ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.E (Two-Year Full Time) DEGREE PROGRAM
Choice Based Credit System

Regulations - 2023

Curriculum for Students Admitted in the Academic Year 2023-2024

HAND BOOK
2023

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
M.E. (Two -Year Full Time) DEGREE PROGRAMME (CBCS)

REGULATION - 2023

1. **Conditions for Admission**

   Candidates for admission to the first year of the four-semester **M.E Degree Programme in Engineering** shall be required to have passed B.E / B.Tech. degree of Annamalai University or any other authority accepted by the syndicate of this University as equivalent there to. They shall satisfy the conditions regarding qualifying marks and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time. The admission for M.E Part Time Programme is restricted to those working or residing within a radius of **90 km** from Annamalainagar. The application should be sent through their employers.

2. **Branches of Study in M.E**

   The Branch and Eligibility criteria of Programmes are given in Annexure

3. **Courses of Study**

   The courses of study along with the respective syllabi and the scheme of Examinations for each of the M.E Programmes offered by the different Departments of study in the Faculty of Engineering and Technology are given separately.

4. **Choice Based Credit System(CBCS)**

   The curriculum includes three components namely Program Core, Program Electives and Open Electives, Mandatory Learning Courses and Audit Courses in addition to Thesis. Each semester curriculum shall normally have blend of theory and practical courses.

5. **Assignment of Credits for Courses**

   Each course is normally assigned one credit per hour of lecture/tutorial per week and 0.5 credit for one hour of laboratory or project or industrial training or seminar per week. The total credits for the Programme will be **68**.

6. **Duration of the Programme**

   A student of M.E Programme is normally expected to complete in four semesters for full-time/six semesters for part-time but in any case not more than four years for full-time/six years for part-time from the date of admission.

7. **Registration for Courses**

   A newly admitted student will automatically be registered for all the courses prescribed for the first semester, without any option. Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current

semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done upto the last working day. Registration for the Thesis Phase-I and Phase-II shall be done at the appropriate semesters.

8. Electives

8.1 Program Electives

The student has to select two electives in first semester, another two electives in the second semester and one more in the third semester from the list of Program Electives.

8.2 Open Electives

The student has to select two electives in third semester from the list of Open Electives offered by the Department and / or other departments in the Faculty of Engineering and Technology.

8.3 MOOC (SWAYAM)Courses

Further, the student can be permitted to earn credits by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

9. Industrial Project

A student may be allowed to take up the one program elective and two open elective courses of third semester (Full Time program) in the first and second semester, to enable him/her to carry out Project Phase-I and Phase-II in an industry during the entire second year of study. The condition is that the student must register those courses in the first semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specifics lots will be allotted in the time table for such courses.

10. Assessment

10.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	08 marks
Second assessment (Mid-Semester Test-II)	12 marks
Third Assessment	05marks
End Semester Examination	75 marks

10.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	15marks
Second assessment (Test-II)	15marks
Maintenance of record book	10marks
End Semester Examination	60marks

10.3 Thesis work

The thesis Phase I will be assessed for 40 marks by a committee consisting of the Head of the Department, the guide and a minimum of two members nominated by the Head of the Department. The Head of the Department will be the chairman. The number of reviews must be a minimum of three per semester. 60 marks are allotted for the thesis work and viva voce examination at the end of the third semester. The same procedure will be adopted for thesis Phase II in the fourth semester.

10.4 Seminar / Industrial Training

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of the seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

11. Student Counselors(Mentors)

To help the students in planning their course of study and for general advice on the academic Programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counselor (mentor) for those students throughout their period of study. Such student counselors shall advise the students in selecting the open elective courses from the prescribed list and obtain the final approval of the Head of the Department monitor their progress in SWAYAM courses /open elective courses.

12. Class Committee

For each of the semesters of M.E Programmes separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from first to fourth semesters for Full time and first to sixth semesters for Part-time will be as follows:

- Teachers of the individual courses.
- A Thesis coordinator (for Thesis Phase I and II) shall be appointed by the Head of the Department from among the Thesis supervisors.
- A thesis review committee chairman shall be appointed by the Head of the Department
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All counselors of the class and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory courses / 40 marks for practical courses, for Industrial Training and for Thesis work (Phase-I and Phase-II) will be finalized for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of Examinations.

13. Temporary Break of Study

A student can take a one-time temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid- semester test. However, the student must complete the entire Programme within the maximum period of **four years.**

14. Substitute Assessments

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

A student who withdraws from or does not meet the minimum attendance requirement in a semester must re-register and repeat the same semester in the subsequent academic years.

16. Passing and Declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. There after, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average(GPA) and cumulative grade point average(CGPA) and prepare the mark sheets.

