Master of Technology
(Electronics Engineering)

Curriculum

(With effect from academic year 2023-24 onwards)

Department of Electronics and Telecommunication Engineering

Government College of Engineering,

Chhatrapati Sambhajinagar M.S. 431005 India

Approved in XXVIII th Academic Council
Dated: 25th Jun 2024

Department of Electronics and Telecommunication Engineering

Vision of the Institute

- In pursuit of global competitiveness, the institute is committed to excel in engineering education and research with concern for environment and society.

Mission of the Institute

- Provide conducive environment for academic excellence in engineering education.
- Enhance research and development along with promotion to sponsored projects and industrial consultancy.
- Foster development of students by creating awareness for needs of society, sustainable development and human values.

Vision of Electronics and Telecommunication Engineering Department

- Excellence in Electronics Engineering Education and Research & Development

Mission of Electronics and Telecommunication Engineering Department

- Impart learning oriented education and equip students with strong foundation enabling for continuing education in Electronics Engineering field
- Educate students through state of art technologies to meet the growing challenges of the industry.
- Encourage students for analytical, creative thinking and innovative research
- Foster moral and ethical practices in the interest of human values

Program Education Objectives (PEO)

1. Graduates will build successful career in Electronics and Telecommunication Engineering andinterdisciplinary domains.
2. Graduates will accomplish professional responsibilities effectively to solve societal andindustrial problems ethically.
3. Graduates will contribute in research and technological developments.
4. Graduates of the program will exhibit capability of lifelong learning for their professionaldevelopment.

Programme Outcomes

1. An ability to independently carry out research / investigation and development work to solve practical problems
2. An ability to write and present a substantial technical report / document.
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a higher level than the requirements in the appropriate bachelor program
4. An ability to select, apply appropriate modern engineering and IT tools for research, testing and validation.
5. Design solutions for complex engineering problems and design system components or processes that meet the specified needs

M.Tech. Programme Components

Components		Total Credits
Programme Core Course (PCC)	Program Courses	20
Programme Elective Course (PEC)	Program Electives	14
Open Elective (OEC) other than a particular program	Open Electives	06
Vocational and Skill Enhancement Course (VSE)	Skill Courses	04
Ability Enhancement Course (AEC) Technical Presentation	Humanities Social Science and Management (HSSM)	03
Entrepreneurship/Economics/Management Courses (EEM)		03
Indian Knowledge System (IKS)		02
Research Methodology (RMC)	Experiential Learning Courses	04
Dissertation/Project/Internship (DIS/INT)		26
Co-curricular Courses (CCC)	Liberal Learning Courses	Audit
	Total Credits	82

Government College of Engineering, Chhatrapati Sambhajinagar

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics and Telecommunication Engineering

Teaching and Evaluation Scheme for NEP Compliant Curriculum

M. Tech. (Electronics Engineering) Full Time

(From 2023-2024 onwards)

Semester I

Sr. No.	Category	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)			
								Theory			Total
				L	T	P		ISE I	ISEII	ESE	
1	PCC	ECPCC5001	Advanced Digital Signal Processing	3	-	-	3	20	20	60	100
2	PCC	ECPCC5003	Advanced Industrial Automation	3	-	-	3	20	20	60	100
3	PEC	ECPEC50XX	Program Elective I	3	-	-	3	20	20	60	100
4	PEC	ECPEC50XX	Program Elective II	4	-	-	4	20	20	60	100
5	RMC	MERMC5001	Research Methodology	4	-	-	4	20	20	60	100
6	CCC (Audit course)	INCCC5001	Yoga		-	4	--	-	-	-	-
7	PCC	ECPCC5002	Lab Advanced Digital Signal Processing	-	-	2	1	-	25	25	50
8	VSE	ECVSE5001	Mini Project with Seminar I	-	-	4	2	-	25	25	50
9	PCC	ECPCC5004	Lab Open-Source Software and Simulation	-	-	4	2	-	25	25	50
			Total Semester I	**17**	**-**	**14**	**22**	**100**	**175**	**375**	**650**

Semester II

Sr. No.	Category	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)			
								Theory			Total
				L	T	P		ISE I	ISE II	ESE	
1	PCC	ECPCC5005	Digital Communication Systems	3	-	-	3	20	20	60	100
2	PCC	ECPCC5007	Modern Computer Network	3	-	-	3	20	20	60	100
3	PCC	ECPCC5008	Artificial Intelligence and Machine Learning	3	-	-	3	20	20	60	100
4	PEC	ECPEC50XX	Program Elective III	3	-	-	3	20	20	60	100
5	PEC	ECPEC50XX	Program Elective IV	4	-	-	4	20	20	60	100
6	OEC	XXOECXX	Open Elective I	3	-	-	3	20	20	60	100
7	AEC	EEAEC5001	Technical Communication	3	-	-	3	20	20	60	100
8	PCC	ECPCC5006	Lab Digital Communication Systems	-	-	2	1	-	25	25	50
9	PCC	ECPCC5009	Lab Artificial Intelligence and Machine Learning	-	-	2	1	-	25	25	50
10	VSE	ECVSE5002	Mini Project with Seminar II	-	-	4	2	-	25	25	50
			Total Semester II	**22**		**8**	**26**	**140**	**215**	**495**	**850**

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(An Autonomous Institute of Government of Maharashtra)

Department of Electronics and Telecommunication Engineering

Teaching and Evaluation Scheme for NEP Compliant Curriculum

M. Tech. (Electronics Engineering) Full Time

(From 2023-2024 onwards)

The student shall select any one of the specializations as per options given below. The option once registered shall not be changed / altered.

Elective No.	Option-I Course Code	Option-I (Specialization in Industrial Automation and Control)	Option-II Course Code	Option-II (Specialization in Signal and Image Processing)	Option-III Course Code	Option-III (Specialization in Computer Applications)	Option-IV Course Code	Option-IV (Specialization in Digital Communication)
Program Elective-I	ECPEC5001	Advanced Embedded System	ECPEC5011	Digital Image Processing and Applications	ECPEC5021	Cloud Computing	ECPEC5031	Information Theory and Coding
Program Elective-II	ECPEC5002	Robotics	ECPEC5012	Pattern Recognition	ECPEC5022	Cyber Security	ECPEC5032	Wireless Mobile Communication
Program Elective-III	ECPEC5003	IOT and Systems	ECPEC5013	Speech and Audio Processing	ECPEC5023	Big Data Analysis	ECPEC5033	Wireless Sensor Network
Program Elective-IV	ECPEC5004	Digital System Design	ECPEC5014	Biomedical Signal Processing	ECPEC5024	Android Applications	ECPEC5034	Smart Antenna and Arrays

List of Open Electives I to be offered in PG Semester II (First Year)

Sr. No.	Course code	Open Elective Course	Course offering Department
1	AMOEC5001	Basics of Finite Element Analysis	Applied Mechanics
2	CSOEC5002	Professional Ethics & Cyber Law	CSE
3	CEOEC5003	Engineering Optimization	Civil
4	MEOEC5004	Robotics	Mechanical
5	EEOEC5005	Electric Vehicles	Electrical
6	ECOEC5006	IoT for Smart Systems	E & TC

List of Open Electives II to be offered in PG Semester III (Second Year)

Sr. No.	Course code	Open Elective Course	Course offering Department
1	AMOEC6001	Indian Constitution	Applied Mechanics
2	CSOEC6002	Data Science	CSE
3	CEOEC6003	Disaster Management	Civil
4	MEOEC6004	Additive manufacturing	Mechanical
5	EEOEC6005	Smart Grid Systems	Electrical
6	ECOEC6006	Soft Computing	E & TC

List of Humanities I to be offered in PG Semester II (First Year)

Sr. No.	Course code	Humanities Course	Course offering Department
1	EEAEC5001	Technical Communication	Electrical

List of Humanities II to be offered in PG Semester III (Second Year)

Sr. No.	Course code	Humanities Course	Course offering Department
1	MEEEM6001	Entrepreneurship Development	Mechanical
2	ECEEM6002	Engineering Economics	E &TC
3	MEEEM6003	Industrial Management	Mechanical

SEMESTER III

Sr. No.	Category	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)			
								Theory			Total
				L	T	P		ISE I	ISE II	ESE	
1	OEC*	XXOECXX	Open Elective - II	3	-	-	3	20	20	60	100
2	HSSM*	XXEEMXX	Humanities - II	3	-	-	3	20	20	60	100
3	HSSM*	INIKS6001	Vedic Approach to Mathematics	2	-	-	2	10	10	30	50
4	PRJ	ECDIS6001	Dissertation I	-	-	20	10		50	50	100
		Total Semester III		**8**		**20**	**18**	**50**	**100**	**200**	**350**

***Students going for Industry/Research Organization/ Research Centre for Internships will complete these courses through MOOCs.**

SEMESTER IV

Sr. No.	Category	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)			
								Theory			Total
				L	T	P		ISE I	ISE II	ESE	
1	PRJ	ECDIS6002	Dissertation II	-	-	32	16		100	150	250
Total Semester IV				**-**	**-**	**32**	**16**		**100**	**150**	**250**

ECPCC5001: Advanced Digital Signal Processing

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To expose the students to the fundamentals of digital signal processing in frequency domain& its application.
- To teach the fundamentals of digital signal processing in time-frequency domain& its application.
- To compare Architectures & features of Programmable DSP processors.
- To discuss Application development with commercial family of DS Processors.
- To introduce the concept of Wavelet, transform in context of real time applications.
- To implement DSP algorithms using DSP Processors.

Course Outcomes: After completing the course students will be able to

CO1	Understand the basic estimate of the spectra of signals that are to be processed by a discrete time filter, and to appreciate the performance of a variety of modern and classical spectrum estimation techniques.
CO2	Design linear and adaptive systems for filtering and linear prediction.
CO3	Apply various real-world problems using transforms and Digital Signal Processing, digital filter design, including hands-on experience with important techniques and digital simulation experiments.
CO4	Design of linear and adaptive systems for filtering and linear prediction.
CO5	Understand the importance of signal processing is DSP processor architecture and its application in real time domain in communication, computer network, speech, and image.
CO6	Understand the basic theory of wavelet transform and the concepts of using simple wavelets for simple application.

Detailed Syllabus:

UNIT-1	**Introduction to Digital Signal Processing** Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-invariant Systems, Decimation and Interpolation, Digital Filters, Random signal
UNIT-2	**FIR and IIR Filters** Difference equation for digital filters: Definition and properties. FIR filters, IIR filters. Digital filter design techniques: Impulse invariance. Bilinear transformation, finite difference, window design methods, frequency sampling optimization algorithms. **Adaptive Filters** Principles of adaptive filter, FIR adaptive filters, Newton Descent algorithm, LMS algorithm, Adaptive noise cancellation, Adaptive equalizer, adaptive echo cancellation
UNIT-3	**Spectral Estimation:** Non-parametric methods and parametric method. **Linear Prediction and Coding** Forward and Backward linear prediction, Filtering-FIR Wiener filter, Filtering and linear prediction, non-causal and causal IIR wiener filter, Discrete Kalman filter.
UNIT-4	**Wavelet Transform** Introduction to continuous wavelet transform- discrete wavelet transform, orthogonal

	wavelet decomposition- Multiresolution Analysis-Wavelet function- DWT, bases, orthogonal Basis-Scaling function, Wavelet coefficients- ortho normal wavelets and their relationship to filter banks-Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal- Example MRA- Haar and Daubechies wavelet.
UNIT-5	**Architectures Of Commercial Digital Signal Processors** Introduction, categorization of DSP Processors, Fixed Point (Black fin),Floating Point (SHARC),TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – comparison : of functional variations of Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface, Memory Interface, Interrupt, DMA (one example Architecture in each of these case studies).

TEXT AND REFERENCE BOOKS

1. Proakis, J. G., Rader, C. M., Ling, F., and Nikias, C. L, Advanced Digital SignalProcessing, Macmillan,1992
2. J.G. Proakis & D. G. Manotakis Digital Signal Processing, Principles algorithms & applications, PHI
3. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley andSons, Inc, Singapore,2002
4. John J. Proakis, Dimitris G. Manolakis, Digital Signal Processing, PearsonEducation,2002
5. Rabiner, L. R. and Schafer, R. W Theory and Application of Speech Processing,PHI,1978
6. Widrow, B. and Stearns, S. D Adaptive Signal Processing, PHI,1985
7. Haykin, S, Adaptive Filter Theory, PHI,2001
8. Emmanuel C Ifeachor, Barrie W Jrevis, Digital Signal Processing, Pearson Education

9.Analog Devices & Texas Instruments Users Manuel of TMS320CX and ADSP2106x

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of the following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	3	3
CO2	1	1	1	3	3
CO3	2	1	1	2	2
CO4	1	1	1	2	2
CO5	2	1	1	2	3
CO6	2	1	1	3	3

1 – Low, 2 – Medium, 3 – High

ECPCC5002: Lab Advanced Digital Signal Processing

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/Week	ISE II	25 Marks
Total Credits	1	ESE	25 Marks

Course Educational Objectives:

Real-time signal processing experiments and design projects using special purpose DSP processor. Focus on C programming for embedded platforms. Understand real-time processing system issues including constraints of embedded systems and complexity analysisfor improved algorithm design.

