SEIA3004	Soft Computing Techniques	3	0	0	3	50	50	82
23.	SCSA1601	Machine Learning	3	0	0	3	50	50	83
24	SCSA1102	Python Programming	3	0	0	3	50	50	84
25	SECA3029	Drone Electronics	3	0	0	3	50	50	85
26	SECA3032	AI in Robotics	3	0	0	3	50	50	86
27	SECA3021	Digital System Design and Verification using System Verilog	3	0	0	3	50	50	87
32	SECA3022	Graphical Programming for Engineers	3	0	0	3	50	50	92
33	SECA3023	Augmented Reality and Virtual Reality	3	0	0	3	50	50	93
34	SECA3024	Advanced Electronic Test Engineering	3	0	0	3	50	50	94

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 ESE - END SEMESTER EXAMINATION

OPEN ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SALA4001	Intellectual Property Law	3	0	0	3	50	50	A1
2	SAEA4001	Fundamentals of Aerospace Technology	3	0	0	3	50	50	A2
3	SBAA4001	Fundamentals of Management	3	0	0	3	50	50	A3
4	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	A4
5	SBTA4001	Biology for Engineers	3	0	0	3	50	50	A5
6	SBMA4001	Neurology	3	0	0	3	50	50	A6
7	SBMA4002	Modelling of Physiological Systems	3	0	0	3	50	50	A7
8	SBMA4003	Drug Delivery System	3	0	0	3	50	50	A8
9	SBMA4004	Fundamentals of Mechatronics	3	0	0	3	50	50	A9
10	SBMA4005	Virtuality and Augmented Reality	3	0	0	3	50	50	A10
11	SBMA4006	Medical Optics and Laser Applications	3	0	0	3	50	50	A11
12	SBMA4007	Forensic Science	3	0	0	3	50	50	A12
13	SBMA4008	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	A13
14	SBMA4009	Human Factors in Engineering and Design	3	0	0	3	50	50	A14
15	SCHA4001	Corrosion Engineering	3	0	0	3	50	50	A15
16	SCHA4002	Energy Engineering	3	0	0	3	50	50	A16
17	SCHA4003	Environmental Impact Assessment	3	0	0	3	50	50	A17
18	SCHA4004	Environmental Pollution and Control	3	0	0	3	50	50	A18
19	SCIA4001	Disaster Management	3	0	0	3	50	50	A19
20	SCSA4001	R Programming	3	0	0	3	50	50	A20
21	SCSA4002	5 G Networks	3	0	0	3	50	50	A21
22	SECA4001	Software Tools for Engineering Applications	3	0	0	3	50	50	A22
23	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	A23
24	SMEA4002	Wind and Solar Energy	3	0	0	3	50	50	A24
25	SAE 1605	Airport Engineering	3	0	0	3	50	50	A25
26	SAU1604	Hybrid and Electric Vehicles	3	0	0	3	50	50	A26
27	SCIA3004	Solid waste Management	3	0	0	3	50	50	A27
28	SCSA3019	Augmented and Virtual Reality	3	0	0	3	50	50	A28
29	SECA3011	Artificial Intelligence	3	0	0	3	50	50	A29
30	SECA4002	Deep Learning Neural Networks	3	0	0	3	50	50	A30
31	SECA4003	Drone Electronics	3	0	0	3	50	50	A31
32	SECA4004	e-Health	3	0	0	3	50	50	A32

33	SEE1611	Electric Vehicles	3	0	0	3	50	50	A33
34	SITA3011	Block Chain Technologies	3	0	0	3	50	50	A34
35	SVCA2501	Film Appreciation	3	0	0	3	50	50	A35
36	SEEA3027	Green Energy Systems	3	0	0	3	50	50	A36
37	SCSA4003	Business Analytics	3	0	0	3	50	50	A37
38	SCHA3008	Food Technology	3	0	0	3	50	50	A38
39	SECA4005	Industrial Internet of Things	3	0	0	3	50	50	A39
40	SCIA4002	Public Health Engineer	3	0	0	3	50	50	A40
41	SCSA4007	Design and Development of Blockchain	3	0	0	3	50	50	A41
42	SECA4007	Real Time System Design	3	0	0	3	50	50	A42
43	SEC1626	System Programming	3	0	0	3	50	50	A43
44	SEC1627	EMBEDDED LINUX BSP & PERFORMANCE TUNING	3	0	0	3	50	50	A45
45	SAUA3013	Alternate Fuels and Energy Systems	3	0	0	3	50	50	A46
46	SAUA3012	Fuel Cell and Applications	3	0	0	3	50	50	A47
47	SCSA3016	Data Science	3	0	0	3	50	50	A48
48	SMEA3012	Industrial Robotics and Expert Systems	3	0	0	3	50	50	A49
49	SECA3030	Digital Image Processing for Real Time Applications	3	0	0	3	50	50	A50
50	SECA3020	5G Communication	3	0	0	3	50	50	A51
51	SECA3028	Machine learning techniques	3	0	0	3	50	50	A52
53	SECA3027	IoT for Real Time Application	3	0	0	3	50	50	A53

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CAE - CONTINUOUS ASSESSMENT EXAMINATION,

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S13ADPROJ	Design Thinking	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives

- To introduce the concept of Design thinking to solve Real World Problems
- To understand the process of design thinking
- To identify and analyze societal issues
- To provide solution to the identified Real World Problem

UNIT I INTRODUCTION AND COGITATION**9 Hrs**

Introduction to design thinking- Johari Window – Persona - DCAFE and VAL. – Theory of prioritization – Brain storming - 25 brainstorming techniques, Case Study - Identification of Real-World Problems using brain storming and assigning priorities. Discussion on case study. Activities: Formation of team – Brain storming – Case study

UNIT II DESIGN THINKING PROCESS**9 Hrs**

Elements of great design - Human element of design thinking – Lateral thinking – HOTS – Out of box thinking - case study Problem Identification – Identification of a specific Real Word Problem after brain storming – Team Presentation on identified problem. Activities: Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.

UNIT III ENGINEERING DESIGN - PHASE 1**9 Hrs**

Identification of stake holders – Roles and responsibilities – Conduct of surveys and interviews for addressing Real World Problems – Literature Surveys - Data collection. Surveys: Stake holder Survey – Literature Survey – Presentation on Stake holder's survey and Literature survey. Activities: SWOT Analysis – Finalize the identified problem

UNIT IV ENGINEERING DESIGN - PHASE 2**9 Hrs**

Difference between Creativity and Innovation – Examples of innovation – Overcoming obstacles – Decision making on implementation of identified problem – Identifying evaluation criteria - Functional decomposition. Documentation: Functional decomposition diagram, Decision on implementation, Evaluation criteria. Activities: Documentation

UNIT V ENGINEERING DESIGN - PHASE 3**9 Hrs**

Brain storming alternate solutions- Developing proof of concept Project: Poster presentation and Proof of concept display Activities: Development of POC

Course Outcomes

On completion of the course, the student will be able to

- CO 1 – Comprehend the various types of thinking skills.
- CO 2 - Explain the innovative and creative ideas.
- CO 3 – Apply engineering design process for the identified problem
- CO 4 - Analyze a suitable solution for socially relevant issues
- CO 5 – Develop working structure and concepts for the identified problem
- CO 6 - Design solutions for Real World Problem.

Text/Reference Books

1. How to have Creative Ideas, Edward deBono, Vermilion publication, UK, 2007
2. The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008
3. G.Pahl and W.Beitz (Translated by Ken Wallace et al.), „Engineering Design: A Systematic Approach, Second Edition, Springer, 2005.
4. George E. Dieter and Linda C. Schmidt, “Engineering Design”, Fourth Edition, McGraw Hill Higher Education, 2009.
5. Power Point Presentation material by Prof.D.K.Subramanian in the Workshop on Engineering Design at TCE, Madurai. Foundation Skills in Integrated Product Development, NASSCOM, Edition 2015.