90 to 100 marks	Grade S‘
80 to 89 marks	Grade A‘
70 to 79 marks	Grade B‘
60 to 69 marks	Grade C‘
55 to 59 marks	Grade D‘
50 to 54 marks	Grade E‘
Less than 50 marks	Grade RA‘
Withdrawn from the Examination	Grade W‘

A student who obtains less than 30/24 marks out of 75/60 in the theory/practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA/W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with there commendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

17. Awarding Degree

After successful completion of the Programme, the degree will be awarded with the following classifications based on CGPA.

For First Class with Distinction the student must earn a minimum of 68 credits within four semesters from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 68 credits within two years and six months from the time of admission and obtain a CGPA of 6.75 or above.

For Second class, the student must earn a minimum of 68 credits within four years from the time of admission.

The conversion of OGPA/CGPA (from I semester to IV Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

Where $OGPA/CGPA = \frac{\sum C_i GP_i}{\sum C_i}$

C_i- Credit hours of a course

GP_i - Grade Point of that course

18. Ranking of Candidates

The candidates who are eligible to get the M.E degree in First Class with Distinction will be ranked on the basis of CGPA for all the courses of study from I to IV semester.

The candidates passing with First Class and without failing in any subject from the time of admission will be ranked next to those with distinction on the basis of CGPA for all the

courses of study from I to IV semester.

19. Transitory Regulations

If a candidate studying under the old regulations M.E could not attend any of the courses in his/her courses, shall be permitted to attend equal number of courses, under the new regulation and will be examined on those subjects. The choice of courses will be decided by the concerned Head of the department. However he/she will be permitted to submit the thesis as per the old regulations. The results of such candidates will be passed as per old regulations.

The University shall have power store vise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

ANNEXURE 1

S.No.	Department		Programme (Full Time & Part time)	Eligible B.E./B.Tech Programme
1.	**Chemical Engineering**	i.	Chemical Engineering	B.E. / B.Tech – Chemical Engg, Petroleum Engg, Petrochemical Technology
		ii.	Food Processing Technology	B.E. / B.Tech - Chemical Engg, Food Technology, Biotechnology, Biochemical Engg, Agricultural Engg.
2	**Civil Engineering**	i.	Environmental Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Industrial Engg, Chemical Engg, BioChemical Engg, Biotechnology, Industrial Biotechnology, Chemical and Environmental Engg.
		ii.	Water Resources Engineering & Management	B.E. / B.Tech – Civil Engg, Civil & Structural Engg, Environmental Engg, Mechanical Engg, Agricutural and irrigation Engg, Geo informatics, Energy and Environmental Engg.
3	**Civil & Structural Engineering**	i.	Structural Engineering	B.E. / B.Tech – Civil Engg, Civil & Structural Engg.
		ii.	Construction Engg. and Management	
5	**Electrical Engineering**	i	Power System Engineering	B.E. / B.Tech – Electrical and Electronics Engg,
6	**Electronics & Communication Engineering**	i.	Communication Systems	B.E. / B.Tech -Electronics and Communication Engg, Electronics Engg.
7	**Electronics & Instrumentation Engineering**	i	Process Control & Instrumentation	B.E. / B.Tech – Electronics and Instrumentation Engg, Electrical and Electronics Engg, Control and Instrumentation Engg, Instrumentation Engg, Electronics and Communication Engg,
8	**Mechanical Engineering**	i.	Thermal Power	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical Engg (Manufacturing).
		ii.	Energy Engineering & Management	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Mechanical (Manufacturing) Engg, Chemical Engg
9	**Manufacturing Engineering**	i	Manufacturing Engineering	B.E. / B.Tech – Mechanical Engg, Automobile Engg, Manufacturing Engg, Production Engg, Marine Materials science Engg, Metallurgy Engg, Mechatronics Engg and Industrial Engg.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To provide innovative, creative and technically competent Electronics and Communication Engineers for industry and society through excellence in technical education and research.

MISSION

- To provide quality education in the field of Electronics and Communication Engineering through periodically updating curriculum, effective teaching-learning process, best laboratory facilities and collaborative ventures with the industries.
- To inculcate innovative skills, research aptitude, team work, ethical practices among students so as to meet the expectations of the industry as well as society.
- To adopt the best educational methods to improve teaching learning process continuously.
- To provide students with training on latest technology with supporting software.
- To facilitate effective interactions among faculty and students, and foster networking with alumni, industries and other institutions of repute.

M.E.(CS)-PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

After few years of graduation, the graduates of M.E. Communication Systems will able to

1. Design, analyze communication circuits and systems, based on the existing as well as emerging technologies.
2. Pursue research in the field of communication Engineering.
3. Work as a hardware and software professional in the industry of repute.
4. Become an entrepreneur by establishing startups to take projects for the societal and environmental cause.