Course Outcomes: Students will be able to

CO1	Compute frequency response of the systems using frequency transformation technique, DFT, DIF-FFT or DIT-FFT algorithm, window techniques and visualization using MATLAB.
CO2	Design FIR and IIR filters.
CO3	Estimate power spectral density.
CO4	Analyze signals using wavelet transform

List of Experiments: Perform practical of ADSP.

- DSP Starter Kit (C54/C62X) with IDE – Code Composer Studio and an efficientoptimizing C/C++ compiler
- Use Tool of MATLAB/Lab view / VLSI DSP code. The lab exposes students to FFT implementation using a DSP Simulator

Sr. No.	List of Experiments
1.	Implementation of IIR/FIR filter (LPF/BPF/HPF/BSF) design using a DSP (C50/C54/C62X)/MATLAB/C/Lab.
2.	Design a decimator using FIR filter.
3.	Sampling, Filters and FFTs: Effect of a low pass filter has on a signal that contains a high and low frequency component. Also to use Fourier Transforms to look at the effect that different sampling rates and sampling window sizes have on the frequency composition of signal.
4.	Implementation of an ADPCM system.
5.	Implementation of a BPSK/QPSK/GMSK system.
6.	Demonstrate the effect of decimation in the spectrum of the signal.
7.	Describe the process of decimation and its spectral effects.
8.	Write a code on spectral analysis Show(ECG/ EEG/Speech/Video) *analysis* often involves *estimation of the* power *spectral* density or PSD.
9.	Perform practical in filtering: Analysis of signal spectrum, Signal separation through filtering.

10.	LMS finite impulse response (FIR) adaptive filter by using Lab VIEW/Matlab/DSP Board.
11.	Demonstrate adaptive filtering.
12.	Perform program on Wavelet Transform DWT and CWT.
13.	Write a program for computing the *Linear Prediction* Coefficients (LPCs) by autocorrelation method using direct matrix solving approach.
14.	Simulation of the LPC Speech Coder.
15.	Simulation of the CELP Speech Coder.
16.	Linear Predictive Coding: Write a code compress or encode the speech/audio data to meet the bandwidth specs.
17.	Design of an *adaptive filter* for active noise cancellation.
18.	Real time Applications of Wavelet Transform.

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	3	3
CO2	2	1	1	3	3
CO3	2	1	1	3	3
CO4	2	1	1	3	3

1 – Low, 2 – Medium, 3 – High

ECPCC5003: Advanced Industrial Automation

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To analyze and provide solutions to industrial problems.
- To interact with industry to reciprocate knowledge and innovative ideas to serve thecommunity and economy
- To Study various Industrial Protocols.
- To use the latest technology of controllers.
- To get Involve in high quality research solutions to the needs of the Indian industry.
- To understand plant, sub plant and instrumentation process used in various processindustries

Course Outcomes:

After completing the course students will be able to

CO1	Understand the principles of Programmable Logic Controllers (PLCs), Virtual Instrumentation, SCADA, MMI (Man Machine Interface).
CO2	Study Industrial Automation using computer control systems.
CO3	Apply fuzzy controllers in real world industrial processes.
CO4	Use various Industrial Protocols.
CO5	Explore plant, sub plant and instrumentation processes used in various process industries.

Detailed Syllabus:

UNIT -1	**Controllers and Distributed Control Systems** Basic concepts, Mathematical modeling, controllers ON/OFF, P, PI, PD, PID controllers, Distributed control systems (DCS): Definition, Local Control (LCU) architecture, LCU communication facilities, configuration of DCS, displays - case studies in DCS.
UNIT -2	**Industrial Control System** Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC). Supervisory Control and Data Acquisition Systems (SCADA). Functional block diagram of computer controlsystems. Alarms, interrupts, controller software, Digital controller modes.
UNIT- 3	**Industrial Communication Protocols** Use of field buses in industrial plants, functions, international standards, performance, use of Ethernet networks, Field-bus advantages and disadvantages. Field-bus design, installation, sensor networks. Global system architectures, advantages and limitations of open networks, HART network and Foundation field bus network
UNIT- 4	**Process and Plant Control** NC, CNC, and DNC machines. Simulation and process control Study of plant, sub plant and instrumentation process used in thermal power station, sugar cement paper and pharmaceuticalindustries
UNIT- 5	**Fuzzy Controllers** Fuzzy sets and Basic notions, Fuzzy relation calculations, Fuzzy members, Indices of Fuzziness,comparison of Fuzzy quantities, Methods of determination of membership functions. Fuzzy Logic Based Control: Fuzzy Controllers, case studies

TEXT AND REFERENCE BOOKS

1. B.G. Liptak, Instrumentation Engineer Handbook
2. B.G. Liptak, Process software and digital networks, CRC press,3rdEdition
3. Noltingk B. E., Instrumentation Reference Book, Butterworth, 2ndEdition
4. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to MachineIntelligence, PHI
5. Curtis D. Johnson, Process Control Instrumentation Technology, PHI, 4thEdition
6. P.B. Deshpande and Raymond H. Ash Computer Process Control
7. Rolf Insermann, Digital Computer System, Vol I Fundamental Deterministic control

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following:

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	1			2	1
CO2			2	2	2
CO3		1	1	3	2
CO4	2	1			1
CO5		2	1		

1 – Low, 2 – Medium, 3 – High

MERMC5001: Research Methodology

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Objectives:

1. To guide students from understanding foundational research concepts to critically formulating research problems, culminating in the adept creation of comprehensive research plans and literature reviews.
2. To develop a comprehensive understanding of various research methods, both qualitative and quantitative
3. To facilitate students in analyzing, evaluating, and creating research proposals.
4. To attain mastery in data collection methods, sampling, data analysis techniques, and resultinterpretation for robust research outcomes.
5. To equip students with the skills to proficiently create and present diverse research reports, encompassing various formats oral delivery, technical writing, and ethical awareness regarding plagiarism.

Course Outcomes:

After completing the course students will be able to

CO1	Develop the ability to comprehend core research concepts, define key elements like variablesand hypotheses, and critically evaluate literature to identify research gaps.
CO2	Justify their chosen research methods and explain their advantages and limitations.
CO3	Create well-structured research proposals that include clear research objectives, methods, andexpected outcomes.
CO4	Proficient in using data analysis techniques relevant to their chosen research methods, such asstatistical analysis for quantitative research or thematic analysis for qualitative research.
CO5	Create comprehensive research reports in diverse formats, such as academic papers, presentations, and technical reports.

Detailed Syllabus:

UNIT -1	**Introduction to RM:** Meaning of Research, Objectives of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Research Design, Important Concepts Relating to Research Design, Developing a Research Plan, Literature review.
UNIT- 2	**Methods of Research:** Qualitative and quantitative methods of research like Historical, case study, ethnography, exposit facto, documentary and content analysis, survey (Normative, descriptive, evaluative etc.) field and laboratory experimental studies. Characteristics of methods and their implications in research area.
UNIT -3	**Development of research proposal:** Research proposal and its elements Formulation of research problem-criteria of sources and definition Development of objectives and characteristics of objectives. Development hypotheses and applications.
UNIT -4	**Methods of data collection:** Concept of sampling and other concepts related to sampling. Probability and non-probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools-like questionnaire, opinionative, observation, interviews, scales and tests etc. **Methods of data analysis:** Analysis of qualitative data based on various tools. Analysis of

	quantitative data and its presentation with tables, graphs etc. Statistical tools and techniques of data analysis-measures of central tendency, dispersion. Decision making with hypothesis testing through parametric and non-parametric tests. Validity and delimitations of research findings.
UNIT 5	**Interpretation and Report Writing:** Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Writing a technical paper, plagiarism and its implications.

Text and Reference Books

1. Garg B. L., Karadia R., Agarwal F. and Agarwal U. K., An introduction to Research Methodology, RBSA Publishers, 2002
2. Kothari C. R., Research Methodology: Methods and Techniques. New Age International, 1990.
3. Merriam S. B., Tisdell E. J., Qualitative Research: A Guide to Design and Implementation, 4th edition, John Wiley & Sons, 2016.
4. Creswell J. W., Research Design: Qualitative, Quantitative and Mixed Methods Approaches, 4th edition, SAGE Publications, Inc, 2014.
5. Olsen C., Devore J., Peck R., Introduction to Statistics and Data Analysis, 5th edition, Brooks/Cole, 2015.
6. Panneer selvam R., Research Methodology, 2nd edition, PHI Learning, 2014.

Teacher Assessment: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	05	02	06
K2	Understand	10	08	24
K3	Apply	00	03	09
K4	Analyze	05	04	12
K5	Evaluate	00	03	09
K6	Create	00	00	00
Total		20	20	60

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3		
CO2	2	2	2	2	1
CO3	2		3		
CO4	1		3	2	1
CO5	1	3	2		

1 – Low, 2 – Medium, 3 – High

INCCC5001: Yoga (Audit Course)

Teaching Scheme		Evaluation Scheme	
Practical	4 Hrs/Week	ISE I	----
Total Credits	--	ISE II	----
		ESE	----

Course Description: Yoga - In today's stressful life, there is much more need to experience relaxation and remain focus. The inner connect is very much needed to retain stability. Beyond physical exercise there is much more to do in the field of Yoga. The content of this course includes Yoga, Pranayama, Meditation, Relaxation, rejuvenation and connection with our own self. The introduction of such an experiential course helps to boost self confidence and with regulation of mind through meditation improves concentration. Meditation is basically training of mind and helps to regulate it. Along with experiential learning, the students are also exposed to learnings contained in the supported literature.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand and perform Yoga Asana
CO2	Gain knowledge about Pranayama and perform it.
CO3	Apply the concept of Mediation in everyday life and studies

Syllabus:

(1) Perfection in at least 3 types of Yoga-asana (Trikonasan, Konasan and Ushtrasan)

(2) Perfection in at least 3 types of Pranayama (Anulom-Vilom, Bhramari and Kapalbhati)

(3) Regular practice of Yoga-asana, Pranayama and Meditation for 10 minutes during the allotted periods as per the timetable and daily at home.

TEXTBOOKS:

1. The Heartfulness way", Heartfulness Kamlesh Patel and Joshua Pollock
2. The Yoga Sutras of Patanjali — Sri Swami Satchidananda
3. The Yamas and Niyamas — Deborah Adele
4. Yoga Practices for Anxiety and Depression --- H. R. Nagendra & R. Nagarathana

Assessment:

The evaluation is based on participating and performing Yoga, Pranayama and meditation regularly and perfectly under the guidance by Yoga Teachers in class as per schedule. Meditation trainers will observe intrinsic goodness, right attitude and happy and joyous way of doing things.

ECVSE5001: Mini Project with Seminar-I

Teaching Scheme		Examination Scheme	
Practical	4 Hrs/Week	ISE II	25 Marks
Total Credits	2	ESE	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes: Students will be able to

CO1	Comprehend, illustrate, explain and apply concepts and theories.
CO2	Write analytical technical report.
CO3	Present and discuss the technical work.
CO4	Develop capability to perform lab work in order to gain expertise.

Individual student or group of two (max)student will perform the work as per following and submit the report based on result obtained and/or study perform under the guidance of respective guide (min 25 pages)

The work will be assessed by oral/practical examination of two hours duration by two examiners out of which one will be respective guide or the teacher nominated by head of the department in the absence of respective guide on schedule .second examiner will be eminent teacher or professional / expert from industry.

Work will be carried out by the student:

1) Students will perform experimentation in any subject laboratory of the department/institute as assigned by the respective guide, leading towards concept understanding, development of laboratory set up and/or learning resources.

OR

2) Student will perform literature survey about the topic and /or concerned subject laboratory assign by respective guide, leading towards the details for modernization, research and development or thrust area subject laboratories (Thrust area should be as per Government of Maharashtra / Govt. of India policies and AICTE/UGC/DST/DRDO/ISRO etc guidelines).

OR

3) Students will develop specific software using C/C++/VB/VC/JAVA etc which will improve functions of system (Subject Laboratory/ Library /Student Section/ Office/ Exam System etc) as assigned by respective guide.