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 Wiley 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****PART A:** 11 Questions of 2 marks each-No choice**PART B:** 2 Questions from each unit with internal choice; each carrying 13 marks**Exam Duration: 3 Hrs.****22 Marks****78 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-Analyze the fundamentals of biomedical signal processing and filters in time domain and frequency domain
- CO2-Apply the principles of modeling for Biomedical systems
- CO3-Apply signal processing techniques on neurological signal
- CO4-Apply various signal processing techniques for cardiological signals
- CO5-Evaluate various signal processing and classification algorithms to obtain HRV and Arrhythmia analysis
- CO6-Model, analyze and predict various pathological conditions using signal processing

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, Electrodynamic 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-Identify right choice of MEMS materials and processing techniques for given application requirement
- CO2-Design micro devices and micro systems for given specifications.
- CO3- Analyze the characteristics of MEMS devices
- CO4-Design MEMS based sensors and actuators for given requirement
- CO5-Design micro-machined RF components and devices such as Switches, phase shifters, antennas, etc for given specifications
- CO6-Investigate various applications of MEMS 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-MAC Protocol, 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-Analyze various challenges in designing of Wireless Sensor Networks and MANETs
- CO2-Categorize the Localization and Routing Techniques in WSN adhering to the IEEE standards
- CO3-Design techniques for the storage, retrieval and manipulation of data in WSN
- CO4-Evaluate the different data aggregation techniques in WSN
- CO5-Design suitable topologies for various Real World Problems
- CO6-Develop a suitable WSN for processing task controlled sensor

TEXT / REFERENCE BOOKS

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

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

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 ELECTRONIC 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-Analyze the frequency range of technologies used for passive and active RF circuit implementation
- CO2-Analyze the behavior of RF frequency signals in transistor environment
- CO3-Evaluate the operations of Transceiver architecture noise, linearity, etc
- CO4-Analyze the behavior of CMOS low noise amplifiers and RF Power Amplifiers in noisy and noiseless environment
- CO5-Design voltage controlled oscillators for Real World problems
- CO6-Develop RF circuits for specific applications using Cadence simulation tools

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-Applied Mathematical equations for developing learning Techniques in AI
- CO2-Analyze various searching techniques for solving Real World Problems
- CO3-Applied predicate logic, ontology and reasoning for knowledge representation in artificial Intelligence
- CO4-Analyze various techniques involved in intelligent agents for communication in AI systems
- CO5-Develop AI based techniques for Real world Applications
- CO6-Evaluate the performance of AI based systems for NLP, Machine translation and speech recognition

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.****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.**

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, photodetectors, 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, protection and network lifetime.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze 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-Apply the principles of Wavelength Division Multiplexing on advanced devices
- CO4-Analyze the optical communication link using various types of network topologies
- CO5-Evaluate the dynamic wavelength allocation for Access networks
- CO6-Analyze the characteristics of optical access and metro networks

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-Analyze both supervised and unsupervised learning techniques in ANN
- CO2-Develop solution to real world problems using BPN, CPN, RBF, SOM and Boltzman machine
- CO3-Apply mathematical equations for developing fuzzy based systems
- CO4-Develop FLC for Real World Problems
- CO5-Analyze various techniques used for optimization in Fuzzy and neural networks
- CO6-Develop GA based solutions for Real World Problems

TEXT / REFERENCE BOOKS

- Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" 2008.
- Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw - Hill International Editions, 2004.
- Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and soft computing", Pearson Education, 2003.
- 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-Comprehend machine learning solutions to classification, regression and clustering problems
- CO2-Understand the strengths and weaknesses of many popular machine learning approaches
- CO3-Interpret the results of the algorithms.
- CO4-Select suitable model parameters for different machine learning techniques
- CO5-Design algorithms for real world problems using machine learning algorithm
- CO6-Gain experience of doing independent study and research

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-Comprehend concepts of lists, tuples dictionaries in python.
- CO2-Develop code for file operations and exception handling.
- CO3-Design GUI based applications.
- CO4-DemonstrateWeb programming concepts using Python
- CO5-Construct Web based applications by integrating with NoSQL Database.
- CO6-Implement machine learning algorithms using Python libraries.

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**

SECA3021	DIGITAL SYSTEM DESIGN AND VERIFICATION USING SYSTEM VERILOG	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To explore the fundamental concepts of verilog
- To understand system Verilog data types and capabilities
- To enumerate system Verilog RTL and abstraction
- To analyze dynamic types and arrays for behavioral modeling
- To evaluate System Verilog Assertions for design and verification

UNIT I DIGITAL DESIGN USING VERILOG HDL 9 Hrs

Hardware modeling with the Verilog HDL: Encapsulation, modeling primitives, Types of Modelling. Logic system, Data types and operators. Behavioral descriptions in verilog HDL. Styles for Synthesis of combinational logic and sequential logic. HDL based Synthesis - Technology independent design

UNIT II INTRODUCTION TO SYSTEM VERILOG 9 Hrs

SystemVerilog standards, Key SystemVerilog enhancements for hardware design. Advantages of System Verilog over Verilog, Data Types: Verilog data types, System Verilog data types, 2 - State Data types, Bit, byte, shortint, int, longint. 4 - State data types. Logic, Enumerated data types, User Defined data types, Struct data types, Strings, Packages, Type Conversion: Dynamic casting, Static Casting, Memories: Arrays, Dynamic Arrays, Multidimensional Arrays, Packed Arrays, Associative Arrays, Queues, Array Methods, Tasks and Functions: Verilog Tasks and Functions

UNIT III CONNECTING THE TEST BENCH AND DESIGN 9 Hrs

Verilog interface signals - Limitations of Verilog interface signals, SystemVerilog interfaces, SystemVerilog port connections, Interface instantiation, Interfaces Arguments, Interface Modports, Interface References, Tasks and functions in interface, Verilog Event Scheduler, SystemVerilog Event Scheduler, Clocking Block, Input and Output Skews, Typical Testbench Environment, Verification plan

UNIT IV CONSTRAINED RANDOMIZATION 9 Hrs

Random Variables - rand and randc, Randomize() Method - Pre/Post Randomize() methods, Constraints in the class, Rand_mode and constraint_mode, Constraint and Inheritance, Constraint Overriding, Set Membership, Distribution Constraints, Conditional Constraints - .implication (->), if/else, Inline Constraints

UNIT V FUNCTIONAL COVERAGE AND ASSERTION BASED VERIFICATION 9 Hrs

Coverage Definition, Code Coverage, Functional Coverage: Cover Group, Creating Cover Group Instances, Coverpoints, Bins - implicit bins, . Explicit bins, Bin creation, Vector and Scalar bins, Cross products, Intersect, Select Expressions, Conditional Expression (iff), Illegal bins, Ignore bins, Coverage Analysis, Covergroup Built-in Methods - .Sample(), . get_coverage(), .get_instance_coverage(), .set_instance_name(string), .start(), . stop()

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the digital system designs skills using VERILOG HDL based on IEEE-1364 standards and managed by Open Verilog International (OVI)

CO2: Model digital systems in Verilog HDL at different levels of abstraction

CO3: Know the simulation techniques and test bench creation.

CO4: Demonstrate the skill on writing test-benches for design of digital systems and connecting them with the design.

CO5 Analyze the complete systems through robust verification methods such as assertion based verification.

CO6 Design the digital systems such as FIFOs, memories, ATM interfaces, etc. using the learnt methods and demonstrate the skills.

TEXT/REFERENCE BOOKS

- Advanced Digital Design With the Verilog HDL, Michael D. Ciletti, 2nd Edition, PHI, ISBN: 978-0- 07-338054-4 2015.
- Digital Systems Design Using Verilog, Charles Roth, Lizy K. John, Byeong KilLee, Cengage Learning, ISBN-10: 1285051076, 2015.
- Fundamentals of Digital Logic with Verilog Design, Stephen Brown and Zvonko Vranesic, 6th Edition, McGraw Hill publication, ISBN: 978-0-07-338054-4, 2014.
- System Verilog for Design - A Guide to Using System Verilog for Hardware Design and Modeling, Stuart Sutherland, Simon David mann and Peter Flake, 2E, Springer Science, ISBN-13: 978-0387-3339-91, 2006.
- System Verilog for Verification-A Guide to Learning the Testbench Language Features, C Spear, Springer Science, IEEE press, ISBN-13: 978-0387-2703-64, 2006.
- SystemVerilog golden reference guide-A concise guide to System Verilog Doulos ,IEEE Standard-1800- 2009, Version 5.0, ISBN: 0-9547345-9-9, 2012.
- Step-by-Step Functional Verification with System Verilog and OVM, SasanIman, Hansen Brown Publishing Company, ISBN-13: 978-0-9816-5621-2, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

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

B.E. / B.Tech. - Regular

Exam Duration: 3 Hrs.

20 Marks

REGUALTIONS 2019

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

SECA3022	Graphical Programming for Engineers	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- Students will understand each topic by doing exercise
- Two sessions will be handled by industry people towards project
- This is a learning by doing course
- The learner can use this tool to understand any subjects by implementing or simulating the concept using LabVIEW
- Students can able to do their project in short span of time

UNIT I LABVIEW FOUNDATIONS**9 Hrs**

LabVIEW Operating Environment-Front Panels, Controls and Indicators, Block Diagrams, LabVIEW Projects, Creating Vis, Basic Controls and Indicators, Debugging Techniques, Creating SubVIs

UNIT II CONTROLLING PROGRAM EXECUTION WITH STRUCTURES**9 Hrs**

For and While Loops, Shift Registers, Case Structure, Sequence Structure, Timed Structures, Formula and Expression Nodes, Combining While Loops with Case Structure.