M.E.(CS)- PROGRAMME OUTCOMES (POs)

PO1: Scholarship of Knowledge

Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2: Critical Thinking

Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3: Problem Solving

Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4: Research Skill

Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO5: Usage of modern tools

Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO6: Collaborative and Multidisciplinary work

Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7: Project Management and Finance

Demonstrate knowledge and understanding of engineering and management principles and apply the same to one‘s own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

PO8: Communication

Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: Life-long Learning

Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10: Ethical Practices and Social Responsibility

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11: Independent and Reflective Learning

Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

M.E. (Communication Systems)

PSOs

PSO1 Apply the fundamental concepts of channels, antennas and signals to design and analyze the Embedded system, VLSI Circuits short range wireless communication systems, satellite communication and the advanced concepts of optical networks.

PSO2 Understanding the advanced modulations and coding techniques and knowledge of base band signal conditioning for successful and effective communication.

PSO3 To apply the knowledge of parametric and nonparametric methods of Spectrum estimation and the fundamentals of multi-rate signal processing.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.E. (COMMUNICATION SYSTEMS) FULL TIME - DEGREE PROGRAMME
CURRICULUM – 2023-2024

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECCSPC11	**PC I**	Advanced Digital Communication Techniques	3	0	0	25	75	100	3
ECCSPC12	**PC II**	Advanced Digital Signal Processing	3	0	0	25	75	100	3
ECCSPE13	**PE I**	Program Elective-I	3	0	0	25	75	100	3
ECCSPE14	**PE II**	Program Elective-II	3	0	0	25	75	100	3
ECCSMC15	**MC**	Research Methodology and IPR	2	0	0	25	75	100	2
ECCSCP16	**CP I**	Advanced Digital Communication Techniques Lab	0	0	3	40	60	100	2
ECCSCP17	**CP II**	Advanced Digital Signal Processing Lab	0	0	3	40	60	100	2
ECCSAC18	**AC I**	Audit Course-I	2	0	0	0	0	0	0
							Total		**18**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECCSPC21	**PC III**	Antenna and Radiating Systems	3	0	0	25	75	100	3
ECCSPC22	**PC IV**	Advanced Wireless Communication Engineering	3	0	0	25	75	100	3
ECCSPE23	**PE III**	Program Elective-III	3	0	0	25	75	100	3
ECCSPE24	**PE IV**	Program Elective-IV	3	0	0	25	75	100	3
ECCSOE25	**OE I**	Open Elective	3	0	0	25	75	100	3
ECCSCP26	**CP III**	Antenna and Radiating Systems Lab	0	0	3	40	60	100	2
ECCSTS27	**TS**	Industrial Training and Seminar / Mini Project		Tr 2	S 2	40	60	100	2
ECCSAC28	**AC II**	Audit Course-II	2	0	0	0	0	0	0
							Total		**19**

PC	Program Core	**CP**	Core Practical	**AC**	Audit Course
PE	Program Elective	**TS**	Industrial Training and Seminar	**PV**	Project work & Viva-voce
OE	Open Elective	**MC**	Mandatory Learning Course	**EC**	Branch code
				CS	M.E Specialization Code

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECCSPE31	**PE V**	Program Elective-V	3	0	0	25	75	100	3
ECCSOE32	**OE II**	Open Elective	3	0	0	25	75	100	3
ECCSPV33	**PV-I**	Project work & Viva-voce Phase-I	-	Pr 16	S 4	40	60	100	10
							Total		**16**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ECCSPV41	**PV-II**	Project work & Viva-voce Phase-II	0	Pr 24	S 6	40	60	100	15
							Total		**15**

Sl. No.	COURSE CODE	LIST OF PROGRAM ELECTIVES	Credits
1	ECCSPESC	RF Engineering	3
2	ECCSPESC	Optical Networks	3
3	ECCSPESC	Wireless Sensor Networks	3
4	ECCSPESC	Speech Processing	3
5	ECCSPESC	Spread Spectrum Communication	3
6	ECCSPESC	Microwave Antenna and Integrated Circuits	3
7	ECCSPESC	RF MEMS for Wireless Communication	3
8	ECCSPESC	OFDM for Wireless Communication	3
9	ECCSPESC	Mobile Ad Hoc Networks	3
10	ECCSPESC	High Speed Networks	3
11	ECCSPESC	Virtual Private Networks	3
12	ECCSPESC	Industrial Internet of Things	3
13	ECCSPESC	Electromagnetic Interference and Compatibility	3
14	ECCSPESC	Advanced Electromagnetic Theory	3
15	ECCSPESC	RF Communication	3
16	ECCSPESC	Advanced Digital Image Processing	3
17	ECCSPESC	Digital Video Processing	3
18	ECCSPESC	Wireless Communication Network	3
19	ECCSPESC	VLSI for Wireless Communication	3
20	ECCSPESC	FPGA based Wireless Communication System Design	3
21	ECCSPESC	Millimeter Wave Communications	3