OR

4) Student will perform detailed hardware and software designing of product /system concerned to the subject laboratory leading towards post graduate dissertation

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1		
CO2		3			
CO3		3	1		1
CO4	2		2	2	2

1 – Low, 2 – Medium, 3 – High

ECPCC5004: Lab Open-Source Software and Simulation

Teaching Scheme		Examination Scheme	
Practical	4 Hrs/Week	ISE II	25 Marks
Total Credits	2	ESE	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes: Students will be able to

CO1	Comprehend, illustrate, explain and apply concepts and theories.
CO2	Write analytical technical report.
CO3	Present and discuss the technical work.
CO4	Develop capability to perform lab work in order to gain expertise.

Students shall learn based on following:

1. Introduction to Open sources, Need of Open Sources, Open source operating systems: LINUX: Introduction, Development with any one Linux distributions Ubuntu, Fedora, opens USE, Enterprise Desktop & Server
   Practical will be based on;
   1) Installation
   2) Basic Commands and Utilities
   3) Features of Operating system
2. Open Source Programming Languages
   Java, PHP: Introduction, PHP and SQL database, Python Practical will be based on
   1) PHP and Python operators, Statements, Functions and Scripts
   2) PHP and SQL database connectivity
   3) Small programs in PHP/Python
   4) Java Eclipse IDE and Net beans
3. Open Source Application Packages: SciLab, Open office, Latex , GCC, NASM, AndroidSDK
   Practical will be based on
   1) SciLab
   2) Open office, Latex
   3) GCC, NASM
   4) Android SDK

TEXT AND REFERENCE BOOKS

1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", WileyPublications,2003
2. Steve Suchring, "MySQL Bible", John Wiley,2002
3. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O Reilly,2002
4. Wesley J. Chun, "Core Python Programming", Prentice Hall,2001
5. Martin C. Brown, "JAVA: The Complete Reference" 2nd Edition, Tata McGraw-HillPublishing Company Limited, Indian Reprint2009
6. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-HillPublishing Company Limited, Indian Reprint 2009
7. VikramVaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw-HillPublishing Company Limited, Indian Reprint2009

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1		
CO2		3			
CO3		3	1		1
CO4	2		2	2	2

1 – Low, 2 – Medium, 3 – High

ECPCC5005: Digital Communication Systems

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To give overview of Digital Modulation Techniques.
- To use the concept of entropy to analyze performance of Digital Communication System.
- To study waveform coding techniques.
- To emphasize the conceptual understand of Error control coding and decoding.
- To study Spread Spectrum techniques.

Course Outcomes: Students will be able to

CO1	Analyze Digital modulation techniques and compare.
CO2	Analyze waveform coding techniques and their performance in presence of noise.
CO3	Simulate error control coding.
CO4	Examine performance of Digital Communication System and its limitations
CO5	Learn efficient utilization of band width and power of Digital Communication Systems.

Detailed Syllabus:

UNIT -1	**Sampling Process** Sampling theorem, Quadrature sampling of band pass signals, Reconstruction of a message processes from its samples, Signal distortion in sampling, Practical aspects of sampling and signal recovery, Pulse amplitude modulation, Time division multiplexing.
UNIT- 2	**Waveform Coding Techniques** Pulse -code modulation, Channel noise and error probability, Quantization Noise and signal- to-noise ratio, robust quantization, differential PCM, delta modulation, coding speech at low bit rates, applications.
UNIT- 3	**Digital Modulation Techniques** Digital modulation formats, coherent binary modulation techniques, coherent quadrature modulation technique, non coherent binary modulation technique, comparison of binary and quaternary modulation technique, M-ary modulation techniques, power spectra, Bandwidth efficiency, M-array modulation format viewed in light of the channel capacity theorem, effectof inter symbol interference, bit versus symbol error probabilities, synchronization, applications.
UNIT -4	**Error Control Coding** Rationale for coding, types of codes, Discrete memory less channels, linear block codes, cyclic codes, convolution codes, maximum likelihood decoding of convolution codes, distance properties of convolution codes, sequential decoding of convolution codes, Trelliscodes, applications.
UNIT -5	**Spread Spectrum Modulation** Pseudo noise sequences, a notion of spread spectrum, direct sequence coherent binary phase shift keying, signal space dimensionality and processing gain, probability of error, FrequencyHop spread spectrum, applications

TEXT AND REFERENCE BOOKS

1. Simon Hykin: Digital Communication, Wiley Publication
2. J. Das, S. K. Mulliek and P.K Chatterjee: Principal of Digital Communication, WileyEastern Ltd. Second Reprint-1992
3. P. Chakrabarti: Principles of Digital Communication Dhanpat Rai and Co-FirstEd.1999
4. Bearnard SKLAR: Digital Communication Fundamentals and Applications, PearsonEducation Asia, Ed.2001
5. K. Shunmugham- Digital Communication Systems, Wiley Publication

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1. Simulation
2. Application Development
3. Power point presentation
4. Question & Answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini-projects

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2		1	2	2
CO2	2		1	2	2
CO3			2	2	2
CO4		2	1	2	2
CO5	1		1	2	2

1 – Low, 2 – Medium, 3 – High

ECPCC5006: Lab Digital Communication Systems

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/Week	ISE II	25 Marks
Total Credits	1	ESE	25 Marks

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Perform all modulation and demodulation techniques
CO2	Find out the effect of parameters on performance of modulation and demodulationtechniques
CO3	Interpret the performance of coding techniques
CO4	Use modern tools for simulation for modulation

List of Experiments

1.	Perform Pulse Amplitude Modulation and TDMA. Find out the effect of change of sampling frequency on signal recovery
2.	Perform all types of pulse modulations
3.	Interpret the performance of modulation technique in presence of noise by EYE diagram
4.	Perform all types of PSKs and compare their performance
5.	Perform all types of Frequency Shift Keying and compare their performance
6.	Perform PCM Find out the effect of changing step size
7.	Simulate Spread Spectrum modulation techniques
8.	Find out information entropy of given signal
9.	Perform Huffman coding
10.	Perform Linear block coding
11.	Perform Cyclic coding

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1		1	1	2	
CO2		1	2		2
CO3	1	1	2	2	2
CO4	1	1		2	1

1 – Low, 2 – Medium, 3 – High

ECPCC5007: Modern Computer Network

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To understand the various error controlling techniques in data communication networks.
- To learn the functions of different protocols.
- To understand TCP/IP & Application layer protocols and its uses in modern communication.
- To identify different components of data communication network & IOT.

Course Outcomes: Students will be able to

CO1	Identify the issues and challenges in the architecture of a computer network and recognize security issues in a network.
CO2	Identify the design issues and develop suitable protocols.
CO3	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
CO4	Analyze topological and routing strategies for an IP based networking, IOT

Detailed Syllabus:

UNIT-1	Data Communication, Networks, Protocols and Standards, Topology, Categories of Networks,OSI & TCP/IP Protocol suites Guided media, Unguided media.
UNIT-2	Data Link Layer Design Issues: Framing, Error control, Flow control, practical data link protocols, Medium Access Technique: Ethernet, CSMA /CD protocol High speed LAN's like FDDI, Ethernet.
UNIT-3	Network Layer & Design Issues: Routing & congestion control algorithms, IP addressing, OSPF & BGP, CIDR & IPV6 Transport Layer: Transport Protocols, Addressing, Establishing & releasing a connection Transport protocol for Internet TCP & UDP.
UNIT-4	Application Layer Protocols. A web server implementation, Study of client-server implementation. Introduction to Network security, firewall, network intrusion detection system.
UNIT-5	Networking simulation and modeling techniques. Case studies. Internet of Things ArchitectureIntroduction, Reference Model Case Study.

TEXT AND REFERENCE BOOKS

1. Behrouz A. Forouzan, Data Communications and Networking, 2nd Edition, Tata McGowan-Hill, New Delhi, 2003.
2. Andrew S. Tanenbaum, Computer Networks, 4th Edition, Prentice-Hall of India, New Delhi, 2000.
3. William Stallings, Data and Computer Communication, 6th Edition, Prentice Hall of India, New Delhi, 1999.
4. Douglas E Comer, Computer Networks and Internet, Pearson Education Asia, 2000.
5. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 3rd edition (2003), Morgan Kaufmann Publishers.

List of Reference Sources for Classes and Assignments: Request for Comments, Network Standards, available from
http://www.rfceditor.org/rfcsearch.html;
IEEE Communications Magazine (technical journal)
IEEE Journal on Selected Areas in Communications (technical journal)
IEEE Network (technical journal)
IEEE Spectrum (technical journal)
IEEE Transactions on Communications (technical journal)
Resources available on e-learning site http://www.e-gecaect.com
Computer Networks and ISDN Systems (technical journal)
Cisco Systems Technical Journal

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	2	3
CO2	2	1	1	2	3
CO3	3	1	2	2	3
CO4	3	1	1	2	3

1 – Low, 2 – Medium, 3 – High

ECPCC5008: Artificial Intelligence and Machine Learning

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To design and implement key component of intelligent agents and expert systems.
- To apply knowledge represents technique and problem solving strategies to common AI application.
- To apply and integrate various artificial intelligence techniques in intelligent system.
- To build rule based and other knowledge intensive problem solvers.
- To apply various classifiers and for real world applications.

Course Outcomes: Students will be able to

CO1	Learn various types of algorithm in artificial intelligence and machine learning.
CO2	Convey the ideas in AI research and programming language related to emerging technology.
CO3	Develop an appreciation for what is involved in learning models from data.
CO4	Understand a wide variety of learning algorithms.
CO5	Understand how to evaluate models generated from data.
CO6	Apply the algorithms to a real-world problem, optimize the models learned and reporton the expected accuracy that can be achieved by applying the models.

Detailed Syllabus:

UNIT-1	Introduction: What is AI? , History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem solving agents, Problem Formulation, Uninformed Search Strategies, Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search.
UNIT-2	Heuristic functions, inventing admissible heuristic functions, Local Search algorithms, Hill- climbing, Simulated Annealing, Genetic Algorithms, Online search, Knowledge Based Agents, Logic, Propositional Logic, Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining.
UNIT-3	DPLL algorithm, Local search algorithms, First Order Logic, Models for first order logic, Symbols and Interpretations, Terms, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.
UNIT-4	Introduction to probability, Classification and K-NN, Decision Trees and Rule Learning, TheNaive Bayes algorithm, Linear Regression, Logistic Regression
UNIT-5	The Perceptron algorithm, Neural networks and Deep Belief Networks, SVMs and Margin Classifiers, SVMs: Duality and kernels, Evaluating and Comparing Classifiers Experimentally, PAC Learning, Clustering, Bias-Variance Decomposition, Ensemble Methods, Bayesian networks, HMMs - inferences, HMMs – learning

TEXT BOOKS

1. Artificial Intelligence: A Modern approach, Stuart Russell and Peter Norvig , Pearson, second Edition
2. Toshinori Munakata, "Fundamentals of the New Artificial Intelligence", Springer, 2ndedition
3. Jacek M. Zurada, "Introduction to Artificial Neural Network", Tata McGraw-Hill
4. "Machine Learning" by Tom M Mitchell, Tata McGraw-Hill
5. "Machine Learning for Hackers" by Drew Conway and John Myles White, Tata McGraw-Hill
6. "Introduction to Machine Learning" by Alex Smola and S.V.N. Vishwanathan
7. "Introduction to Octave", Dr. P. J. G. Long
8. Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd

REFERENCE BOOKS

1) Elaine Rich, Kevin Knight, B. Nair, "Artificial Intelligence", Tata McGraw-Hill, 3rdedition
2) "Artificial Intelligence for Humans" by Jeff Heaton

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	1		1		
CO2	1		2	2	1
CO3	1		2		
CO4	1		1		
CO5	2	2	2	2	1
CO6	3	2	2	3	2

1 – Low, 2 – Medium, 3 – High

ECPCC5009: Lab Artificial Intelligence and Machine Learning

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/Week	ISE II	25 Marks
Total Credits	1	ESE	25 Marks

Course Educational Objectives:

Artificial Intelligence and Machine Learning algorithms are implemented using Python programming language. Focus on making students familiar with different machine learning libraries (eg. Scikit- learn.org) & encourage them to implement the basic algorithms in Python Understand Artificial Intelligence and machine learning issues involved during the implementation of the algorithm.

Course Outcomes: Students will be able to

CO1	Understand The Artificial Intelligence and Machine learning theory (including different types of search algorithms to search the specified data and machine learning algorithms for prediction and classification) and the ability to apply this theory to real-world machine learning based Artificial Intelligence application.
CO2	Learn machine learning algorithms relevant to current industrial practice.
CO3	Learning, applying, and implementing Artificial Intelligence and machine learning methods
CO4	Implementation of blind search, heuristic search and randomized search algorithms. Implementation of estimators needed for regression and classification.