UNIT III ARRAYS AND CLUSTERS & CHARTS AND GRAPHS**9 Hrs**

Array Controls and Indicators, Auto-Indexing, Two Dimensional Arrays, Compound Arithmetic, Cluster Controls and Indicators, Interchangeable Arrays and Clusters, Error Clusters and Error Handling Functions., Waveform Charts, Waveform Graphs, X-Y Graphs, Time Stamps

.UNIT IV SIGNAL CONDITIONING & DATA ACQUISITION SYSTEMS**9 Hrs**

Introduction- Basic Signal Conditioning Requirements of Common Transducers- Thermocouple- RTDs- Strain Gauges- Current Signals- General Signal Conditioning Functions- Amplification- Filtering and Averaging- Isolation- Multiplexing- Digital Signal Conditioning.

UNIT V APPLICATION USING GRAPHICAL PROGRAMMING**9 Hrs**

Logging Temperature data to a text file, Signal noise removal, water tank control, Function Generator, Equalizer design, Signal spectrum measurement, PAM, FM, ASK, FSK modulation

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1- Develop and edit functional block diagrams and front panels.
- CO2- Develop codes to load, save, and debug VIs.
- CO3- Analyze program execution through structures such as 'For-While' loops and 'Case Structures
- CO4- Analyze composite data in the form of Arrays and Clusters
- CO5- Implement techniques to acquire and process signals and can able to realize engineering concept using LabVIEW
- CO6- Develop solutions to the given problem using LabVIEW

TEXT/REFERENCE BOOKS

1. Jeffrey Travis, Jim Kring, Labview for Everyone: Graphical Programming Made Easy and Fun, 3rd Edition, 2009.
2. www.ni.com
3. <http://www.learnni.com/getting-started/Home/Index/91>
4. <https://www.halvorsen.blog/documents/tutorials/tutorials.php>

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**

SECA3023	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To explore the basic of AR/VR technology and devices
- To understand the various elements and components used in AR/VR Hardware and Software
- To explore the industrial application of AR/VR technology
- To analyze the difference between AR and VR
- To enable working on real life projects using AR/VR technology

UNIT I AUGMENTED REALITY 9 Hrs

Introduction to Augmented Reality, Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

UNIT II DEVELOPMENT OF AR MODELS 9 Hrs

Unity, Basics of Unity, Understanding different panels in Unity, Moving, rotating & scaling Game objects in Unity, Game Panel in Unity, Physics in Unity, Increasing the light intensity, Adding colors to Game object, Adding textures to Game object, Parent and child Game objects in Unity, Local/Global and Pivot/Center tools in Unity, Prefabs in Unity, Scripts, Rotating the spheres, Revolving the spheres

UNIT III AUGMENTED REALITY ONE SECTION(ARONE) INTRODUCTION 9 Hrs

Augmented Reality One (AROne) Section Introduction, Importing Vuforia package inside Unity, Importing Vuforia package via Vuforia Core Samples, Web Camera output and creating the ARONE License Key, Capturing an Image, Creating a Vuforia Database and uploading Image Targets, Projecting Barbarian 3D Model on Image Target, Testing the output on an Android smartphone, Testing the output on iPhone or iPad.

UNIT IV VIRTUAL REALITY 9 Hrs

Introduction of Virtual Reality, Fundamental Concept and Components of Virtual Reality, Difference between AR and VR, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark, Primary Features and Present Development on Virtual Reality, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection

UNIT V AR / VR APPLICATIONS 9 Hrs

Engineering, Entertainment - Movies, Game development, Science, Medical applications, military applications, robotics application, Case study - CRO based experiment, Building Electronic circuit using AR/VR.

Course Outcomes

On completion of the course, the student will be able to

CO1-Apply mathematical concepts for understanding Augmented reality and Virtual Reality

CO2-Analyze the development of AR models

CO3-Analyze various Vuforia package inside Unity

CO4-Develop a Virtual reality Model

CO5-Implement AR/VR in game development

CO6-Build any Electronic circuit using AR/VR

TEXT / REFERENCE BOOKS

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009
3. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016
4. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA, . 2015.
5. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
6. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.

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

SECA4002	DEEP LEARNING NEURAL NETWORKS	L	T	P	Credits	Total marks
		3	0	0	3	100

COURSE OBJECTIVES

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT I INTRODUCTION TO DEEP LEARNING**9 Hrs.**

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS**9 Hrs.**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENSIONALITY REDUCTION**9 Hrs.**

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT IV OPTIMIZATION AND GENERALIZATION**9 Hrs.**

Optimization in deep learning- Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT V APPLICATIONS OF DEEP LEARNING**9 Hrs.**

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

Max: 45 Hours**Course Outcomes**

On completion of the course, the student will be able to

- CO1 - Select suitable model parameters for different machine learning techniques
- CO2 - Evaluate the performance of existing deep learning models for various applications
- CO3 - Realign high dimensional data using reduction techniques
- CO4 - Analyze the performance of various optimization and generalization techniques in deep learning
- CO5 - Modify the existing architectures for domain specific applications
- CO6 - Develop a real time application using deep learning neural networks

TEXT / REFERENCE BOOKS

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

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.**

SECA4003	DRONE ELECTRONICS	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVES

- To Introduce The Concepts Of Applying Aerodynamics To Drone Design
- To Familiarize The Student's Ability To Analyze The Concepts Of Drone
- To Understand The Basic Operation Of Various Sensors In Drone Application
- To Design Drone For The Mission Control Application

UNIT I INTRODUCTION TO DRONE**9 Hrs.**

Definition of drones , History of drones , Classification of drones based on structure- Fixed wing structure, Lighter than air systems and Rotary-wing aircraft, Application of drones, Parts of Drone system, System design, Mechanical design, hardware design, software architecture, Logistic and Operations Management

UNIT II DYNAMICS AND STABILITY**9 Hrs.**

Forces of flight, Principal axes and rotation of aerial systems - Longitudinal axis, Lateral(transverse) axis and Perpendicular axis, Equilibrium, Stability - Stable system, Unstable system and Neutrally stable system, Control - Roll, Pitch, Yaw and Throttle.

UNIT III SENSORS IN DRONE**9 Hrs.**

Sensors - Accelerometer, Barometer, Gyro Sensor, Magnetometer, Distance sensors , Time of Flight (ToF) Sensors, Thermal sensors, Chemical Sensors and thermal sensors. Sensor Testing - Test Philosophies and methodologies, Test equipment, Performance testing of sensors

UNIT IV GLIDING DRONES**9 Hrs.**

Glider, Lift, Drag, Airfoil and its type, Incident and decalage angle, Three axis motion (roll, pitch, and yaw), Thrust, Aspect ratio and glide ratio, Glide or dive and descent, gliding angle, Climb, Center of pressure, Pitching moment, Load factor, Angle of attack, Build our own glider drone.

UNIT V DRONES FOR MISSION CONTROL APPLICATIONS**9 Hrs.**

ESP8266, Downloading and installing APM Planner or Mission Planner, Configuring the quadcopter - Frame type selection, Compass calibration, Access calibration, Radio calibration, Flight mode calibration and Failsafe calibration, Surveying with a drone, tweaks with the Flight Plan screen. Future of Drone Systems

Maximum Hours: 45**Course Outcomes**

On completion of the course, the student should be able to

- CO1 - Apply the mathematical/engineering concepts in building drones
- CO2 -Analyze the mathematical relation between force, equilibrium, stability and the movement of drones
- CO3 - Select appropriate sensors and actuators for specific applications
- CO4 - Design gliding drones for real world applications
- CO5 - Appraise the performance of subunits in drones
- CO6 - Design a drone for mission control application.