22	ECCSPESC	Error Control Coding	3
23	ECCSPESC	Nano Materials and Nano Electronics	3
24	ECCSPESC	Micro Electro Mechanical Systems	3
25	ECCSPESC	Fundamentals of Nano Electronics	3
26	ECCSPESC	Fundamentals of IC Packaging, Assembly and Testing	3
27	ECCSPESC	Avionics Engineering	3
28	ECCSPESC	Satellite Communication	3

Sl. No.	**COURSE CODE**	**LIST OF OPEN ELECTIVES**	**Credits**
1	ECCSOESC	Business Analytics	3
2	ECCSOESC	Industrial Safety	3
3	ECCSOESC	Operations Research	3
4	ECCSOESC	Cost Management of Engineering Projects	3
5	ECCSOESC	Composite Materials	3
6	ECCSOESC	Waste to Energy	3
7	ECCSOESC	Wireless Intelligent Networks	3
8	ECCSOESC	System Management and Security	3
9	ECCSOESC	Embedded System Design	3
10	ECCSOESC	Multimedia Communication	3
11	ECCSOESC	Soft Computing Techniques	3
12	ECCSOESC	Cloud Computing	3
13	ECCSOESC	Cryptography Systems	3

Sl. No.	**COURSE CODE**	**LIST OF AUDIT COURSE**
1	ECCSACSC	English for Research Paper Writing
2	ECCSACSC	Disaster Management
3	ECCSACSC	Sanskrit for Technical Knowledge
4	ECCSACSC	Value Education
5	ECCSACSC	Constitution of India
6	ECCSACSC	Pedagogy Studies
7	ECCSACSC	Stress Management by Yoga
8	ECCSACSC	Personality Development through Life Enlightenment Skills

ECCSPC11	ADVANCED DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To enable the student to understand advanced modulation and coding techniques.
- To learn the optimum receivers for digital communication schemes.
- To have a knowledge on base band signal conditioning methods for exploiting the channel.
- To provide in-depth treatment on methods and techniques in Turbo coding
- To study the fundamentals of equalization

Unit I: Digital Modulation Techniques

Digital Modulation, an Overview, Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals, Line Coding, Geometrical representation of Modulation Signals, Linear Modulation Techniques: BPSK, DPSK, QPSK, Offset QPSK, $\pi/4$ QPSK, Constant Envelope Modulation: BFSK, MSK, Combined Linear and Constant Envelope Modulation: MPSK, QAM, and MFSK.

Unit II: Optimum Receivers

Optimum Receiver for Signals Corrupted by Additive White Gaussian Noise - Correlation Demodulator, Matched-Filter Demodulator, The Optimum Detector, The Maximum-Likelihood Sequence Detector, A Symbol-by-Symbol MAP Detector for Signals with Memory, Performance of the Optimum Receiver for Memory less - Probability of Error for Binary Modulation, Probability of Error for M-ary Orthogonal Signals, Probability of Error for M-ary PAM, Probability of Error for M-ary PSK, Probability of Error for DPSK, Probability of Error for QAM, Comparison of Digital Modulation Methods, Performance Analysis for Wire line and Radio Communication Systems.

Unit III: Equalization Techniques

Pulse shaping Techniques: Nyquist criterion for ISI cancellation, Raised Cosine Roll off Factor, Gaussian Pulse Shaping Filter, Fundamentals of Equalization, Generic Adaptive Equalizer, Equalizers in Communication Receivers, Survey of Equalization Techniques, Linear Equalizers, Non Linear Equalizers: Decision Feedback and Maximum Likelihood Sequence Equalizer, Algorithms for adaptive Equalization.

Unit IV: Trellis Coded Modulation

Modulation and Coding for Band Limited Channels, Coded Modulation for Bandwidth- Constrained Channels-Trellis Coded Modulation; Set Partitioning, Four –State Trellis Coded Modulation with 8-PSK Signal Constellation, Eight-State Trellis Code for Coded 8-PSK Modulation, Eight-State Trellis for Rectangular QAM Signal Constellations, Decoding Methods.

Unit V: Advanced Channel Coding

Introduction-Turbo Encoder, Turbo Decoder, Iterative Turbo Decoding Principles; Modifications of the MAP Algorithm-The Soft-Output Viterbi Algorithm (SOVA); Turbo Coded BPSK Performance over Gaussian channels, Turbo Coding Performance over Rayleigh Channels.