List of Experiments:

- Perform practical of AIML Using Matlab/Python programming language
- Perform any ten experiments (5 from AI & 5 from ML) from the given list.

Sr. No.	List of Experiments
1.	Implementation of different uninformed search strategies: i) Depth First Search Algorithm , ii) Breadth First Search Algorithm
2.	A map of different cities from the source to destination is given. Implement Greedy Best First Search Algorithm to reach to the destination from given starting point. (Travelling salesman problem).
3.	A bidirectional weighted graph is given. The heuristic is given as the distance of various nodes from the goal. Find the path to the goal and also the cost by implementing of A* search Algorithm.
4.	Implementation of Memory bounded heuristic search
5.	Implementation of local search algorithm: Hill climbing Algorithm
6.	Implementation of local search algorithm: Simulated Anealing Algorithm
7.	Study of different cross over techniques and Genetic algorithm.
8.	Implementation of Davis–Putnam–Logemann–Loveland (DPLL) algorithm: a complete, backtracking-based search algorithm for deciding the Satisfiability of propositional logic formulae in conjunctive normal form, i.e. for solving the CNF-SAT problem.
9.	Fit the given set of data points using the Linear regression algorithm. Plot the graph and estimate the value for unknown input.

10.	Classify the brain tumor dataset using Logistic regression algorithm. Find out the accuracy of the algorithm.
11.	Implement Naive Bayes Classifier on the iris data set. Comment on accuracy, precision and recall rate obtained.
12.	Mnist dataset contains the data of 10 numbers. Classify the data using K-nearest neighbour classifier. Comment on the misclassified data.
13.	Write a program to classify Mnist dataset using decision tree algorithm. Compare the results obtained with that of K-nearest neighbor classifier.
14.	Classify the iris data set using SVM classifier.
15.	Use Expectation Maximization algorithm to Cluster the randomly generated dataset. Write k-nearest neighbor clustering algorithm to cluster the data. Compare the results obtained by two algorithms.
16.	Study of Bayesian networks
17.	Study of Ensembles methods for classification
18.	Evaluating and Comparing different Classifiers Experimentally on Iris data set.

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2		1	1	
CO2			1	2	1
CO3			1	3	2
CO4	1	2	2	3	3

1 – Low, 2 – Medium, 3 – High

ECOEC5006: IoT for Smart Systems (Open Elective I)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Description: After completing this course, students will have a broad and fundamental understanding of IoT. Topics range from an overview of basics IoT, network and communication aspect, Domain specific applications of loT, Developing IoTs.

Course Objectives:

- To provide a clear view of internet of Things (IoT).
- To get accustomed with building blocks of IoT and its characteristics.
- To get familiarize with various applications of loT.

Course Outcomes: Students will be able to

COI	Understand the concepts of internet of Things and various challenges regarding it
CO2	Understand different network protocols and challenges in IoT
CO3	Describe IoT applications in different domain and be able to explain their
CO4	Demonstrate IoT applications on embedded platform

Detailed Syllabus:

UNIT-1	**Introduction to IOT** Defining IoT, Characteristics of IoT, physical design of IoT ,logical design of IoT, Functional blocks of IoT
UNIT-2	**Network & communication** Basics of networking, communication protocols, sensor networks, machine –to-machine communication, overview of embedded OS, IoT communication model and protocols
UNIT-3	**Challenges in IoT** Design challenges, development challenges, security challenges, other challenges
UNIT-4	**Developing IoT** Interpretability in IOT, introduction to Arduino programming, integration of sensor and actuators with Arduino, introduction to embedded programming, introduction to Raspberry, Implementation of IoT with Raspberry pi
UNIT-5	**Industrial case studies** Agriculture, healthcare, activity monitoring, home automation, logistics, retails, etc

TEXT AND REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things A Hands-On-Approach",2014
2. Adrian McEwen, "Designing the Internet of Things", WileyPublishers,2013,
3. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things" 2013
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter
5. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless sensor Networks:Theory and Practice"

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ECOEC6006: Soft Computing (Open Elective II)

Teaching		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To introduce students about Soft Computing Techniques.
- To explain students Fuzzy sets & its Applications.
- To introduce students to Genetic Algorithm fundamentals.
- To explain students concepts and categories of Neural Network

Course Outcomes: Students will be able to

CO1	Describe Soft Computing Techniques
CO2	Gain knowledge of Fuzzy sets
CO3	Understand the Neural Network concepts
CO4	Understand and apply Genetic Algorithms

Detailed Syllabus:

UNIT-1	**Fuzzy Logic** Basic concepts of Fuzzy systems, Conventional and fuzzy sets, fuzzy relations, fuzzy operations, fuzzy operators and operations, fuzzification, defuzzificaztion methods, application of fuzzy logic.
UNIT-2	**Neurocomputing** Feed forward, feedback and competitive neural network. Models of Neurocomputing: Perceptron Training, Back propagation learning, Hopfield nets. Additional models.
UNIT-3	**Adaptive Resonance Theory I and II** Self-organizing feature map, ADALINE. Applications in pattern classification and image understanding.
UNIT-4	**Genetic Algorithms** The basic operators, Schema theorem, convergence analysis, stochastic models, applications in search andoptimization. Learning with GA & NN.
UNIT-5	**Composite use of fuzzy logic** Neural network & Genetic Algorithms. Chaos Theory, Fusion of Neuro, Fuzzy, GA and Chaos theory andapplications.

TEXT AND REFERENCE BOOKS

1. David E. Goldberg: Genetic Algorithms in search optimization, and machine learning, AdditionWesley, A
2. S. Haykin, Neural Networks – A comprehensive Foundation, Macmillan College PublishingCompany, New York
3. H.J. Zimmermann, Fuzzy set theory and its application, 2nd revised edition, Allied Publishers Ltd
4. G.J. Klir, B. Yuan: Fuzzy sets and Fuzzy Logic, Theory and applications, PHI
5. R.L. Devaney, An Introduction to Chaotic Dynamical Systems, Addition Wesley, 2nd
6. B. Yegnanarayana, Artificial Neural Networks, PHI
7. Resource available on e-learning site: http://www.e-gecaect.com

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

INIKS6001 Vedic Approach to Mathematics		
Teaching: Scheme	**Examination Scheme**	
Lectures:02hrs/week	**ISEI**	**10 Marks**
Credits:2	**ISEII**	**10Marks**
	ESE	**30 Marks**

Course description: This course is planned as Ability enhancement course. It is an exposure to the Engineering students about vedic Mathematics. Vedic Mathematics is a collection of Techniques/Sutras to solve mathematical arithmetics in easy and faster way. It consists of 16 Sutras (Formulae) and 13 sub-sutras (Sub Formulae) which can be used for problems involved in arithmetic, algebra, geometry, calculus, conics. By using Vedic maths, the problems are solved mentally with the use of few or some of steps which increase accuracy and reduce mistakes. Through the application of the sutras, it ensures both speed and accuracy and enhances computational skills. In this course some of the topics from Vedic Mathematics are introduced which are use full to Engineering Students.

Course Objectives:

The main objectives of the course are:

1. Multiply two or three digits numbers.
2. Compute the division by two and three digit divisors.
3. Check the divisibility by two or three digit numbers without actual division.
4. Evaluate square, cubes, square roots and cube roots of larger numbers within no time.
5. To factorize the quadratic expressions of single variable.
6. To find the Solution of Linear Simultaneous Equations

Course Outcomes

After completing the course, students will be able to:

CO1	Do multiplication and division of two and three digit numbers by applying Sutras in Vedic Mathematics
CO2	To factorize and find LCM/HCF of numbers by applying Sutras in Vedic Mathematics
CO3	To solve Simultaneous Linear Equations by applying Sutras in Vedic Mathematics

Detailed Syllabus:

Unit 1	**Multiplication :** 1. Ekadhikenpurven method (multiplication of two numbers of two digits) 2. Eknunenpurven method (multiplication of two numbers of three digits) 3. Urdhvatiragbhyam method (multiplication of two numbers of three digits) 4. Nikhilam Navtashchramam Dashtaha (multiplication of two numbers of three digits)
Unit 2	**Division and Divisibility :** Part A: Division 1. Nikhilam Navtashchramam Dashtaha (two digits divisor) 2. Paravartya Yojyet method (three digits divisor) Part B: Divisibility 1. Ekadhikenpurven method (two digits divisor) 2. Eknunenpurven method (two digits divisor)

Unit 3	**Factorization /LCM/HCF**
Unit 4	**Solution of Linear Simultaneous Equations :** Simple equations, Simultaneous Simple Equations, Quadratic Equations, Cubic Equations, Simultaneous Quadratic Equations.
Unit 5	**Power and Root Power :** (i) Square (two digit numbers), (ii) Cube (two digit numbers). (iii) Square root (four digit number) (iv) Cube root (six digit numbers) [Self Study and assignments]

Text and Reference Books

1. Vedic Mathematics,Jagadguru Swami Sri BHARATI KRSNA TIRTHAJI MAHARAJA, Motilal Banarsi Das Publishing House, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Leelavati, Chokhambba Vidya Bhavan, Varanasi.
6. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi

Assessment:

ISEI:	Shall be based on Class Tests/ Assignments/Quizzes/Presentations/ Course Projects
ISEII:	Shall be based on class test.

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE1	ISEII	ESE
Kl	Remember	05	05	10
K2	Understand	05	05	20
K3	Apply	-	-	-
K4	Analyze	-	-	-
KS	Evaluate	-	-	-
K6	Create	-	-	-
Total Mars 50		10	10	30

Assessment table

Assessment Tool	K2	K2	K2
	COl	CO2	CO3
ISE I (10Marks)	10	-	-
ISE II (10Marks)	-	10	-
ESE (30Marks)	10	10	10

HSS AEC- I

EEAEC5001: Technical Communication (Humanities I)

Teaching Scheme		**Evaluation Scheme**	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Outcomes (COs):

At the end of the course, the student will be able to

CO1	Understand the nature and objective of Technical Communication relevant for the work placeas Engineers.
CO2	Utilize the technical writing for the purposes of Technical Communication and its exposure invarious dimensions
CO3	Enhance confidence in face of diverse audience.
CO4	Evaluate their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Detailed Syllabus:

UNIT -1	**Fundamentals of Technical Communication:** Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.
UNIT -2	**Forms of Technical Communication:** Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Key-Note Speech: Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.
UNIT -3	**Technical Presentation:** Strategies & Techniques Presentation: Forms; interpersonal Communication; Classroom presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.
UNIT -4	**Technical Communication Skills:** Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.
UNIT -5	**Kinesics & Voice Dynamics: Kinesics:** Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent; Linguistic features of voice control: Vowel & Consonant Sounds.