TEXT / REFERENCE BOOKS

1. Syed Omar Faruk Towaha, "Building Smart Drones with ESP8266 and Arduino: Build exciting drones by leveraging the capabilities of Arduino and ESP8266" Packt Publishing, 2018
2. Aaron Asadi, "Drones The Complete Manual. The essential handbook for drone enthusiasts", Imagine Publishing Limited, 2016
3. Neeraj Kumar Singh, Porselvan Muthukrishnan, Satyanarayana Sanpini, "Industrial System Engineering for Drones: A Guide with Best Practices for Designing", Apress, 2019
4. Felipe Gonzalez Toro, Antonios Tsourdos, "UAV or Drones for Remote Sensing Applications"2018.
5. K R Krishna, "Agricultural Drones: A Peaceful Pursuit", Apple Academic Press; CRC Press, 2018

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**

SECA4004	e-Health	L	T	P	Credits	Total marks
		3	1	0	3	100

Course Objectives

- To introduce the concepts of eHealth
- To have an in-depth knowledge on medical data analytics and wearable devices used in e-Health systems
- To assess the advantages of eHealth
- To explore the usage of AI in eHealth
- To design and develop applications for e-Health

UNIT I INTRODUCTION TO e-Health**9 Hrs**

Overview and introduction to eHealth and flow of health information- International regulations in e-Health-Advantages, Challenges and future of e-Health.

UNIT II MEDICAL DATA ANALYTICS AND WEARABLE DEVICES**9 Hrs**

Health care data and Electronic Health Records (EHR) systems- Medical data bases -Wearable devices-Data collection from wearable devices- Clinical use of personal health data- Big data in the field of Medicine.

UNIT III DIGITAL HEALTH**9 Hrs**

Introduction to health care digital transformation- Digital health: Tools, Strategies of digital health- Technologies in digital health-Implementation of Digital health- Advantages and challenges of Digital health

UNIT IV ARTIFICIAL INTELLIGENCE IN e-Health**9 Hrs**

History of AI in health care-Impacts and Aspects of AI in health care- Current research in AI in e-Health-Regulations and Ethical concerns in using AI in e-Health

UNIT V APPLICATION DEVELOPMENT FOR e-Health**9 Hrs**

Introduction to Android, Creating Android Activities, Android User interface design, Access Wi-fi and Bluetooth with mobile applications-Web based App for eHealth applications.

Max: 45 Hrs**Course Outcomes**

On Completion of The Course, Student Should Be Able To

- CO1 - Articulate e-Health and Its Regulations
- CO2 - Explore Medical Data Analytics and Records
- CO3 - Appraise Digital Transformation in The Field of Medicine
- CO4 - Analyse AI in Health Care Systems
- CO5 - Design System Level Architecture for Health Information Systems
- CO6 - Deploy Android Application on Devices

TEXT / REFERENCE BOOKS

- Shortliffe, Edward H and Cimino James J. Biomedical Informatics, Computer Applications in Health Care and Biomedicine, Springer-Verlag London 2014.
- Lavis, JN (ed). Ontario's Health System: Key Insights for Engaged Citizens, Professionals and Policymakers. 2016.
- Hoyt RE, Yoshihashi A, Bailey N. Health informatics: Practical guide for healthcare and information technology professionals. Lulu Press. 2014 Seventh edition.
- Gaddi A, Capello F, Manca M. eHealth, Care and Quality of Life. 2014 electronic library holding in the Health Science Library

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**

SECA4005	INDUSTRIAL INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To focus on basics of Industrial Internet
- To modify the various existing industrial systems
- To get an idea about IIoT Architectures
- To acquire the knowledge about various Network Protocols
- To extract the backend Middleware Protocols

UNIT I Introduction to Industrial Internet**9 Hrs**

Innovation and IIoT - Intelligent Devices - Industrial Internet - Health care -Oil and Gas Industry - Smart Office - Logistics - IoT Innovations in Retail.

UNIT II Technical and Business Innovators of Industrial Internet**9 HRS**

Miniaturization - Cyber Physical Systems - Wireless technology - IP Mobility - Network Functionality Virtualization - Cloud and Fog - Big Data and Analytics - M2M Learning and Artificial Intelligence

UNIT III IIoT Reference Architecture**9 Hrs**

Industrial Internet Architecture Framework - Functional Viewpoint - Operational Domain, Information Domain, Application Domain, Business Domain - Implementation View point - Architectural Topology - Three Tier Topology - Data Management.

UNIT IV Industrial Internet Systems**9 Hrs**

Introduction-Proximity Network Protocols - WSN Edge Node - Legacy Industrial Protocols -RS232 Serial Communications, 40-20ma Current Loop, Field Bus Technologies - Modern Communication Protocols - Industrial Ethernet - Industrial Gateways.

UNIT V Middleware Transport Protocol**9 Hrs**

TCP/IP, UDP, RTP, CoAP -Middleware Software patterns -Software Design patterns - Application Programming Interface (API) - CAN Protocol-Web Services - Middleware IIoT - Securing the IIoT- Identity Access Management.

Max. 45 Hrs**Course Outcomes**

On completion of the course, the student should be able to

- CO1 -Enhance the company's performance using IoT
- CO2 -Demonstrate the different styles of technical and business innovators
- CO3 -Examine various IIoT Architectures related to data management system
- CO4 -Organize the design of Industrial Internet Systems
- CO5 -Select various Software design patterns using API
- CO6 -Construct a Middleware software system related to proximity edge networks.

Text/Reference Books

1. S. Misra, A. Mukherjee, and A. Roy, Introduction to IoT. Cambridge University Press, 2020
2. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.2020
3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024', Yole Development Copyrights ,2014
4. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

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**

SECA4007	REAL-TIME SYSTEM DESIGN	L	T	P	Credits	Total marks
		2	0	2	3	100

Course Objectives

- To explain the features of real-time applications.
- To learn different task scheduling algorithms for real-time systems.
- To discuss various fault-tolerance techniques available for real-time systems.
- To learn about real-time operating systems and their characteristics.
- To study about various software tools for development of real-time embedded systems

UNIT I INTRODUCTION TO REAL-TIME SYSTEMS 9 Hrs

Real-time system characteristics-Hard real-time and soft real-time systems -Timing Constraints-Modelling Timing Constraints of typical real-time systems- Safety airbag - Aircraft Flight controller.

UNIT II REAL-TIME TASK SCHEDULING 9 Hrs

Task Modelling -Types of Schedulers - Preemptive and Non-Preemptive scheduling - Cyclic schedulers- Rate Monotonic Algorithm (RMA-Earliest Deadline First Algorithm (EDFA)- Handling Resource sharing among real-time tasks - Priority Inversion - Priority Inheritance and Priority Ceiling Protocol for Deadlock prevention.

UNIT III REAL-TIME OPERATING SYSTEMS 9 Hrs

Introduction to RTOS -Survey of real-time OS:Vxworks, QNX, Micrium OS, RT Linux and freeRTOS - Creating Tasks -Multitasking using RTOS - Interprocess Communication using mailbox, message queues - Task Synchronisation and Resource management using semaphores-Timers and Interrupts in RTOS-Memory Management in RTOS

UNIT IV REAL-TIME SYSTEM MODELING 9 Hrs

Model based system design frameworks - Petrinets and applications in real-time modeling, Vending Machine - Air traffic controller system - Distributed air defense system- Evaluation of system performance - In the loop Testing - Hardware in the loop testing-Software in loop testing

UNIT V CASE STUDY OF REAL-TIME SYSTEMS 9 Hrs

Real-time PID controller-Real-time Multimedia communication-Real-time Databases-Aircraft Avionics-ECU in Automobiles

Max: 45 Hrs**Course Outcomes**

On completion of this course, students are able to

- CO1- Identify timing constraints of real-time systems
- CO2- Apply appropriate scheduling algorithms for timely execution of real-time tasks
- CO3- Develop real-time applications using RTOS
- CO4- Apply model based design approach for given real-time application
- CO5- Apply fault tolerant design techniques in developing real-time systems.
- CO6-Evaluate performance of real-time systems using model based design frameworks.

TEXT / REFERENCE BOOKS

1. Philip. A Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 4th Edition.2012.
2. Jane W. S Liu, "Real Time Systems" Pearson Higher Education, 4th Edition, 2014.
3. Richard Barry, "Mastering the Free RTOS: Real Time Kernel", Real Time Engineers Ltd, 1st Edition, 2016.
4. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2nd Edition, 2014.
5. Warren Gay, "Beginning STM32: Developing with Free RTOS",Apress, 1st Edition, 2018.
6. Li Q, Yao C, "Real-Time Concepts for Embedded Systems", CMP Books, 1st Edition, 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 12 marks**80 Marks**

SEC1626	System Programming	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

This course is meant to give them a broad exposure to the understanding of various concepts of System Programming.

The course will provide the students with

- (i) the concept of advanced Embedded C Language,
- (ii) the knowledge of microcontroller architecture,
- (iii) the methodology to write Program for chosen microcontroller, and
- (iv) the skill to use basic technique for debugging in Linux environment and
- (v) basic understanding of system programming.