REFERENCES

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3. Bernard Sklar, — Digital Communications, 3rd edition, Pearson Education, 2021
4. Stephen G. Wilson, — Digital Modulation and Coding, First Indian Reprint, Pearson Education, 2003.
5. M.K. Simon, S.M. Hinedi and W.C. Lindsey, — Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi,1995.
6. Simon Haykin -- Digital Communication Systems , John Wiley &sons, 2013.

COURSE OUTCOMES

The student would be able

CO1. To demonstrate merits and demerits of various digital modulation techniques

CO2. To compare performance of different types of modulation for a digital communication system

CO3. To use base band signal conditioning methods involved for exploiting channel

CO4. To design and demonstrate various equalization techniques

CO5. To understand and analyze the concepts and characteristics of advanced channel coding techniques

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1		1									1		
CO2	3	2	3							2				
CO3	1		1									1		
CO4		2	2							1				
CO5		2	2							1		1		

ECCSPC12	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide in-depth treatment on methods and techniques in discrete-time signal transforms, digital filter design, optimal filtering power spectrum estimation, multi-rate digital signal processing.
- To estimate the spectrum using parametric methods and non parametric methods and prediction using wiener FIR & IIR filters.
- To study adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- To apply multirate signal processing fundamentals.
- To learn about wavelet transform

Unit I: Discrete Random Signal Processing

Discrete Random Processes, Expectations, variance, Co-variance, energy of discrete signals – Parseval's theorem. Wiener Khintchine relation – Power spectral density – Periodogram- Sample autocorrelation-sum decomposition theorem, spectral factorization theorem – Discrete random signal processing by linear systems – Simulations of white noise.

Unit II: Spectrum Estimation

Non-parametric methods-correlation method- co-variance estimator – performance analysis of estimators-unbiased, consistent estimators- Periodogram Estimator – Barlett spectrum estimation – Welch estimation – Model based approach- AR, MA, ARMA Signal Modeling – Parameter estimation using Yule-Walker method.

Unit III: Linear Estimation and Prediction

Maximum likelihood criterion- efficiency of estimator – least mean squared error criterion- Wiener filter – Discrete Wiener-Hoff equations – Recursive estimators – Kalman filter- linear prediction, prediction error- whitening filter, inverse filter – Levinson recursion and Levinson recursion algorithm for solving Toeplitz system of equations. Lattice recursion, Lattice realization

Unit IV: Adaptive Filters

FIR adaptive filters – Newton's Steepest Descent method – adaptive filter based on steepest descent method Widrow-Hoff LMS adaptive algorithm – Adaptive channel equalization- Adaptive Echo Canceller- Adaptive noise cancellation- RLS adaptive filters-Exponentially weighted RLS- sliding window RLS-simplified IIR LMS adaptive filter.

Unit V: Multirate Signal Processing and Wavelet Transform

Review of Decimation and Interpolation Process. Sub band filter theory – Perfect Reconstruct (PR) condition – Cosine modulated filters – Para-unitary filters. Application of wavelet transform with Sub band filter theory. Wavelet transform as a correlator- Multiresolution theory – Heisenberg uncertainty principle – Two dimensional wavelet transform.

REFERENCES

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal processing", Prentice Hall of India, Fourth Edition 2006.
2. Manson H.Hayes, "Statistical Digital Signal Processing and Modelling", John Wiley and sons, Inc., New York, 1996.
3. Sopocles J. Orfanidis, "Optical Signal Processing", McGraw Hill, 1990.
4. Fliege N. J ,Multirate, "Digital Signal Processing", John Wiley & Sons, 2000.
5. Sopocles J. Orfanidis,"Introduction to Signal Processing" ,Prentice hall, 2010

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Have broad knowledge in Random Processes in signal Processing
2. Acquire in-depth treatment on methods and techniques in discrete-time signal transforms, digital filter design, optimal filtering power spectrum estimation, multi-rate digital signal processing.
3. Estimate the spectrum using parametric methods and non parametric methods and prediction using wiener FIR & IIR filters.
4. Analyse adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
5. Understand clearly about multi rate signal processing fundamentals.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3						3	3	3
CO2	3	2	3	1	2	2			3				3	
CO3	2	1	1		1	1			1			2		
CO4	1	3												2
CO5	1	2		3								1	2	1

ECCSMC15	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To understand research problem formulation and Analyze research related information
- To Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

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

Unit II: Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

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

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

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

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction",2nd Edition, reprint 2007
3. Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners",2010
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

COURSE OUTCOMES

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

1. Understand and Analyse research and formulating solution related to research problem.
2. Follow research ethics in creating and generating ideas
3. Understanding the need and want of IPR to go for copy rights and patenting their design and idea in order to enrich the country's engineering knowledge.
4. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and

better products, and in turn brings about, economic growth and social benefits.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3		2	3				2	3	3			
CO2		2		2		3			2		3			
CO3	3	2		3		3	3			2	2			
CO4			2	3		3	2		3					

ECCSCP16	ADVANCED DIGITAL COMMUNICATION TECHNIQUES LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To understand underlying concepts in signal processing
- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To provide a comprehensive analysis of spread spectrum systems
- To have a knowledge of the basics of OFDM.