Text And Reference Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma,Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGrawHill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.;Krishna Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

MEEEM6001: Entrepreneurship Development (Humanities II)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Objectives:

1. Interpreting information about support systems, skill sets, financial and risk covering institutions and other for building an enterprise so that budding entrepreneurs can make right decisions for starting and running a venture.
2. Articulating the entrepreneurial process of creating new businesses, role of Creativity and innovation in Entrepreneurial start-ups
3. Preparing a context of social innovation and social entrepreneurship and issues and practices of financing entrepreneurial businesses., and live cases of social, techno, women entrepreneurs

Course Outcomes:

After completing the course students will able to

CO1	Articulate the value proposition of an Entrepreneurial venture.
CO2	Evaluate a business plan to determine if it is complete and of investment grade;
CO3	Demonstrate key entrepreneurial leadership qualities
CO4	Determine the competitiveness of their business versus direct competitors by creating a competitive matrix

Detailed Syllabus:

UNIT -1	Introduction to Entrepreneurship. Business ideas, Development of a Business plan
UNIT -2	Establishing a small-scale enterprise, Functional strategies for new business, Overview of financial markets – Meaning and scope
UNIT -3	Social entrepreneurship, Sustainability of non-profit organizations, Financing and risks in social enterprises, Business Strategies and Scaling up
UNIT -4	Entrepreneurial Management, managing growth, expansion and winding up of business, Valuation of a new company, corporate entrepreneurship, Entrepreneurship in the era of Globalization: Environment and Strategy
UNIT- 5	Entrepreneurship, Creativity and Innovation, Centre of Innovation, Incubation and Entrepreneurship- An expert Interview, Entrepreneurship: Role of stimulating creativity, Creative teams and managerial responsibilities, Innovation and entrepreneurship: types and sources of innovation, Creativity and Innovations in Start Ups, Start-up Case Studies

TEXT AND REFERENCE BOOKS

1. Eric Ries, "The Lean Startup" Crown Business, USA
2. Alexander Osterwalder and Yves Pigneur, "Business Model Generation" Pigneur Publications
3. Bill Aulet, "Disciplined Entrepreneurship: 24 Steps to a Successful Startup", 1st edition, Wiley
4. Steve Blank and Bob Dorf, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", Strategyser Publishing
5. Bruce R. Barringer and R. Duane Ireland, "Entrepreneurship: Successfully Launching New Ventures", Pearson Global Edition

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	2	
CO2	1	2	2		3
CO3	1	3	2	2	3
CO4	1		1		

1 – Low, 2 – Medium, 3 – High

ECEEM6002: Engineering Economics (Humanities II)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Objectives:

- To built up the knowledge of managerial economics and analysis of project considering economical concepts.
- Expertise in costing, finance and accounting related to the organization. Able to do corporate planning

Course Outcome:

After completing the course, students will able to:

CO1	Implement the knowledge of economics for costing, finance and accounting of engineering problems
CO2	Execute economic analysis of Analyze engineering projects.
CO3	Understand financial analysis of engineering projects and prepare project report.
CO4	Understand various aspects of corporate planning

Detailed Syllabus:

UNIT- 1	**Engineering Economics and estimation:** The principle and use of economic analysis in engineering practice. Discounted cash flow analysis, corporate tax and investment, Depreciation and economic studies, replacement analysis, valuation of assets. Estimating: Importance and aim, objectives, functions, Estimating Procedure, Constituents of Estimation. Concept of direct tax, indirect tax as GST.
UNIT -2	**Depreciation & break even analysis:** Introduction, purpose, methods for calculating depreciation-straight line method, Diminishing balance method, sum of year digit method, machine hour basis method. **Break even analysis:** Introduction, assumptions in break even analysis, important terms and definitions, calculation of breakeven point, advantages and limitations.
UNIT- 3	**Economic analysis of projects**: analysis of risks and uncertainty, elements of demand analysis and forecasting, production function, output and pricing decisions **Labor costing:** Introduction, factors influencing wage rate, methods of wage payments for direct and indirect labor-time wage system, Wage incentives: different plans, labor, indirect expenses
UNIT -4	**Costing:** Definition, aims, procedure for Costing, types of costs, Costing controls, Control of Costs, Profit and Pricing Policy. Costing methodology for raw materials, Products and Services, Nature of Costs-Direct, Traceable and Non traceable. Determining of Cost of manufactured products, methods of overhead allocation

UNIT -5	**Corporate Planning:** Corporate objectives, goals and policies, process of corporate planning, SWOT analysis, GAP analysis, strategy formulation, investment evaluation, capital budgeting, industrial dynamics, Business case development.

REFERENCE BOOKS:

1. Owler W., Brown J. L., "Cost Accounting and Cost Methods", 14th Ed., McDonald and Evans Publications
2. 2.Kuchal S. C., Financial Management - An Analytical and Conceptual Approach", 10th Ed., Chaitanya Publishing House
3. Shukla M. S. and Grewal T. S., "Advance Accounts", S. Chand and Co., New Delhi
4. Mechanical Estimating and Costing By B.P. Sinha. Tata McGraw Hill Publishing Co. Ltd. N. Delhi
5. Mechanical Estimating and Costing T.R. Banga and S.C.Sharma, Khanna Publishers Delhi
6. Industrial Engineering & Operations management by S.K.Sharma&SavitaSharma,Kataria publishers
7. Process Planning & Cost Estimation by R. Kesoram& others, New Age International Pub., N. Delhi
8. Handbook of Engineering Management- Edited by Dennis Lock Butterwork & Heinemanky Ltd
9. Theusan and Theusan, "Engineering Economics", 5 Ed., PHI, New Delhi
10. Dean Joel, "Managerial Economics", PHI, New Delhi
11. Hussey D. D., "Introducing Corporate Planning", Pergamon Press, New York,1982

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

MEEEM6003: Industrial Management (Humanities II)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Objectives:

1. Provide an overview of the principles, concepts, and importance of industrial management in modern business environments.
2. Examine techniques for maintaining and improving product and service quality.
3. Develop skills in formulating and implementing strategic plans for industrial organizations to achieve long-term objectives and stay competitive in the market.
4. Provide an overview of the role and importance of Management Information Systems in modern organizations, including their impact on decision-making, efficiency, and competitive advantage.
5. Introduce students to the fundamental concepts, theories, and models that underlie human resource development, including adult learning principles, organizational development, talent management,and performance improvement.

Course Outcomes:

After completing the course students will able to

CO1	Understanding of fundamental concepts and theories related to industrial management.
CO2	Acquire the ability to analyze complex industrial challenges
CO3	Evaluate methodologies to ensure consistent product quality and process improvement.
CO4	Examining human resources in various industrial setting
CO5	Formulate and implement strategic plans that align with organizational goals and adapt to changing market dynamics.

Detailed Syllabus:

UNIT- 1	**Basics of Management**: Introduction, Definition of management, characteristics of management, functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making, Principles of management – F.W.Taylor, Henry Fayol, Elton Mayo, Administration and management, Nature of management, levels of management, managerial skills, managerial roles, Forms of Organization- Line, Line –staff etc. Forms of ownerships – Partnership, Proprietorship, Joint stock, Co-operative society, Govt. Sector etc., concept of Globalization
UNIT -2	**Quality Management:** Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality – quality of design, conformance and performance, phases of quality management, Juran's and Demings view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mistake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management Standards (Introductory aspects only)- The ISO 9001:2000 Quality Management System Standard- The ISO 14001:2004 Environmental Management System Standard- ISO 27001:2005 Information Security Management System.
UNIT -3	**Strategic Management:** Military origins of strategy Evolution - Concept and Characteristics of strategic management –Defining strategy – Mint berg's 5P's of strategy – Corporate, Business and Functional Levels of strategy - Strategic Management Process.

UNIT- 4	**Management Information Systems:** Concept of data and information, characteristics of information, types of information, Definition of MIS, Need, Purpose and Objectives, Contemporary Approaches to MIS, Components of an information system, need to study information systems, Classification of information systems, Decision-making models, Types of decisions, Decision 3 Support Systems
UNIT -5	**Human Resource Development (**HRM): Objectives of HRM; challenges to HR professionals; role, Responsibilities and competencies of HR professionals; HR department operations; Human Resource Planning - objectives and process; human resource information system. Talent acquisition; recruitment and selection strategies, career planning and management, training and development, investment in training Programme; executive development.

TEXT AND REFERENCE BOOKS

1. O. P. Khanna, "Industrial Engineering and Management", Dhanpat Rai, Rai publicationsLtd, New Delhi.
2. L. C. Jhamb, Savitri Jhamb, Industrial Management – I, Everest Publishing House.
3. Dinesh Seth and Subhash C. Rastogi, "Global Management Solutions", Cengage Learning, Second Edition, USA.
4. B. Davis and Margrethe H. Olson, "Management Information Systems", Mc-Graw-Hill International Editions.
5. Azar Kazmi, "Strategic Management & Business Policy", Tata McGraw Hill, New Delhi
6. Kenneth C. Laudon and Jane P. Laudon, ""Management Information Systems", Eighth Edition, Pearson Education
7. K. Shridhara Bhatt, "Materials and Logistics Management", Himalaya Publishing House,Mumbai
8. M. Y. Khan and P. K. Jain, "Financial Management", Tata McGraw Hill, New Delhi
9. Ravi M. Kishore, "Project Management", Tata McGraw Hill

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:: Students will perform one or more of the following activities

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1		1	3	2	3
CO2	1	2	2	3	2
CO3	2	1	2	2	3
CO4	1		2	3	
CO5	1	2	3	2	

1 – Low, 2 – Medium, 3 – High

ECVSE5002: Mini Project with Seminar-II

Teaching Scheme		Examination Scheme	
Practical	4 Hrs/Week	ISE II	25 Marks
Total Credits	2	ESE	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes: Students will be able to

CO1	Comprehend, illustrate, explain and apply concepts and theories.
CO2	Write analytical technical report
CO3	Present and discuss the technical work.
CO4	Develop capability to perform lab work in order to gain expertise.

Individual student or group of two (max)student will perform the work as per following and submit the report based on result obtained and/or study perform under the guidance of respective guide (min 25 pages)

The work will be assessed by oral/practical examination of two hours duration by two examiners out of which one will be respective guide or the teacher nominated by head of the department in the absence of respective guide on schedule .second examiner will be eminent teacher or professional / expert from industry.

Work will be carried out by the student:

1) Student will perform experimentation in any subject laboratory of the department/institute as assigned by the respective guide, leading towards concept understanding, development of laboratory set up and/or learning resources.

OR

2) Student will perform literature survey about the topic and /or concerned subject laboratory assign by respective guide, leading towards the details for modernization, research and development or thrust area subject laboratories (Thrust area should be as per Government of Maharashtra / Govt. of India policies and AICTE/UGC/DST/DRDO/ISRO etc guide lines).

OR

3) Student will develop ,specific software using C/C++/VB/VC/JAVA etc which will improve functions of system (Subject Laboratory/ Library /Student Section/ Office/ Exam System etc) as assigned by respective guide.

OR

4) Student will perform detailed hardware and software designing of product /system concerned to the subject laboratory leading towards post graduate dissertation

Mapping of Course Outcomes with Program Outcomes:

Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1		
CO2		3			
CO3		3	1		1
CO4	2		2	2	2

1 – Low, 2 – Medium, 3 – High

ECPEC5001: Advanced Embedded Systems

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To develop understanding about requirements and general design methodology of Embedded Systems.
- To apply hardware and software knowledge for developing Embedded Systems as perrequirements, specifications and constraints.
- To impart knowledge of serial communication protocols, ARM architecture and RealTime Operating Systems.
- To expose the students to development cycle of Embedded System.

Course Outcomes: Students will be able to

CO1	Understand classification, design issues, components and peripherals of embedded systems.
CO2	Understand ARM architecture, serial communication protocols and RTOS concepts.
CO3	Interface different peripherals with assembly and C language programming toprocessors for engineering solution.
CO4	Design embedded systems for various applications with ARM, cortex and Zynq.

Detailed Syllabus:

UNIT-1	**Introduction to Embedded Systems** Definition of Embedded System, Components of a typical Embedded System, Categories and Specialties of Embedded Systems, Processor, Memory, Peripherals, Software, Microcontroller. Overview of Embedded Processors, Introduction to RISC processors- Berkeley/ Stanford RISC model, Introduction to Real Time non-OS and RTOS systems.
UNIT-2	**ARM as Embedded Processor** Overview of ARM based Embedded Systems, ARM Architecture and differentiation in Cortex Series (A, M, R), ARM Assembly Language, Thumb Instruction Set, ARM Basics- Register, Stack, RAM Cache, Memory Management Unit, Memory Protection Unit, Interrupt and Exception Handling, Introduction to Floating Point Unit.
UNIT-3	**Basic Peripherals** Introduction to Parallel and Serial I/O, Timers/counters, Real Time Clocks, SPI, USB, Introduction to PCI Express and AXI Bus.
UNIT-4	**Embedded System Development** ARM Assembly Language Programming using Keil, Assembly programming using ARM Cortex, Introduction to Embedded C Programming, and C Programming for ARM Cortex.
UNIT-5	**System on Chip** Introduction to ZynqSoC, Anatomy of Embedded SoC, IP block design, High Level Synthesis, Embedded Processing with ARM Cortex-A9 using High Level Synthesis, Linux and RTOS on Zynq, Case Study- Video Processing and Computer Vision on Zynq.

Text Books

1. ARM System Developer's Guide, Andrew N. Sloss, Dominic Symes, Chris Wright, ELSEVIER, 2005, ISBN 8181476468, 9788181476463
2. ARM System-On-Chip Architecture, 2ND ED, Steve Furber, Pearson Education, 2007,ISBN 8131708403
3. Embedded Systems Design, 2ND ED, Steve Heath, Newnes, 2003, ISBN 0750655461
4. Professional Embedded ARM Development, James A. Lang bridge, John Wiley & Sons,Inc., 2014, ISBN 9781118788943
5. The Zynq Book, 1ST ED, Louise H. Crockett, Ross A. Elliot, Martin A. Enderwitz, Robert W. Stewart, Strathclyde Academic Media, 2014
6. ARM Assembly Language Fundamentals and Techniques, 2ND ED, William Hohl, Christopher Hinds, CRC Press, 2015, ISBN 9781482229868

Reference Books

1. ARM Assembly Language with Hardware Experiments, Ata Elahi, Trevor Arjeski, Springer, 2014, ISBN 9783319117034
2. PCI System Architecture, 4TH ED, Tom Shanley, Don Anderson, MindShare Inc. PEARSON Education, 2006, ISBN 813170100X

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini -projects

ECPEC5002: Robotics

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course description: The course gives exposure to fundamentals of Robotics- Mechanical Systems, Microprocessors and Microcontrollers, Sensors and Actuators, Image Acquisition and Processing, Speech Processing. This course introduces Robot Operating System and Programming is C. This course discusses the applications of Robot in Industry and Home.