Experiments will run in synchronism with the lectures to support the methods and techniques taught in the lectures. Through the experiments, the students will

- (i) learn how to use Linux commands and programming environment,
- (ii) gain confidence to do system programming in Linux environment, and learn how to test and debug the developed programs.

Learning Outcome of students are

- (i) Perform advanced C programming using linked list, Function pointers, arrays, sorting, etc.,
- (ii) Basic scripting in Linux environment
- (iii) Demonstrate programming using Linux System calls
- (iv) Demonstrate various debugging techniques when the program throws error
- (v) Plan and execute projects simple system programming projects.

UNIT 1 EMBEDDED C PROGRAMMING**9Hrs.**

Essential C Programming Concepts, Variables and Constants, IO operation, Memory Layouts, Operators and Expression, Control Statements, Functions, Arrays, Pointer, Structure and Union, Debugging Methods.

Lab work

1. Programs to understand the various C memory layouts and variable storage locations.
2. Programs to understand the control and conditional statements extensively.
3. Programs to understand the passing of 1-D, 2-D arrays to functions as argument.
4. Programs to understand the pointer usage and passing argument by reference.
5. Programs to understand the structure, union, enum, typedef and bitwise logical operations.

Project

1. Projects based on the modular programming design.
2. Projects based on event handlers
3. Projects based on finite state machine

UNIT 2 EMBEDDED SYSTEM SOFTWARE**9Hrs.**

Assembly and C Microcontroller Programming, IO Port Programming, Timer Programming, Handling Interrupts, Interfacing with external peripherals and memory, ADC Programming, LCD & Keypad Programming, Interfacing with Sensors.

Lab work

1. Programs to understand the GPIO input, output and alternate functionalities.
2. Programs to understand the timer functionalities in the microcontroller.
3. Programs to understand various interrupts and interrupt service handler and interrupt service routines.
4. Programs to understand the external interrupts and external peripheral interface with the microcontroller.
5. Programs to understand the ADC and DAC interfaces with the microcontroller.
6. Programs to understand the display and keypad interfaces with the microcontroller.
7. Programs to understand the external sensor signal handling in the microcontroller.

Project

1. Constructing the circuit in the breadboard to execute the lab work exercises in the actual hardware.
2. Developing programs for microcontroller with modular programming using state machines approaches.

UNIT3 EMBEDDED LINUX SYSTEM PROGRAMMING**9Hrs.**

System Programming Concepts, File Operation Programming, IO Operation Programming, Advance Process Management Programming and Thread Programming and Mutex.

Lab work

1. Programs to understand the file management in Linux C.
2. Programs to understand the process handling in Linux C.
3. Programs to understand the threads and mutex in Linux C.

Project

1. Developing multi processes project in Linux C.
2. Developing project using threads and mutex.

UNIT 4 EMBEDDED LINUX SYSTEM PROGRAMMING IPCs**9Hrs.**

Essential Inter Process Communication and Synchronization, Pipes, Signals, Timers, Shared Memory, Message Queues and Semaphores.

1. Programs to understand the Pipes in Linux C.
2. Programs to understand the Signals and Timers in Linux C.
3. Programs to understand the Shared Memory and Semaphores in Linux C.
4. Programs to understand the Message Queues in Linux C.

Project

1. Developing event-based project using Linux IPC and synchronization mechanism.
2. Developing message queue-based project using message queue and synchronization mechanism.

UNIT 5 ADVANCE MICROCONTROLLER PROGRAMMING

9Hrs.

Introduction of Advanced Microcontroller Architectures, Buses, Memory, Clock Tree, Reset, Interrupts Management, IOs, Timers, and external interfaces.

Lab work

1. Programs to understand the various clock configurations.
2. Programs to understand the timer configurations and event handlers.
3. Programs to understand various interrupts and interrupt service handler and interrupt service routines.
4. Programs to understand the external interrupts and external peripheral interface with the microcontroller.
5. Programs to understand the handling of external signals.

TEXT BOOK/ REFERENCE BOOKS

Text Books:

Advanced Embedded C Programming
The C Language Programming, Brian W. Kernighan , Dennis M. Ritchie, 1998.
Linux System Programming
Linux System Programming, Robert Love, 2013.
Advanced Microcontroller Programming
Discovering the STM32 Microcontroller, Geoffrey Brown, 2012.

Reference Books:

Advanced Embedded C Programming

1. THE FIRMWARE HANDBOOK, Jack Ganssle, 2004..
2. C Programming for Embedded Systems, Kirk Zurell, 2000.
3. Making Embedded Systems, Elecia White, 2011.

Linux System Programming

1. Beginning Linux Programming, Neil Matthew & Richard Stones, 2008.
2. Hands-On System Programming with Linux, Kaiwan N Billimoria, 2018.

Advanced Microcontroller Programming

1. Mastering STM32, Carmine Noviello, 2016.
2. ARM Cortex M4 Cookbook, Dr. Mark Fisher, 2016.
3. RM0090, Reference manual, STM32F405/415, STM32F407/417, STM32F427/437 and STM32F429/439 advanced Arm®-based 32-bit MCUs.
4. PM0214 Programming manual STM32 Cortex-M4 MCUs and MPUs programming manual.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3Hrs.

SEC1627	EMBEDDED LINUX BSP & PERFORMANCE TUNING	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

This course focusses on applying the topics learned in 6th and 7th semester for a real-world application, expands the understanding of the components that make up an embedded system.

The course will provide the students with

- (vi) Advanced C skills and exposure to C++
- (vii) The core concepts of boot loader, BSP and performance tuning
- (viii) Substantiate the previous learnings of C programming and device drivers,
- (ix) The methodologies for debugging and performance tuning

UNIT 1**APPLICATIONS of 'C' & C++ BASIC****9Hrs.**

Advanced C: Compiler - linker - loader, ELF, Static and Dynamic Libraries, Structure, Union and Bit field Structure, Pointers, Arrays, Multi-dimensional Arrays, Double pointers, Function Pointers, Memory Allocation, linked list, Queue and Stack, Hash table, Data structure algorithms, Makefiles. C++ basic: Classes & Objects, C++ Pointers & Arrays, Constructors & Destructors, Overloading, Inheritance, Virtual functions, Polymorphism, Exception handling, Templates, CMAKE.

UNIT 2**APPLICATIONS of LINUX SYSTEM PROGRAMMING****9Hrs.**

Industrial Protocols Overview: CAN, Modbus, Profibus, EtherCAT, CoAP, Advanced Process Management: Scheduler Types, Priorities, Affinity, Hard Vs Soft Real-time Systems, Advanced Thread Management: Revisiting Thread Models, Patterns, Concurrency, Parallelism, Races, Synchronization and Pthread.

UNIT 3**APPLICATIONS of DEVICE DRIVERS****9Hrs.**

PCI: PCI Vs PCI-X Vs PCIe, PCI Architecture, Memory and IO map, Configuration Space, Enumeration, Block drivers, DAS/NAS/SAN Overview, Storage Architecture. Ethernet Driver: Ethernet boot loader driver, Ethernet Linux driver, Ethernet tools & tests, Raw socket, General Device Drivers1: Memory, RTC, Sensors, Power rails, General Device Drivers2: Timers, ADC, IOs using PINCTRL, Waveforms using PWM, High level tests for Audio & Video

UNIT 4**EMBEDDED LINUX BSP****9Hrs.**

Boot Loader: Introduction, Device tree, Arguments, Boot sequence, Drivers, Optimizations, U-boot commands, Accessing boot environments from user space. Board Support Package: of a BSP, Toolchain, build system, Booting Linux locally and from remote, Booting Ubuntu with a new Kernel, Booting with plain vanilla Kernel, Core dumps, Busy box.

UNIT 5**DEBUGGING & PERFORMANCE TUNING****9Hrs.**

Introduction, Methods and Concepts, Boot parameters, /proc, /Sys and Sysctl, System Monitoring, Timer counter, Memory Management (swap, page, defragmentation), Tuning - memory/Network/Device usage, Controlling Process - Threads, Profiling and Benchmarking methods, Debugging Methods and Techniques – CRO and Logic Analyzers, JTAG, Problem Reproduction, Dumps, Break point, Single Step, variables and history analysis, Print statement, Interrupt, I/O points, Instrumenting code, Code Tracing & Coverage.