LIST OF EXPERIMENTS

1. Simulation of Convolutional Coding Techniques.
2. Simulation of Linear Block Coding Techniques.
3. Simulation of Arithmetic Coding Techniques.
4. Simulation of Huffman Coding.
5. Simulation of Turbo Coding.
6. Simulation of Direct Sequence Spread Spectrum System.
7. Simulation of Frequency Hopping Spread Spectrum System.
8. Study of QPSK and QAM Modulation Technique.
9. Simulation of Pulse Radar Parameter on Detection Range.
10. Simulation of OFDM System.

COURSE OUTCOMES

1. Able to learn about signal processing concepts.
2. Able to understand the practical implementation issues, such as Error control coding, source coding.
3. Learn about design and simulation of modulation and coding techniques using software.
4. Know about Turbo Coding and Huffman Coding

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3			1	2	1		2	3	1
CO2	2	3	3					1	2	1			3	1
CO3	2	3	3	2	2			1	2	1			3	1
CO4	2	3	3	2	2			1	2	1		3	3	1

ECCSCP17	ADVANCED DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To learn about the adaptive filtering algorithms.

- To study the basics of pitch estimation in speech signal and formulation of Linear Prediction.
- To learn the short term power spectrum of sound using MFC.
- To generate binary sequence using Gold Code, Kasami code.
- To study the concepts of micro strip patch antenna.
- To analyze the spectral characteristics of AWGN noise and Colored noise.

LIST OF EXPERIMENTS

1. Simulation of Adaptive Filters using LMS and RLS algorithm.
2. Pitch Estimation for Speech.
3. Linear Prediction Analysis of Speech Signal.
4. Mel Frequency Spectral Coefficients.
5. Simulation of Gold Cold Technique.
6. Simulation of Kasami Code Sequence.
7. Measurement of Frequency Response Directivity and Radiation Efficiency of Microstrip Square Patch Antenna.
8. Simulation of Spectral Analysis of AWGN and Colored Noise.
9. Spectral Characterization of communication signals (using Spectrum Analyzer).
10. Wireless Channel simulation and characterization

COURSE OUTCOMES

1. Ability to design LMS and RLS adaptive filters for signal enhancement, channel equalization.
2. The ability to analyze speech signal using of Linear Prediction.
3. Able to extract features speech using MFC.
4. Able to generate binary sequence for digital applications.
5. Able to handle the noise in any system.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1		3	2	2		3					2	3		2
CO2			3		2				3	3			3	
CO3				3	1	1	3		1			2	3	
CO4						2			2		1			2
CO5		2			3			2				1	2	3

ECCSPC21	**ANTENNA AND RADIATING SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the fundamental principles and vital parameters of antennas in general and to apply them to the design and analysis of antenna systems.
- To learn the basic concepts of Radiation in wave guides and aperture and apply them to standard antenna.
- To study the various frequency dependent and independent antennas.
- To learn about printed antennas particularly microstrip antennas including design,and it's analysis.
- Different types of antennas and their applications will be introduced, with focus on Frequency independent antenna, Travelling Wave antennas, microstrip patch antennas, V-antenna, Reflector antenna, and the design considerations of using antennas in wireless communication systems.

Unit I: Concepts of Radiation

Physical Concept of Radiation: Radiation from surface and line current distributions - radiation pattern - near and far field regions - reciprocity - directivity

and gain – effective aperture - polarization - input impedance - efficiency - Friss transmission equation – radiation integrals and auxiliary potential functions.

Unit II: Aperture and Reflector Antennas
Huygens's principle - radiation from rectangular and circular apertures – design considerations - Babinets principle - radiation from sectoral - pyramidal - conical and corrugated horns - design concepts of parabolic reflectors and cassegrain antennas.

Unit III: Broadband Antennas
Principles - design and properties of log periodic - yagi-uda - frequency independent antennas - loop antenna - helical antennas - biconical antennas - broadcast antenna - spiral antenna and slot antennas.

Unit III: Microstrip Antennas
Microstrip Antennas: Radiation mechanism - parameters and applications - feeding methods - method of analysis - design of rectangular and circular patch - impedance matching of microstrip antennas.

Unit IV: Applications
Antennas for biomedical applications - smart antennas for mobile communications – antenna for infrared detectors - marine applications - plasma antennas.