Course objectives: The course has the following objectives:

- To develop understanding Robotics components
- To know the classification of Robots
- To impart knowledge of Microprocessors and Microcontrollers
- To expose the students to Robot control and Robot Operating System

Course Outcomes: After completing the course, the students will be able to:

CO1	Learn classification and mechanics and controls involved in Robot
CO2	Understand data acquisition and processing
CO3	Explore role of Sensors and Actuators in Robotics
CO4	Study Machine Learning and AI
CO5	Understand the role of Computer Vision in Robotics
CO6	Understand various classes of Robots

Detailed Syllabus:

UNIT-1	**Mechanical Systems in Robotics** Motion Control Classification, Open and Closed Loop Systems, Mechanical Components, Motors and Motor Drives- Servo Motors and Stepper Motors, Brushless DC Motors, Feedback Sensors- Linear and Rotary Encoders, Magnetic Encoders, Tachometers, Linear and Angular Displacement Transducers, Actuators- Solenoids. Power Transfer Mechanisms- Belts, Chains, Gears, Worm Gears, Rocker and Cam, Rack and Pinion, Walkers- Leg Actuators, Leg Geometry, Walking Techniques
UNIT-2	**Data Acquisition and Processing** Sensors- Ultrasonic, Accelerometer, Temperature, Ambient Light, Ambient Temperature, Pressure, Strain Gauges, Smoke sensors, Signal Pre-conditioning, Instrumentation Amplifier, Analog to Digital Conversion, Microprocessors and Microcontrollers for Robotics- their choice, architecture, ATMEGA328p, STM32 Microcontroller, Multicore SOCs, Introduction to C and Robotic Operating System
UNIT-3	**Robotic Vision System** Camera Specifications, Camera SOC, Image Formats, Multiresolution Images, Compression Formats, Image Processing System, introduction to segmentation and classification, introduction to Open CV system. Introduction to Speech acquisition and storage, Speech Synthesis.

UNIT-4	**Robotic Control Systems** Wheeled Robotic System, feedback control systems, study and application of PID controller to motion control, stability analysis Study of Robotic Arm
UNIT-5	**Machine Learning** Introduction to AI and Machine Learning, Data Processing and Storage, Data Mining basics, interface to cloud, introduction to Machine to Machine Communication, Data Interpretation and inference engine

TEXT AND REFERENCE BOOKS:

1. Robot Mechanisms and Mechanical Devices – Paul E. Sandin, McGraw Hill, New York
2. Embedded C Programming and the Atmel AVR – Richard H. Barnett, Sarah Cox, Larry O'Cull,
   Thomson Delmar Learning, Canada
3. Mastering STM32, Carmine Noviello, Learn Pub
4. Robot Operating System (ROS), AnisKoubaa, Springer International Publishing

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ECPEC5003: IOT and System

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- Students will understand the concepts of Internet of Things and can able to build IOT applications.
- To explore the principles of IOT, its architecture for IOT systems
- To make the students understand the building blocks of Internet of Things and characteristics.

Course Outcomes: Students will be able to

CO1	Understand the concepts of Internet of Things
CO2	Analyze basic protocols in serial communication, wireless data transfer and design principles.
CO3	Implement basic IOT applications on embedded platform

Detailed Syllabus:

UNIT-1	**Automotive Fundamentals -** The engine-components-Drive train -Starting &charging systems operation- Ignition system- Suspension systems-brakes -ABS - Steering system **IOT Platform overview:** Overview of IoT supported Hardware Platform such as : Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo Boards, Network Fundamentals: Overview and working principle of Wired Networking equipment's-Router, Switches, Access Points, Hubs etc. Linux Network Configuration Concept
UNIT-2	**IOT Architecture:** History of IOT, M2M, Web of Things, IOT protocols, Remote Monitoring & Sensing, Remote Controlling, Performance Analysis, The layering Concept, IOT Communication Pattern, IOT protocols Architecture, The 6LoWPAN.
UNIT-3	**Internet/Web and Networking Basics** OSI Model, Data transfer, referred with OSI model, IP Addressing, Point to Point data transfer, Point to Multipoint data transfer and Networking Topologies, Sub-netting network topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing.
UNIT-4	**Communication Protocols and Design Principles:** SPI, I2C, Firewire, LAN, MAC level, Link Protocols such as point to point protocols, Ethernet, Wi-Fi 802.11, Cellular Internet access and machine to machine, Web thinking for connected devices, Prototyping Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and production, changing embedded platform.
UNIT-5	**Case Studies and Advanced IOT Applications** IOT applications in home, infrastructure, buildings, security, Industries, home appliances, agriculture, environment and other IOT electronic equipment's Sensor and sensor node, interfacing using any target board.

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks:Theory and Practice"
3. Peter Waher, " Learning Internet of Things," PACKT publishing, Birmingham-Mumbai
4. Vijay Madisetti and Arshdeep Bahga," Internet Of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation

ECPEC5004: Digital System Design

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To provide experience in designing integrated circuits using software tools.
- To introduce the fundamental principles of VLSI circuit design.
- To model, simulate, verify and synthesize with Hardware Description Languages.
- To examine the basic building blocks of large-scale digital integrated circuits.
- To develop different memory and programmable devices.
- To design for testability concepts.

Course Outcomes: Students will be able to

CO1	Analyze the operation and performance of a finite state machine (FSM) design.
CO2	Simulate hardware description language-based digital systems designs throughmodern electronic design automation software.
CO3	Design of simple SSI and MSI combinational and sequential circuits for a targeted problem.
CO4	Verify and test digital logic circuits and work upon testability.
CO5	Synthesize large-scale digital systems designs suitable for Implementation on programmable device technologies

Detailed Syllabus:

UNIT-1	**Analysis of Sequential systems:** State tables and Diagrams, latches, flip flops, sequential machine analysis and design, Algorithmic State Machine diagrams, Design using ASM
UNIT-2	**Design using VHDL:** Hardware Description Languages, HDL Design Flow, Hardware Simulation, Hardware Synthesis, Levels of Abstraction, Entities and architectures, Data objects, types, design description, libraries, synthesis basics, mapping statements to Gates, model optimization, verification, test benches, Architectural synthesis, optimization
UNIT-3	**Combinational and sequential circuit designs:** Use VHDL to design adders, decoders, multiplexers, comparators, code converters, latches, flip-flops, shift registers, counters, ALU, CPU.
UNIT-4	**Memory, PAL, PLA, CPLDs and FPGAs** Design using ROM, Programmable Logic Arrays (PLA) and Programmable Array Logic (PAL).Types of memory devices, Read-Only Memory (ROM), Read / write memory, Static RAM, Dynamic RAM, Introduction to Xilinx XC9500 CPLD family and Xilinx XC 4000FPGA family
UNIT-5	**Design for testability** Testing combinational and sequential logic, Boundary scan testing, compression techniques andBuilt-in self test

TEXT AND REFERENCE BOOKS

1) William I Fleatcher, An Engineering Approach To Digital Design, PHI
2) Giovanni De Micheli, Synthesis and Optimization of Digital Circuits, McGrawHill
3) Alan B. Marcovitz, Introduction to Logic and Computer Design, Tata McGrawHill
4) Charles H Roth, Jr., Digital System Design using VHDL, Brooks/Cole Thomsonlearning
5) VHDL Programming by examples, Perry, Tata McGrawHill
6) J.P. Hayes, Computer Architecture and Organization, McGrawHill
7) John F. Wakerley, Digital Design Principles and Practices, Pearson Education
8) Stephen Brown and ZvonkoVranesic, Fundamentals of Digital Logic with VHDLDesign, McGrawHill
9) Melvin A Breuer, Arthur D. Friedem, Miron AbraMovici, Digital System Design andTestability, JAICO publishing.

Assessment: ISE I (Class Test), ISE II (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5011: Digital Image Processing and Application

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To understand the principles of Digital Image Processing.
- To analyze the image signal in Spatial and Spatial frequency domain.
- To understand various Image Processing techniques for enhancement, segmentation, restoration, compression and implement using MATLAB.
- To apply Image Processing techniques to solve real world problems.

Course Outcomes: Students will be able to

CO1	Apply image processing techniques in spatial and frequency domain.
CO2	Apply various transforms on images and simulate its application to 2 D signals.
CO3	Apply image restoration and encoding techniques.
CO4	Study and implement various image segmentation approaches.
CO5	Perform various images processing tasks and simulates them.
CO6	Apply image processing techniques for real world applications

Detailed Syllabus:

UNIT-1	**Introduction** Digital Image Representation, Sampling and Quantization, some basic relationship between Pixels, Image Geometry, Image Enhancement in spatial domain, spatial filtering.
UNIT-2	**Image Transformation** Fourier Transform, the discrete Fourier Transform, properties of the Two-dimensional Fourier Transform, The Fast Fourier Transform, Hadamand-Hough-Hotelling transform, Wavelet transforms, Enhancement in the Frequency Domain, Color Image Processing.
UNIT-3	**Image Restoration** Degradation Model, Diagonalisation of Circulant and Block circulant Matrices, Algebraic approach to Restoration, Inverse Filtering, Least Mean Square Filter, and Geometric Transformation. Image Compression: Fundamentals Image Compression Models, Error-free Compression Lossy Compression.
UNIT-4	**Image Segmentation** Edge Detection, Thresholding, Region based and motion based Segmentation, Morphology, Representation and Description Representation Schemes, Boundary Descriptors, Regional Descriptions, Relation Descriptors.
UNIT-5	Engineering Applications of Image Processing, Multimodal Biometrics, Industrial Applications etc.

TEXT AND REFERENCE BOOKS:

1) Gonzalez and Woods, Digital Image Processing, Pearson Education
2) A.K. Jain- Fundamentals of Digital Image Processing, PHI1007
3) W.K. Pratt – Digital Image Processing- Wiley New Delhi.1987
4) Vasudev Bhaskaran- Image and video Coding Standards- Cluwer Academic

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5012: Pattern Recognition

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To understand concepts of Statistical and Non parametric Decision making.
- To gain knowledge about clustering.
- To learn image analysis techniques.

Course Outcomes: Students will be able to

CO1	Understand and analyze methods for automatic training of classification system.
CO2	Design systems and algorithms for Pattern Recognition.
CO3	Implement typical Pattern Recognition algorithms using MATLAB.
CO4	Implement algorithms for real world problems.

Detailed Syllabus:

UNIT-1	**Introduction to Pattern Recognition** Pattern Recognition, Classification and description, Patterns and Feature extraction, trainingand learning in PR system, Pattern Recognition approaches.
UNIT-2	**Statistical Decision Making** Probability, random variables, Joint Distribution and Densities, Minimum Risk Estimators, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal Costs Of Errors, Estimation Of Error Rates, The Leaving-One-Out Technique, Characteristic Curves, Estimating The Composition Populations.
UNIT-3	**Non-parametric Decision Making** Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Squared Error Discriminant Functions, ChoosingDecision-Making Techniques
UNIT-4	**Clustering** Various clustering techniques, cluster analysis, Hierarchical Clustering, Partitional Clustering,algorithms for clustering data
UNIT-5	**Applications** Applications of Pattern Recognition, typical case studies of Pattern Recognition in data mining,medical imaging, industrial automation.

TEXT AND REFERENCE BOOKS

1. E. Gose, R. Johnson Baugh, S. Jost, Pattern Recognition & Image Analysis, PHI
2. R. O. Duda and P. E. Hart, Pattern classification and scene analysis, Wiley Inter science publications.
3. Robert Schaloff, Pattern recognition: statistical, structural and neural approaches, John Wiley and Sons. Inc

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5013: Speech and Audio Processing

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To present fundamentals of speech signal.
- To explain various parameters of speech signal using time domain and frequency domain methods.
- To confer comprehensive understanding of Linear prediction analysis and Cepstral analysis.
- To explore the applications of speech and audio processing.

Course Outcomes: Students will be able to

CO1	State fundamentals for speech signal.
CO2	Describe features of speech signal using different analysis methods.
CO3	Understand the speech signal in time domain and frequency domain.
CO4	Interpret applications of speech and audio processing.