COURSE OUTCOMES

On completion of the course the student will be able to

Learning Outcome of students are

- CO1: Become well versed in C and exposed to C++
- CO2: Applying PCI device driver knowledge for a Storage use case
- CO3: Understanding of Bootloader and BSP components
- CO4: Understanding of build systems
- CO5: Demonstrate building a custom Linux distribution
- CO6: Demonstrate various debugging and performance tuning techniques

TEXTBOOK/ REFERENCE BOOKS

- Peter D Hipson, Advanced C, Sams Publishing, 1982
- John Perry, Advanced C programming by Example, PWS, 1982
- Andrew and Barbara, Accelerated C++ Practical Programming by Example, Addison-Wesley, 2000.
- Robert Love, Linux System Programming, 2nd Edition, O'Reilly Media, Inc. 2013
- Michael Kerrisk, The Linux Programming Interface: A Linux and UNIX System Programming Handbook, No Starch Press, 2010

SECA3020	5G COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To learn about wireless mobile communication standards and co-existence of 4G and 5G.
- To learn 5G network architecture, components, features and their benefits.
- To learn channel access methods, modulation and spectrum sensing techniques used in 5G wireless systems.
- To understand advanced wireless concepts such as Massive MIMO, Virtualized RAN and Network Slicing.
- To learn about mmWave communication systems and its use cases.

UNIT I**INTRODUCTION TO 5G****9 Hrs**

3G and 4G(LTE) overview- Introduction to 5G – Use Cases - Evolving LTE to 5G Capability- 5G NR and 5G core network (5GCN) - 5G Standardization - 3GPP and IMT2020 - Spectrum for 5G – 5G deployment - Options, Challenges and Applications.

UNIT II**5G CHANNEL ACCESS METHODS****9 Hrs**

OFDM and OFDMA – MIMO OFDM – Generalized Frequency Division Multiplexing (GFDM) – Non-Orthogonal Multiple Access (NOMA) - Universal Filtered OFDM -Filter bank multicarrier (FBMC)- Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods

UNIT III**RADIO ACCESS NETWORK FOR 5G NR****9 Hrs**

5G NR requirements - 5G Core Network Architecture - Radio-Access Network (RAN)- Radio Protocol Architecture -User Plane Protocols-Radio Link Control - Medium-Access Control – Physical Layer functions -Control Plane Protocols - Network Slicing- RAN virtualization-Spectrum Management in 5G.

UNIT IV**CHANNEL MODELS FOR 5G NR****9 Hrs**

Channel Hierarchy in 5G NR – Logical Channels and Transport Channels in 5G NR - Physical Layer Data Channels in 5G NR - Downlink Physical Channel and Uplink Physical Channels - Propagation Channel models for 5G.

UNIT V**ENABLING TECHNOLOGIES FOR 5G****9 Hrs**

Device-to-Device (D2D) Communication - 5G for Massive Machine Type Communication and Massive IoT- V2X Communication - Full Duplex and Green Communication - mmWave Communications -Massive MIMO and Beamforming Techniques.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 - Distinguish major mobile communication standards such as 3G, 4G and 5G
- CO2 - Analyze various modulation and multiplexing techniques like OFDM, NOMA etc.
- CO3 - Design system level architecture of 5G communication systems.
- CO4 - Analyze spectrum sensing and sharing techniques in 5G systems.
- CO5 - Assess the potential of mmWave spectrum for 5G applications.
- CO6 - Apply the concepts of green communications in real life applications.

TEXT/REFERENCE BOOKS

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies, CRC Press, 1st Edition, 2019.
2. Erik Dahlman, Stefan Parkvall, Johan Skold "5G NR: The Next Generation Wireless Access Technology", Academic Press, 1st Edition, 2018.
3. Jonathan Rodriguez, "Fundamentals 5G Mobile Networks", John Wiley & Sons, 1st Edition, 2015.
4. Long Zhao, Hui Zhao, Kan Zheng, Wei Xiang, "Massive MIMO in 5G Networks: Selected Applications", Springer, 1st Edition, 2018.
5. Robert W. Heath Jr., Angel Lozano, "Foundations of MIMO Communication", Cambridge University Press, 1st Edition, 2019.
6. R. Vannithamby and S. Talwar, "Towards 5G: Applications, Requirements and Candidate Technologies", John Wiley & Sons, 1st Edition, 2017.

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**

SECA3028	MACHINE LEARNING TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To Recognize Different Key Paradigms For Machine Learning Concepts
- To Familiarize With Various Classifiers Used For Machine Learning
- To Understand And Differentiate Among Various Supervised Learning Concepts
- To Become Familiarize With Data Reduction And Feature Extraction Methods
- To Apply Suitable Machine Learning Algorithms For Simple Engineering Problems

UNIT I INTRODUCTION TO MACHINE LEARNING**9 Hrs**

Machine Learning vs Statistical Modelling, Applications of Machine Learning, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning Classification, Python libraries suitable for Machine Learning.

UNIT II CLASSIFIERS**9 Hrs**

Classification, K- nearest neighbour, Decision Trees, Implementing Decision Tree, building a Tree, Random Forests - Working of Random Forest, Pros and Cons of Random Forest, Naiver Bayes, building model Using Naiver Bayes

UNIT III SUPERVISED LEARNING**9 Hrs**

Regression, Types of Regression model, Building a Regressor in Python, Types of ML Algorithm, Linear Regression, Multiple Linear Regression, Non-linear Regression, Model evaluation methods.

UNIT IV K-MEANS CLUSTERING**9 Hrs**

Working of K-Means Clustering Algorithm, Advantages and Disadvantages, Applications of K-Means Clustering Algorithm, Hierarchical Clustering, Steps to Perform Agglomerative Hierarchical Clustering, Role of Dendrograms Agglomerative Hierarchical Clustering, Density-Based Clustering.

UNIT V ML MODELS AND COMPUTATIONAL LEARNING**9 Hrs**

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers. Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting

Maximum Hours: 45**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO 1 - Classify supervised and unsupervised learning
- CO 2 - Apply appropriate machine learning strategies for any given problem
- CO 3 - Recommend supervised and unsupervised learning algorithms for any given problem
- CO 4 - Apply the Bayesian concepts to machine learning
- CO 5 – Evaluate existing machine learning algorithms
- CO 6 - Develop an appropriate machine learning approach for Real World Problems

TEXT/REFERENCE BOOKS

1. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media, Inc.2018
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
4. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
5. EthemAlpaydin, Introduction to machine learning, second edition, MIT press.
6. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition
7. Sebastian Raschka, "Python Machine Learning", Second Edition. Packt Publication

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**

SECA3027	IoT FOR REAL TIME APPLICATIONS	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To design products related to IoT based Health care applications
- To design IoT enable smart cities considering various energy harvesting techniques
- To develop IoT based system for supporting farmers and agriculture
- To develop IoT based system for industrial automation
- To analyze various IoT based system considering societal benefits
- To develop an IoT based wearable device for measuring physiological parameters and physical movements

UNIT I IoT FOR HEALTHCARE**9 Hrs.**

Architecture of IoT for Healthcare , IoT based Health Monitoring System using Arduino, Healthcare monitoring Technique for Diabetes Patients, Remote Patient Monitoring- IoT Heart Rate Monitoring, remote monitoring of physiological parameters, ECG, EEG, and BP.

UNIT II IoT ENABLED SMART CITIES**9 Hrs**

Smart Energy meters, , Smart home powered by IoT, Smart Lightning, Smart Traffic Control ,Smart Grid and Solar Energy Harvesting, Intelligent Parking System.

UNIT III IoT FOR SMART AGRICULTURE**9 Hrs.**

Smart Agriculture, IoT Based Agriculture, Animal Intrusion detection in farms, soil moisture detection and Irrigation system, Livestock monitoring system, IoT based Greenhouse Environment Monitoring and controlling

UNIT IV IoT BASED INDUSTRIAL AUTOMATION**9 Hrs.**

IoT based gas leakage monitoring system, Temperature and liquid level monitoring in boilers, Wireless video surveillance robot, Automatic Solar Tracker, IoT in Logistics Sector

UNIT V IoT FOR SOCIETY**9 Hrs.**

Medical Waste Management, Weather update system with IoT, Women security system, wearable glove to enable sign to speech conversation, IoT based air pollution meter, Improved productivity of staff and reduced human labor

Maximum Hours: 45**Course Outcomes**

On completion of the course, the student should be able to

- CO1-Develop MATLAB programs for solving basic mathematical problems
- CO2-Develop MATLAB programs for solving Real World Problems
- CO3-Develop GUI and MATLAB programs for Plotting various types of Graphs
- CO4-Develop MATLAB programs for Advanced Mathematical applications
- CO5-Develop Simulink based systems for solving Real World Problems
- CO-6 Develop Simulink programs for resolving specialized engineering related issues

TEXT / REFERENCE BOOKS

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Krishna P. Venkata, Sasikumar Gurumoorthy, Mohammad S.Obaidat, Internet of Things and Personalized Healthcare Systems , Springer-2019.
4. Pattnaik, Prasant Kumar, Mohanty, Suneeta, Mohanty, Satarupa, Smart Healthcare Analytics in IoT Enabled Environment, Springer-2020.
5. Avijit Mathur, Thomas Newe, Walid Elgenaidi, Muzaffar Rao, Elfed Lewis and Daniel Toal, Medical IoT systems: architecture and security by Wearable Sensors, 2017.
6. Verónica Saiz-Rubio , Francisco Rovira-Mas ,From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management, Agronomy 2020, 10, 207; doi:10.3390/ agronomy 10020207

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**

S13AEPICS	Engineering Projects in Community Service	L	T	P	Credits	Total marks
						100

Course Objectives

To Properly define and scope a problem;

To Identify and analyze relevant factors;

To apply appropriate industrial engineering methodologies and computational tools;

To Generate and evaluate alternative solutions;

To Improve skills in

▪ Technical writing, ▪ Public speaking, ▪ Working within a team (when applicable), and ▪ Project and time management.