REFERENCES

1. Jordan E.C, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2003.
2. Balanis C.A, "Antenna Theory : Analysis and Design ", 4th Edition, Wiley,.2016
3. J.D. Krauss, "Antennas", Tata McGraw Hill, 2006.
4. Elliot, "Antenna Theory and Design", IEEE press, 2003.
5. K.D.Prasad, "Antenna and Wave Propagation", Satya Prakashan, 2009

COURSE OUTCOMES
On completing this course, the students should be able to:
1. Understand the various parameters of antennas.
2. To get know the concept of aperture and reflector antennas.
3. Design and analyze of frequency independent and de-pendent antennas.
4. Understand the design of microstrip patch antennas.
5. Realize the various types and applications of the antennas.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2									2	3		
CO2	3	2					3					2		
CO3	2	3	3	2		3			3		3	2		
CO4	2	2	3	2		3						3		
CO5	3	2	3	3		2				3		2		

ECCSPC22	ADVANCED WIRELESS COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To introduce various wireless channel models
- To compare different diversity and combining technique
- To make channel capacity for multiple antennas.
- To learn the concept of capacity of Wireless Channels

- To study MIMO Communication Techniques

Unit I: Mobile Radio Propagation: Path Loss and Shadowing
Radio Wave Propagation, Transmit and Receive Signal Models, Free-Space Path Loss, Ray Tracing: Two-Ray Model, Dielectric Canyon (Ten-Ray Model), General Ray Tracing, Simplified Path Loss Model, Empirical Path Loss Models: Okumura's Model, Hata Model, Walfisch / Bertoni Model, Piecewise Linear (Multi-Slope) Model, Indoor Propagation Models, Shadow Fading, Combined Path Loss and Shadowing, Outage Probability under Path Loss and Shadowing, Cell Coverage Area.

Unit II: Statistical Multipath Channel Models
Time-Varying Channel Impulse Response, Narrowband fading models: Autocorrelation, Cross Correlation, and Power Spectral Density, Envelope and Power Distributions, Level Crossing Rate and Average Fade Duration, Finite State Markov Models, Wideband Fading Models: Power Delay Profile, Coherence Band width, Doppler Power Spectrum and Channel Coherence Time, Transforms for Autocorrelation and Scattering Functions, Discrete-Time Model, Spatio-Temporal Models.

Unit III: Capacity of Wireless Channels
Introduction, Capacity in AWGN, Capacity of Flat-Fading Channels : Channel and System Model, Channel Distribution Information (CDI) Known, Channel Side Information at Receiver, Channel Side Information at the Transmitter and Receiver, Capacity with Receiver Diversity, Capacity Comparisons, Capacity of Frequency-Selective Fading: Time-Invariant Channels, Time-Varying Channels

Unit IV: Diversity
Realization of Independent Fading Paths, Diversity System Model, Selection Combining, Threshold Combining Maximal Ratio Combining, Equal-Gain Combining, Moment Generating Functions in Diversity Analysis: Diversity Analysis for MRC, Diversity Analysis for EGC and SC Diversity Analysis for Non coherent and Differentially Coherent Modulation, Transmitter Diversity

Unit V: MIMO Communications
Narrow Band MIMO Model, Parallel Decomposition of the MIMO Channel, MIMO Channel Capacity, MIMO Diversity Gain: Beam forming, Diversity Multiplexing Trade Off, Space Time Modulation and Coding: STBC, STTC, Spacial Multiplexing and BLAST Architecture.

REFERENCES

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2007.
2. Theodore S. Rappaport , "Wireless Communications Principles and Practice", Second Edition, Pearson Education, Asia, 2002.
3. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
4. A.Paulraj, R.Nabar, D.Gore, "Introduction to Space Time Wireless Communications", Cambridge University Press, 2003.

COURSE OUTCOMES
The student would have the
1. Diverse knowledge in wireless communication.
2. Understanding of basic Channel Capacity
3. Familiarity in Diversity Analysis
4. Knowledge in multipath channel modelling
5. Knowledge in Multiple Input Multiple Output Concepts

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1		3							1		1		
CO2		2	3	1		2				1		1		
CO3	1	2	1							1		1		
CO4		2	3	1		2				1		1		
CO5			3	1		2				1		1		

ECCSCP26	ANTENNA AND RADIATING SYSTEMS LAB	L	T	P	C
			0	0	3

COURSE OBJECTIVES

- To understand and verify the basic principles and characteristics of dipole & monopole antenna.
- To visualize the design aspects involved in antennas.
- To design and develop Dipole and Monopole Antennas.
- To expose the student to different high frequency components.
- To get familiar with antenna testing and analysis.

LIST OF EXPERIMENTS

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.