Detailed Syllabus:

UNIT-1	**Fundamentals of speech production** Anatomy and physiology of speech production, Human speech production mechanism. LTI model for speech production, Nature of speech signal, linear time varying model, articulatory phonetics, acoustic phonetics, Voiced and Unvoiced speech. Sound intensity and Decibel sound levels. Concept of critical band and introduction to auditory system as a filter bank, Uniform, non-uniform filter bank, mel scale and bark scale. Speech perception: vowel perception.
UNIT-2	**Time and frequency domain methods for audio processing** Short-time energy, average magnitude, average zero crossing rate, autocorrelation function, average magnitude difference function. Pitch period estimation using autocorrelation method, Wavelet, Audio feature extraction, Spectral centroid, spread, entropy, flux, and roll-off. Spectrogram.
UNIT-3	**Linear prediction analysis** Basic principles of linear predictive analysis. Autocorrelation method, covariance method. Solution of LPC equations: Cholesky decomposition, Durbin's recursive solution, lattice formulations and solutions. Frequency domain interpretation of LP analysis. Applications of LPC parameters as pitch detection and formant analysis.
UNIT-4	**Cepstral Analysis** Homomorphic speech processing, Real and complex cestrum, pitch estimation, format estimation,Mel cepstrum.
UNIT-5	**Speech and Audio processing applications** Speech enhancement, Speech and Speaker recognition, Text to speech conversion, Musical instrument classification, Musical Informationretrieval

TEXT BOOKS:

1) Deller J. R. Proakis J. G. and Hanson J. H., "Discrete Time Processing of Speech Signals", Wiley Interscience
2) Ben Gold and Nelson Morgan, "Speech and audio signal processing" Wiley

REFERENCE BOOKS:

1) L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Education.
2) Thomas F. Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice" Pearson
3) Dr. Shaila Apte, "Speech and audio processing", Wiley India Publication
4) L. R. Rabiner and B. H. Juang, "Fundamentals of speech recognition"
5) Theodoros Giannakopoulos and Aggelospikrakis, "Introduction to audio analysis: AMATLAB Approach: Elsevier Publication.

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5014: Biomedical Signal Processing

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To understand the principles of Digital Image Processing.
- To analyze the image signal in Spatial and Spatial frequency domain.
- To understand various Image Processing techniques for enhancement, segmentation, restoration, compression and implement using MATLAB.

Course Outcomes: Students will be able to

CO1	Apply image processing techniques in spatial and frequency domain.
CO2	To apply various transforms on images and simulate its application to 2 D signals.
CO3	Apply image restoration and encoding techniques.
CO4	Study and implement various image segmentation approaches.
CO5	To perform various images processing tasks and simulates them.
CO6	Apply image processing techniques for real world applications.

Detailed Syllabus:

UNIT-1	**Essentials of continuous time signals and systems** Convolution, Fourier transform, system transfer functions; Discrete time signals and systems: sampling and quantization, the sampling theorem and signal reconstruction; Frequency analysis of discrete signals and systems: the discrete Fourier transform, power spectrum estimation and system identification. Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables. Stationary random process, Periodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.
UNIT-2	**Data Compression Techniques** Lossy and Lossless data reduction Algorithms.ECG data compression using Turning point, AZTEC, CORTES, Hoffman coding, vector quantization, DCT and the K L transform.
UNIT-3	**Cardiological Signal Processing** Pre-processing, QRS Detection Methods. Rhythm analysis. Arrhythmia detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition, Heart rate variability analysis.
UNIT-4	**Adaptive Noise Cancelling** Principles of Adaptive Noise cancelling. Adaptive Noise cancelling with the LMS adaptation Algorithm. Noise cancelling Method to Enhance ECG Monitoring. Fatal ECG Monitoring. Signal Averaging, polishing–mean and trend removal, Prony's method. Linear prediction. Yule– walker(Y–W) equations
UNIT-5	**Neurological Signal Processing** Modelling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis. Inverse Filtering.Least squares and polynomial modelling. Original Prony's Method, Prony's Method based on the Least Squares Estimate. Analysis of Evoked Potentials and PCG .Analysis of non-stationary processes: examples using Wavelet analysis and Time-series models; Examples of physiological signals and systems including feedback systems

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TEXT BOOKS:

1) Cromwell, “Biomedical Instrumentation and Measurement”, PHI.
2) Carr and Brown, “Biomedical Instrumentation”.
3) Koebmer K R, "Lasers in Medicine", John Wiley & Sons.
4) “Biomedical Engg. System”, Cromwell, McGrawHill

REFERENCE BOOKS:

1) R. S. Khandpur, “handbook Biomedical Instrumentation”, by Tata MaGraw Hill
2) Webster, “Application and Design of Medical Instruments"
3) “Biomedical phenomenon’, Plonasy Robert, McGrawHill

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5021: Cloud Computing

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To present fundamentals of cloud computing.
- To explain various parameters of deployment of web services from cloud architecture.
- To confer comprehensive understanding of consistency of services deployed from a cloud architecture
- To explore the significance of cloud computing.

Course Outcomes: Students will be able to

CO1	Analyze the components of cloud computing showing how business agility in an organization can be created.
CO2	Evaluate the deployment of web services from cloud architecture.
CO3	Critique the consistency of services deployed from a cloud architecture.
CO4	Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications.

Detailed Syllabus:

UNIT-1	**Cloud Computing Fundamentals** Cloud Computing definition, Characteristics of Cloud Computing, Components of CloudComputing. Models in Cloud Computing, Deployment models, Private cloud, Public cloud, Hybrid cloud, Community cloud. Service models- IaaS, PaaS, SaaS Concept of Tenancy, Multi-Tenancy, Introduction to Grid Computing, Applications of cloudcomputing, Benefits of cloud computing, Limitations of cloud computing
UNIT-2	**Cloud architecture, Services** Cloud Architecture, Introduction to Services, Infrastructure as a Service, Platform as a Service, Software as a Service, Identity as a Service, Security as a Service, Compliance as a Service
UNIT-3	**Cloud Infrastructure and Virtualization** Infrastructure – Clients, Security, Network and Services, Introduction to Virtualization, Virtualization types: Server virtualization, Storage virtualization, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Introduction toHypervisors, Types of Hypervisor, Concept of Load balancing
UNIT-4	**Security** Cloud Security, Risks, Privacy, Operating system security, Security of virtualization, Data security. Concept of data privacy and data security, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business consideration, Infrastructure Security, Network level security, Host level security, Application level security.
UNIT-5	**Cloud implementation and applications** Cloud Platforms: Amazon EC2 and S3, Cloud stack, Inter cloud, Google App Engine, OpenSource cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.

TEXT BOOKS:

1) Barrie Sosinsky, " Cloud Computing Bible", Wiley
2) Gautham Shroff, "Enterprise Cloud Computing", Cambridge.
3) Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions" by John Wiley & Sons, 2011.
4) Shrinivasan, J. Suresh, "Cloud Computing: A practical approach forlearning and implementation", Pearson.
5) RajkumarBuyya, J. Broberg, A. Goscinski, "Cloud Computing Principles and Paradigms", Wiley.
6) Ronald Krutz,"Cloud Security: Comprehensive guide to Secure Cloud Computing", Wiley Publishing.
7) Anthony T. Velte, "Cloud Computing: Practical Approach", McGraw Hill.
8) Tim Mather, "Cloud Security and Privacy", O'REILLY.

List of Reference Sources for Classes and Assignments:

1) Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
2) Enterprise Cloud Computing by Gautam Shroff, Cambridge
3) Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4) Google Apps by Scott Granneman, Pearson
5) Cloud Security & Privacy by Tim Malhar, S. Kumaraswammy, S. Latif (SPD,O'REILLY)
6) Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
7) Cloud Computing Bible by Barrie Sosinsky, Wiley India
8) Stefano Ferrettiet QoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing
9) Virtualization for Dummies: Wiley India.

Resources available on e-learning site http://www.e-gecaect.com
Microsoft Technical Journal, Google Cloud Platform resources

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5022: Cyber Security

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To inculcate fundamental knowledge of Application Layer Protocol.
- To lay a strong base of, Peer-to-Peer network architectures.
- To develop conceptual understanding of Cryptography and security protocols.
- To understand web based bio authentication and legal aspects of data communication.

Course Outcomes: Students will be able to

CO1	Analyze the requirements for a given organizational structure and select the most appropriateNetworking architecture.
CO2	Understand client-server, socket programming and develop web applications.
CO3	Have a basic knowledge of the use of cryptography and network security.
CO4	Understand and apply the concepts for administrating security to corporate network.
CO5	Get knowledge of available legal framework such as IT Act2005.

Detailed Syllabus:

UNIT-1	Client-server, Web, HTTP, FTP, SMTP, POP3, and DNS, Peer-to-peer file sharing networks,Networking simulation and modeling techniques
UNIT-2	Managing network devices such as switch, Router, Firewall & modems, Sockets Programming and Implementation. Client-server implementation, Web server implementation, Case Studies
UNIT-3	Advanced IP multicast, including IPv6 multicast and SSM, Peer-to-Peer network architectures, IP network management and monitoring, Host configuration methods, Trends in network threats Information security principles.
UNIT-4	Cryptography, Goals, Attacks, Services and mechanisms Design principle of Block Ciphers & Block Cipher algorithms, Modern symmetric key ciphers, DES $ AES Public Key Cryptography RSA, Elliptic curve cryptosystems.
UNIT-5	System Security: Computer virus, Firewall and Intrusion detection, Electronic commerce security Introduction to web based bio authentication, Smart card, RF ID, Cyber laws related toE – commerce, IT Act-2005.

TEXT AND REFERENCE BOOKS

1) William Stallings, Data and Computer Communications, 7th edition, PH,2004.
2) Andrew S. Tanenbaum, Computer Networks, 4th edition, PH, Inc.,2003
3) Behrouz Forouzan, Cryptography and Network Security, McGraw-Hill.
4) H. Bidgoli, Handbook of Information Security, Vols. 1-3, John Wiley & Sons, January2006.
5) H. Bidgoli, The Internet Encyclopedia, Vols. 1-3, John Wiley & Sons, Jan.2004
6) Behrouz Forouzan, Data Communications McGraw-Hill IVth Edition
7) Request For Comments, Network Standards, available from http://www.rfc-editor.org/rfcsearch.html

Assessment: ISEI (Class Test),ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ECPEC5023: Big Data Analysis

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- Understand the big data platform and its use cases.
- Provide HDFS concepts and interfacing with HDFS.
- Provide hands on Hadoop Eco System.
- Apply analytics on structured, unstructured data.
- Exposure to data analytic with R.

Course Outcomes: Students will be able to

CO1	List the components of Hadoop and Hadoop Eco-System.
CO2	Access and process data on distributed file system.
CO3	Manage job execution in Hadoop environment.
CO4	Develop big data solutions using Hadoop Eco System.
CO5	Analyze info sphere big insights big data recommendations.
CO6	Apply Machine Learning Techniques using R.

Detailed Syllabus:

UNIT-1	**Big Data introduction** Big data: definition and taxonomy, big data value for the enterprise, setting up the demoenvironment, First steps with the Hadoop "ecosystem".
UNIT-2	**The Hadoop ecosystem** Introduction to Hadoop, Hadoop components: Map Reduce/Pig/Hive/H Base, Loading datainto Hadoop, Handling files in Hadoop, Getting data from Hadoop.
UNIT-3	**Querying big data with Hive** Introduction to the SQL Language, From SQL to HiveQL, Introduction to HIVE e HIVEQL,and Using Hive to query Hadoop files.
UNIT-4	**Big data and Machine learning** Quick into to Machine learning, Big Data and Machine Learning, Machine learning tools.
UNIT-5	**Data Analytics** Introduction to R and Python, Spark and SparkML, H2O, Azure ML.

TEXT AND REFERENCE BOOKS

Text Books:

1) Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2) Seema Acharya, Subhasini Chellappan, "Big Data Analytics” Wiley 2015.

References:

1) Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2) Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press(2013)
3) Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4) Anand Rajaraman and Jefrey David Ulman, “Mining of Massive Data sets”, CambridgeUniversity Press, 2012.
5) Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6) Request For Comments, Network Standards, available from http://www.rfc-editor.org/rfcsearch.html

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5024: Android Applications

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To understand the architecture of Android applications.
- To provide an overview of life cycle of various components for Android development.
- To provide user interfaces by using extending and creating your own layouts and views.
- To understand Android's Application Framework API to build complex Android applications.
- To apply various techniques on working with menu.

Course Outcomes: Students will be able to

CO1	Understand the architecture of Android applications, life cycle of various components,manifest, Intents and the use of external resources for Android development.
CO2	Design and develop Android applications with compelling user interfaces by using extending and creating your own layouts and views and using menus.
CO3	Execute Android's Application Framework API to build complex Android applications.
CO4	Utilize the power of background services, threads, asynchronous tasks and notifications.
CO5	Apply various techniques on working with menu.