Unit I	Multidisciplinary Design: Learn how to be better designers, gain design knowledge and skills; learn how to apply disciplinary knowledge to real and possibly ill-defined problems; learn how to identify and acquire new knowledge; learn to collaborate with people from other disciplines and develop an appreciation for cross-disciplinary contributions in design.	9 Hrs
Unit II	Professional Preparation: Develop the broad set of skills needed to be successful in the changing global workplace and world:	9 Hrs
Unit III	Service-Learning: Provide significant service to the community while learning; gain an understanding of the role that engineering (and their discipline) can play in society and the broader issues related to the needs we are addressing.	9 Hrs
Unit IV	Case studies on community service	9 Hrs
Unit V	Identification of engineering solutions to a real world problem	9 Hrs

The students will be able

CO1: To investigate the real -world problems

CO 2: To illustrate the real -world problems with community service

CO 3: To demonstrate design the solutions using multi- disciplinary approach

CO 4: To investigate the processes

CO 5: To analyze the solutions given

CO 6: To develop empathy

SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence
- To strengthen self-reflection
- To develop commitment and courage to act

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
 2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
- Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
 10. Understanding the characteristics and activities of 'I' and harmony in 'I'
 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
 12. Programs to ensure Sanyam and Health.
- Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
 14. Understanding the meaning of Trust; Difference between intention and competence
 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
- Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total: 28 Lectures And 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student are expected

CO1: To become more aware of themselves, and their surroundings (family, society, nature)

CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind

CO3: To have better critical ability

CO4: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT /REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor: 10 marks

Self-assessment:: 10 marks

Assessment by peers: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

SEC1601	ADVANCED MICROPROCESSORS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 ADVANCED MICROPROCESSOR ARCHITECTURE

9 hrs

Internal Microprocessor Architecture - Real mode memory addressing - Protected mode memory addressing - Memory paging – Data addressing modes - Program memory addressing modes - Stack memory addressing modes - Data movement instructions - Program control instructions - Arithmetic and Logic Instructions. Intel 80186 - Architecture.

UNIT 2 INTRODUCTION TO INTEL 80286, 80386 & 80486

9 hrs

Introduction to 80286 - Architecture, Real address mode & protected virtual address mode. 80386 Microprocessor - Architecture, Pins & Signals, Memory System Registers, 80386 operating modes - Paging Technique, Protected Mode Operation & Intel 80486 Architecture. Comparison of Microprocessors (8086 - 80286 - 80386 - 80486)

UNIT 3 PENTIUM PROCESSORS

9 hrs

Introduction to Pentium Microprocessor - Special Pentium registers - Branch Prediction Logic, Floating Point Module, Cache Structure, and Superscalar Architecture. Pentium memory management - New Pentium Instructions - Pentium Processor -Special Pentium pro features - Pentium 4 processor

UNIT4 RISC PROCESSORS

9 hrs

PowerPC-620 - Instruction fetching - Branch Prediction - Fetching - Speculation, Instruction dispatching - dispatch stalls - Instruction Execution - Issue stalls- Execution Parallelism - Instruction completion - Basics of P6 micro architecture - Pipelining - Memory subsystem

UNIT5 FEATURES IN VERILOG HDL

9 hrs

Conversion of Colour Models; Basic of Full-Colour Image Processing; Colour Transformations; Smoothing; Sharpening; Segmentation Applications of Image Processing - Motion Analysis, Image Fusion, Image Classification n;

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the architecture of advanced microprocessors, addressing modes and control instruction
CO2	Illustrate the architectures and working of 80286,80386 and 80486
CO3	Analyze the Pentium processor and its pro features
CO4	Evaluate the RISC processor I and to use the features pipelining to solve problems
CO5	Implement RISC processor II in real time application
CO6	Develop algorithm/program of the advanced microcontrollers for a particular task

TEXT / REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 2nd Edition, Pearson Education, Inc., 2004
2. Barry B.Brey , "The Intel Microprocessors 8086/8088, 8086, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing", Prentice Hall of India Private Limited, New Delhi, 2003
3. Alan Clements, "The Principles of computer Hardware", Oxford University Press, 3rd Edition, 2003
4. 4. John Paul Shen, Mikko H.Lipasti, "Modern Processor Design", Tata McGraw Hill, 2006

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: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1603	AUTOMATIC SPEECH RECOGNITION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL

9 hrs

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING

9 hrs

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING

9 hrs

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION

9 hrs

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION

9 hrs

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project

Max. 45 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Recognize and acquire knowledge about the fundamentals of speech production
CO2	Understand the application of Time domain analysis in speech signals
CO3	Comprehend the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Representation of speech signals using the parametric methods of Hidden Markov model for speech recognition
CO6	Will be able to develop a speech processing and recognition system using various mathematical models and signal analysis tools

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H. Juang, "Fundamentals of Speech Recognition", Prentice Hall, 1995, ISBN 0-13-015157-2
2. L. R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals", Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O'Shaughnessy, "Speech Communications: Human & Machine" -, 2nd ed., IEEE Press
4. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice" - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", Wiley

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: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1616	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION

9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non-supervised learning methods.

UNIT 2 OBJECT DETECTION METHODOLOGIES

9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT 3 PATTERN CLASSIFICATION

9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. STATISTICAL FUNCTIONS - Pattern classification using Statistical classifiers - Bayes' classifier - Classification performance measures - Risk and error probabilities.

UNIT 4 PATTERN RECOGNITION

9 hrs

FUZZY CLASSIFIERS - Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. **NEURAL CLASSIFIERS**- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS

9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. **Area Extraction**: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction **BOUNDARY ANALYSIS AND MATCHING** Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach,

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the fundamentals of Pattern Recognition
CO2	Learn the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the fuzzy classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

TEXT/REFERENCE BOOKS:

1. Dude, Hart, and Stock, "Pattern Classification", John Wiley and Sons, 2nd Edition, 2001
2. Gose, Johnsonbaugh and Jost, "Pattern Recognition and Image Analysis", Prentice Hall; Har/Dsk Edition, 1996
3. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Prentice Hall
4. Robot Vision, by B. K. P. Horn, McGraw-Hill
5. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 2007
6. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I & II, Addison-Wesley, 1993
7. Christopher M Bishop, "Neural Network for pattern recognition", Oxford university press, 2008

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: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

		L	T	P	Credits	Total Marks
SEC1617	ADVANCED ELECTRONIC TEST ENGINEERING	3	0	0	3	100

UNIT1 INTRODUCTION TO PCB TECHNOLOGY 9hrs

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection - Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT2 PCB TROUBLE SHOOTING PROCESS 9 hrs

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES 9 hrs

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics

UNIT4 ATE SYSTEM ARCHITECTURE 9 hrs

ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway – Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics

UNIT5 DESIGN FOR TESTABILITY (DFT) 9 hrs

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems - Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis - Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify various types of printed circuit boards and effectively use testing tools
CO2	Describe the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

- 1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit", 1st edition, Academic Press, 2002
- 2 Parag.K.lala, "Digital circuit Testing and Testability", 1st edition, Academic press, 2001
- 3 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 2nd edition, PHI, 1999
- 4 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007

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: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCS1315	COMPUTER ARCHITECTURE AND OPERATING SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 hrs**

Central Processing Unit - Introduction - General Register Organization - Stack organization -- Basic computer Organization - Computer Registers - Computer Instructions - Instruction Cycle. Arithmetic, Logic, Shift, Micro operations- Arithmetic Logic Shift Unit -Example Architectures: MIPS, Power PC, RISC, CISC