Detailed Syllabus:

UNIT-1	Introduction to mobile computing, installing of required software and preparing the working environment, **Introduction to ANDROID:** ANDROID SDK Features, Introduction to Development Features. **Basics of ANDROID:** Developing for ANDROID, developing for mobile and embedded devices, ANDROID development tools **Creating Applications using ANDROID:** Basics of an ANDROID application, introduction to manifest, externalizing resources, application life cycle, and ANDROID activities.
UNIT-2	**Building user interfaces:** Introduction to layouts, introduction to fragments, creating newviews, introduction to adapters. **Intents and broadcast receivers:** Introduction to intents, creating intents and broadcastreceivers. **Using Internet resources:** Downloading and parsing internet resources, using the downloadmanager, using internet services
UNIT-3	**Files, saving state and preferences:** Creating, saving and retrieving shares preferences, including static files as resources, working with the file system. **Database and content providers:** Introducing ANDROID databases, content values and cursors, working with SQLite databases, creating content providers, using content providers, native ANDROID content providers. **Working in background:** Introducing services, using background threads, using alarms.

UNIT-4	**Enhancing user experience:** Introduction and addition of action bar, menus and dialogs, drawables and gradients, custom animations. **Hardware sensors:** Sensors and sensor manager, monitoring devices' movement andorientation. **Maps and location based services:** Using location based services, selecting a location provider, finding your current location, and creating map based activities.
UNIT-5	**Audio, video and using the camera:** Playing audio and video, manipulating raw audio, usingcamera to take pictures, recording video, adding media to media store. **Telephony and SMS:** Hardware support for telephony API, using telephony API, introducing,how to send and receive SMS and MMS. **Monetizing, promoting and distributing the applications** Signing and publishing applications, distributing applications, introduction to monetizingapplications.

TEXT AND REFERENCE BOOKS

1) Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsican
2) Android Programming – Pushing the limits by Hellman
3) Building Android Apps, IN EASY STEPS, McGraw-Hill Education
4) Professional Android 2 Application Development, Reto Meier ,Wiley India Pvt Ltd
5) Beginning Android, Mark L Murphy,Wiley India Pvt Ltd
6) Pro Android,Sayed Y Hashimi and Satya Komatineni,Wiley India Pvt Ltd

Suggested Readings:

1. Android Studio Development Essentials by Neil Smyth
2. The Definitive Guide to SQL Lite by Michael Owens

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5031: Information Theory and Coding

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To give exposure to students about concepts of information, entropy, coding efficiency.
- To explain need of data compression.
- To give mathematical foundation of compression, error control and security of information.
- To give exposure to students about various source coding and channel coding.

Course Outcomes: Students will be able to

CO1	Describe fundamentals concepts of Information theory and source coding.
CO2	Explain the need of Source coding and Channel coding.
CO3	Describe various types of Source coding and Channel coding and decoding.
CO4	Apply theoretical concepts to derive various codes for real world signal.

Detailed Syllabus:

UNIT-1	Information Theory, Entropy, Source coding theorem, Channel models, capacity and coding,Information capacity theorem, Shannon's Limit.
UNIT-2	Linear Block Coding/Decoding, Matrix description of linear block codes, Hamming codes, optimal linear codes, Maximum Distance Separable codes.
UNIT-3	Cyclic Codes, "Polynomials, Generation of Cyclic codes, matrix description of cyclic codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check.
UNIT-4	BCH Coding /Decoding , Primitive elements, Minimal Polynomials, Generator Polynomials,Reed Solomon codes, Nested Codes.
UNIT-5	Convolutional Code, Tree Codes and trellis codes, Polynomial description of Convolutional Codes, Distance Notion, Generating function, Matrix description, Viterbi coding , Distance Bound , Performance bound, Turbo Coding/Decoding.

TEXT AND REFERENCE BOOKS

1) Ranjan Bose, "Information Theory coding and Cryptography", McGraw-HillPublication, 2nd Edition
2) R. Avudaiammal, , Information Coding Techniques" Second Edition. Tata McGraw Hill
3) J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition.
4) Simon Haykin, "Communication Systems", John Wiley & Sons, Fourth Edition.

Assessment: ISEI (Class Test),ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ECPEC5032: Wireless Mobile Communication

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To describe different types of diversity and how they improve performance for mobile radio channels.
- To enable the student to synthesis and analyze wireless channel modeling and mobile cellular communication systems.
- To understand the Multicarrier modulation and OFD issues.
- To learn the MIMO communication and its types.
- To explore the Ultra Wide Band modulation and Wireless Standards.

Course Outcomes: Students will be able to

CO1	To identify and know various mobile and Cellular telephony systems with standards and working algorithms.
CO2	To understand multiple access schemes in mobile and Wireless networks.
CO3	To understand the OFDM and MIMO communication systems.
CO4	To deal with Diversity modeling for Wireless Communications.

Detailed Syllabus:

UNIT-1	**Wireless Communications and Diversity** Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performancein Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space.
UNIT-2	**Broadband Wireless Channel Modeling** WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Autocorrelation, Jakes Spectrum, Impact of Doppler Fading. **Cellular Communications** Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies,Cellular Processes -Call Setup, Handover etc, Tele traffic Theory.
UNIT-3	**OFDM** Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNRperformance, OFDM Issues – PAPR, Frequency and Timing Offset Issues
UNIT-4	**MIMO** Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Altamonte, OSTBC, MRT,MIMO, OFDM.
UNIT-5	**UWB (Ultra wide Band)** UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, UniformPulse Train, Bit-Error Rate Performance of UWB **3G and 4G Wireless Standards:** GSM, GPRS, WCDMA, LTE, WiMAX.

TEXT AND REFERENCE BOOKS

1) David Tse and Pramod Viswanath, Fundamentals of Wireless Communications,Cambridge University Press.
2) Andrea Goldsmith, Wireless Communications, Cambridge University Press.
3) Theodore Rappaport, Wireless Communications: Principles and Practice, PrenticeHall.
4) Ezio Biglieri, MIMO Wireless Communications, Cambridge University Press.
5) John G Proakis, Digital Communications, McGraw HillScience/Engineering/Math.

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ECPEC5033: Wireless Sensor Network

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	ISE I	20 Marks
Total Credits	3	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To learn the concepts and principles behind WSN.
- To learn WSN network design, sensor node embedded system design and implementation.
- To understand WSN network management, different protocols and architecture.
- To introduce sensor network platforms, operating systems and programming tools for sensor networks.
- To study wireless sensor network solutions with practical implementation examples andcase studies.

Course Outcomes: Students will be able to

CO1	Understand the fundamental concepts of wireless and sensor networks.
CO2	Develop simple wireless sensor network applications using actual motes and sensor devices.
CO3	Develop simple wireless sensor network applications using hardware, software platforms.
CO4	Get an overview of the various network level protocols for MAC, routing, time synchronization, aggregation, and consensus and distributed tracking
CO5	Program sensor network platforms using Tiny OS, C and Java and to develop applications on wireless motes, smart phones and other embedded platforms.

Detailed Syllabus:

UNIT-1	**Introduction** Introduction of wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks
UNIT-2	**Wireless Sensor Node Architecture** System level -Main components with detailed description ,Microcontroller, Communication (RF) module , Sensors (depending on application) and signal conditioning ,Memory, Power Supply, Battery Management, Energy Harvesting, Topology/Network Structure, Power Management, Physical, MAC, Routing
UNIT-3	**Networked Wireless Control Systems** Implementation and Considerations, Design Principles of Wireless Sensor Networks Protocols for Control Applications, Adaptive IEEE 802.15.4, Medium Access Control Protocol forControl and Monitoring Applications.
UNIT-4	**Sensor Network Platforms** Test beds, Operating Systems: Tiny OS, Contiki, Hardware test beds: IITH Motes, Libelium,WASP motes, Crossbow Motes **Case Study:** Security in Sensor networks, Localization, IEEE 802.15.4 low rate WPAN,Practical implementation issues.
UNIT-5	**WSN Applications** Target detection tracking, Habitat monitoring, Military eness

	Environmental disaster monitoring, Underwater Acoustic and Deep space networks, Wireless Body Area Networks (WBAN) for health-monitoring, Open issues and Design challenges.

TEXT AND REFERENCE BOOKS

1) Principles of Embedded Networked Systems Design Gregory Pottie, William Kaiser Hardback (ISBN-10: 0521840120 | ISBN-13:9780521840125)
2) Wireless Sensor Networks: An Information Processing Approach, Feng Zhao and Leonidas Guibas
3) Wireless Communications & Networks, 2nd Edition, William Stallings. ISBN:0131918354
4) Elements of network protocol design, Mohammed G. Gouda
5) Elements of distributed computing, Vijay K. Garg

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-project

ECPEC5034: Smart Antenna and Array

Teaching Scheme		Evaluation Scheme	
Lectures	4 Hrs/Week	ISE I	20 Marks
Total Credits	4	ISE II	20 Marks
		ESE	60 Marks

Course Educational Objectives:

- To identify antenna array types.
- To analyze antenna performance parameters.
- To introduce and illustrate antenna pattern synthesis methods.
- To expose to the concept of micro strip antenna.
- To analyze radiation patterns for design of different smart antennas.

Course Outcomes: Students will be able to

CO1	Calculate antenna parameters.
CO2	Analyze and design antenna arrays.
CO3	Explain factors affecting the design of antenna systems.
CO4	Know working of smart antenna and micro strip antenna.
CO5	Simulate the digital beam formation concept.

Detailed Syllabus:

UNIT-1	**Review of wired antennas** Antenna Parameters, Infinitesimal dipole, antenna, half wave half wave dipole antenna, smallloop antenna, helical antenna.
UNIT-2	**Antenna Arrays** N element linear arrays, uniform amplitude and spacing, Directivity of Broadside and End fire arrays. Three dimensional characteristics, Pattern multiplication- Binomial arrays and Dolph- Tchebycheff arrays. Circular array, Mutual coupling in arrays, multidimensional arrays, phasedarrays and array feeding techniques.
UNIT-3	**Antenna Synthesis** Synthesis problem-Line source based beam, synthesis methods, Fourier transform and Woodward-Lawson sampling method, Linear array shaped beam synthesis method, Low side lobe, narrow main beam synthesis methods- discretization of continuous sources. Schelkunoff polynomial method.
UNIT-4	**Microstrip antennas** Introduction, Rectangular Patch, Circular Patch, Quality Factor, Bandwidth, and Efficiency, Input Impedance, Coupling, Circular Polarization, Arrays and Feed Networks, Corporate andSeries Feeds, Reflect array.
UNIT-5	**Smart Antenna** Smart antennas Introduction, Smart-Antenna Analogy, Cellular Radio Systems Evolution, Signal Propagation, Smart Antennas' Benefits and draw backs, Antenna Beam forming, Multiple-Input Multiple-Output (MIMO) System, Re configurable Arrays.

TEXT AND REFERENCE BOOKS

1) Girish Kumar and K.P. Ray, Broad and Microstrip Antennas, Artech House
2) C. A. Balanis Antenna Theory Wiley and Sons
3) John. D. Krauss Antennas TMH References
4) By Randy L, Antenna Arrays: A Computational Approach

Assessment: ISEI (Class Test), ISEII (TA) & ESE

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini -project

ECDIS6001 : DISSERTATION I

Teaching Scheme		Evaluation Scheme	
Practical	20 Hrs/Week	ISE II	50 Marks
Total Credits	10	ESE	50 Marks

Dissertation I phase will consist of following:

1. Identification of Project title
2. Literature survey and database collection (if needed)
3. Preparation of list of components for hardware projects and decision of methodology for software projects
4. Feasibility study
5. Scheduling and planning of entire project

Students will present a seminar on the dissertation work carried out as a part of term work. The department will constitute a committee of minimum two members to evaluate the presentation. The committee will monitor the quality of the dissertation work.

Approximately 40% of the project work will be completed during the dissertation I phase.

ECDIS6002: DISSERTATION II

Teaching Scheme		Evaluation Scheme	
Practical	32 Hrs/Week	ISE II	100 Marks
Total Credits	16	ESE	150 Marks

This work will be in continuation with the work done in dissertation I phase.

Students will present a progress seminar on the dissertation work carried out as a part of term work. The department will constitute a committee of two members to evaluate the presentation. The committee will monitor the quality of the dissertation work. Minimum one publication is mandatory for students on their project area/work. There will be pre final demonstration of project by the student which is for internal faculty members. After satisfactory completion of project work and dissertation report, student may be permitted for viva-voce.