UNIT2 CONTROLUNIT DESIGN AND MULTIPROCESSORS**9 hrs**

Micro programmed Control: Control memory - address sequencing - Micro program Example- Design of Control unit -Example Processor design Multiprocessors: Characteristics- Interprocessor Arbitration- Interprocessor Communication

UNIT 3 MEMORY AND I/O SYSTEM**9 hrs**

Memory Organization: Memory Hierarchy - Main memory - auxiliary Memory - Associative Memory - Cache Memory - Virtual memory Input - Output Organization: Peripheral Devices - I/O Interface, Modes of transfer – Priority Interrupt - DMA -IOP - Serial Communication

UNIT4 INTRODUCTION**9 hrs**

Introduction - Operating system structures - System components - OS services - Process Management: Processes – Process concepts - Process scheduling-- CPU scheduling- Scheduling algorithms - Preemptive strategies - Non-preemptive strategies

UNIT5 DEADLOCKS AND MEMORY MANAGEMENT**9 hrs**

The critical section problem - Semaphores - Deadlocks - Deadlock characterization - Prevention – Avoidance – Detection - Recovery. Storage Management Strategies - Contiguous vs. non-contiguous storage allocation- Paging - Segmentation - Paging/Segmentation systems - Page replacement strategies

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the micro level dataflow in various units of computer
CO2	Demonstrate the impact of control memory operations and multi-processor characteristics
CO3	Examine the different types of memory and experimenting the mapping techniques
CO4	Select the suitable process scheduling technique for optimized function of operating systems
CO5	Critically appraise the deadlock in CPU and other memory management techniques
CO6	Develop an optimized architecture for stand-alone applications

TEXT / REFERENCE BOOKS:

1. M.Morris Mano, "Computer System Architecture", Prentice-Hall Publishers, Third Edition,2007
2. John P Hayes, 'Computer Architecture and Organization', McGraw Hill international edition, Third Edition,2007
3. Kai Hwang and Faye A Briggs, 'Computer Architecture and Parallel Processing', McGraw Hill International edition.
4. Abraham Silberschatz,Peter Galvin and Gagne, "Operating System Concepts", 6th Edition, Addison Wesley, 2002
5. Harvey M.Deitel, "Operating System", 2nd Edition, Addison Wesley, 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:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1	Develop a C++ program to implement a class, object creation, member function invocation concept	4 hrs
2	Develop a C++ program to implement the various constructors and destructor concept	3 hrs
3	Develop a C++ program to implement a friend function, Inline function	3 hrs
4	Develop a C++ program to implement an operator (Unary & Binary) overloading concept	5 hrs
5	Develop a C++ program to implement a function overloading concept	3 hrs
6	Develop a C++ program to implement a run time polymorphism	4 hrs
7	Develop a C++ program to implement the following inheritance types: a. Single b. Multiple c. Multilevel d. Hierarchical e. Hybrid	6 hrs
8	Develop a C++ program to implement an Abstract class concept.	4 hrs
9	Develop a C++ program to implement a Virtual function.	4 hrs
10	Develop a C++ program to find the number of characters in a file	4 hrs
11	Develop a C++ program to handle the exceptions.	5 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Explain the difference between object-oriented programming and procedural oriented language and data types in C++
CO3	Describe dynamic memory management techniques using pointers, constructors, destructors, etc.
CO4	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CO5	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CO6	Develop program using C++ features such as composition of objects, Operator overloading, inheritance, Polymorphism etc

SECX1060	RADAR AND NAVIGATIONAL AIDS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To impart the basic knowledge of Radar and Detection of Signals in noise.
2. To discuss Doppler and MTI Radar.
3. To understand the various types of the Radar Antennas.
4. To analyze the methods of Navigation.
5. To implement Microwave Landing System and Doppler Navigation.

UNIT I

10 hrs

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses- Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency- Antenna Parameters-System Losses-Other Radar Equation Considerations.

UNIT II

10 hrs

Introduction To Doppler and MTI Radar-Delay- Line Cancelers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar-Other Doppler Radar Topics-Tracking with Radar-Monopulse Tracking-Conical Scan and Sequential Lobing-Limitation to Tracking Accuracy-Low-Angle Tracking-Tracking in Range-other Tracking Radar Topics-Comparison of Trackers-Automatic Tracking with Surveillance Radars(ADT).

UNIT III

10 hrs

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifier-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Superheterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays.

UNIT IV

10 hrs

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System.

UNIT V

10 hrs

DME and TACAN-Distance Measuring Equipment-Operation of DME-TACAN-TACAN Equipment Aids to Approach and Landing-Instrument Landing System-Ground Controlled Approach System-Microwave Landing System(MLS) Doppler Navigation-The Doppler Effect-Beam Configuration-Doppler frequency Equation-Track Stabilization-Doppler

Spectrum-Components of The Doppler Navigation System-Doppler Range Equation-Accuracy of Doppler Navigation System. Inertial Navigation-Principles of Operation-Navigation Over The Earth-Components of an inertial Navigation System-Earth Coordinate Mechanization-Strapped-Down Systems-Accuracy of Inertial Navigation Systems. Satellite Navigation System-The Transit System-Navstar Global Positioning System(GPS)-Nightvision systems.

Course Outcomes

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise.
CO2	Illustrate Doppler and MTI Radar.
CO3	Classify various types of the Radar Antennas.
CO4	Describe the methods of Navigation.
CO5	Explain the Microwave Landing System.

TEXT / REFERENCE BOOKS:

1. Merrill I.Skolnik, "Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
2. Nagaraja.N.S, "Elements of Electronics Navigation", Tata McGraw Hill 1993.
3. Nadav Levanon, "Radar Principles", John Wiley and Sons, 1989
4. Peyton Z. Peebles, "Radar Principles", John Wiley & Sons, 2004
5. Toomay.J.C, "Principles of Radar", 2nd edition- PHI, 2004
6. Brookner, "Radar Technology", Artech Hons,1986.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice

20Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60Marks

SECX1043	TELEVISION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To discuss on TV pictures and TV standards.
2. To impart knowledge on camera tubes
3. To understand the usage of different types of Television Receiver.
4. To analyze the behavior of Monochrome and Color TV.
5. To impart the knowledge on Advances In TV Technology

UNIT I

10 hrs

Geo metric form and aspect ratio of the picture- scanning- interlaced scanning-number of scanned lines- vertical and horizontal resolution – picture brightness- transfer characteristics – negative transmission – VSB transmission – Complete channel bandwidth- reception of VSB signals – allocation of frequency band for TV signals- CCIR and FCC standards.

UNIT II

10 hrs

Camera tubes requirements- Iconoscope – Image Orthicon- Vidicon –Plumbicon- Silicon diode array-solid array – solid state image scanning- Gamma collection, Requirements of TV broad cast transmission- TV transmitter – Visual exciter- Aural exciter- Diplexer- transmitting antennas – MW TV relay systems- TV via satellites- CCTV- Cable TV – TV receiver as a data communication terminal-tele conference

UNIT III

10 hrs

Receiver block diagram- receiving antennas- Balun and TV filters- RF tuners –VHF and UHF tuners, IF response – Wave traps, Video Detector, Video amplifier- DC restoration-Sync separator – Vertical and horizontal output stage EHT generation- Picture tube- Beam deflection- Centering and focusing- Geometric distortion in raster- Sound sections.

UNIT IV

10 hrs

Nature of colour- Chromotocity diagram- compatibility with monochrome and vice versa Colour TV- Transmission and Reception-Video Tape recording, VCR/VCPs. Video discs- teletext and video text – Video games

UNIT V

10 hrs

Projection TV- Stereo sound in TV - 3D TV pictures - Digital TV - High definition TV (HD TV) - Flat panel display - LED TV

Course Outcomes

On completion of the course, student will be able to–

CO1	Illustrate various types of standards for Television.
CO2	Acquire the complete knowledge on camera tubes.
CO3	Demonstrate the usage of different types of Television Receiver.
CO4	Describe the behavior of Monochrome and Color TV.
CO5	Explain about advancement in TV technology.

TEXT / REFERENCE BOOKS:

1. R.R.Gulati, Monochrome and Colour Television, 2nd edition, New Age International publishers, 2004
2. A.M.Dhake, Television and Video Engineering, 2nd edition, TMH, 2003.
3. Grob and Bernard, Basic television principles and servicing, Mc Graw Hill, 2004.
4. R.R.Gulati, Modern TV practices:Principles, Technologies & servicing, New Age International, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks :80

Exam Duration : 3 Hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice

20Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60Marks