COURSE OUTCOMES

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

1. Demonstrate and describe the structure, operation and parameter of dipole and monopole antennas.
2. Construct and test antenna by determining its specifications and design parameters.
3. Analyze antenna measurements to assess antenna's performance.
4. Explore antenna testing tools and analyzer like Antenna design and analysis software, network analyzer and spectrum analyzer.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2			2						3		
CO2	3	2	2	2	3		3		2			2		
CO3	3	2		2	3	2			3			2		3
CO4	3				3				2		3			3

ECCSTS27	INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT	L	Tr	S	C
		0	2	2	2

COURSE OBJECTIVES

- To train the students in the field work related to Communication Systems and to have a practical knowledge in carrying out the related problems.
- To train and develop skills in solving problems during execution of the problems.
- To work on a technical topic related to Communication Systems and acquire the ability of written and oral presentation.
- To acquire the ability of writing technical papers for Conferences and Journals.

The students will individually undertake a training program in reputed concerns in the field of Communication systems during summer vacation (at the end of second semester for Full Time / Fifth semester for Part – Time) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the third semester for Full Time / Fifth semester for Part – Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

For seminar/mini project, the students will work for two periods per week guided by a faculty. They will be asked to give a presentation of not less than 15 minutes and not more than 30 minutes (on any technical topic for seminar and on the project title for mini project). They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the examiners based on the technical presentation, the report and also on the interaction shown during the seminar/viva for seminar and mini project respectively.

COURSE OUTCOMES

After the completion of the course, the students will be able to

1. Analyze a given Communication Engineering problem and to identify and implement appropriate problem solving methodology to propose a meaningful solution.
2. Understand of contemporary / emerging technology for various processes and systems.
3. Share knowledge effectively in oral and written form and formulate documents.
4. Acquire the ability to work in the actual environment and to use the technical resources.
5. Analyse any short coming while implementing a technical problem and to handle the same.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2											1		
CO2			2											
CO3												2		
CO4														
CO5												2		

ECCSPV33	PROJECT WORK AND VIVA-VOCE PHASE-I	L	Pr	S	C
		0	16	4	10

COURSE OBJECTIVES

- To train the students in the current thrust area in Communication Engineering and to have practical knowledge in handling the technical scenario.

- To develop skills on the research topic and to implement the appropriate methods to handle the issue.
- To apply the relevant knowledge and skills, which are acquired within the technical area, to the relevant problems in the area of communication.

The students will individually undertake a research problem in the field of Communication Engineering in the third semester for Full-Time / Fifth semester for Part-Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Third semester for Full-Time / Fifth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
4. Ability to present the findings of their technical solution in a written report.
5. Presenting the work in International/ National conference or reputed journals.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**2**			**2**							**3**	**2**
CO2				**3**								**2**		**1**
CO3	**2**							**3**			**2**	**3**	**2**	
CO4										**3**				**2**
CO5			**3**							**2**		**1**	**2**	**3**

ECCSPV41	**PROJECT WORK AND VIVA-VOCE PHASE – II**	**L**	**Pr**	**S**	**C**
		0	**24**	**6**	**15**

COURSE OBJECTIVES

- To train the students in the current thrust area in Communication Engineering and to have practical knowledge in handling the technical scenario.
- To develop skills on the research topic and to implement the appropriate methods to handle the issue.
- To apply the relevant knowledge and skills, which are acquired within the technical area, to the relevant problems in the area of communication.

The students will continue the research problem undertaken during third semester for Full-Time / Fifth semester for Part-Time in the field of Communication Engineering. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Fourth semester for Full-Time / Sixth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES

After the completion of the course, the students will be able to

1. Conduct independent empirical research to evaluate and present their results responsibly and critically.
2. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
4. Ability to present the findings of their technical solution in a written report.
5. Presenting the work in International/ National conference or reputed journals.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**			**2**				**3**		**3**		**3**
CO2	**3**			**3**									**2**	**2**
CO3	**2**	**1**			**2**			**2**			**2**	**2**		
CO4			**2**				**3**			**2**				**3**
CO5	**1**		**1**							**3**		**1**	**2**	

PROGRAM ELECTIVES

ECCSPESC	**RF ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To learn the fundamental concepts of passive RF components and basic transmission line concepts.
- To explore the concepts of modulation techniques.
- To introduce transmitter and receiver system design techniques and analysis through three terminal RF device and it's active applications, role in a communication system.
- To understand the basics of radio system design and applications, rf technology, and it's components.
- To study the Designing of RF system.

Unit I: RF Passive Components and Transmission Line Analysis

High Frequency Resistors: Capacitors and inductors – transmission line analysis – line equation – microstrip line – SWR voltage reflection co-efficient propagation constant – phase constant – phase velocity – Smith chart – parallel RL and RC circuits – ABCD parameters and S parameters.

Unit II: RF Active Components and RF Amplifier Design

RF Diode: PIN diode – Gunn Diode – RF bipolar junction transistor – RF field effect transistor – modeling of diode – transistor and FET; RF Amplifier: Characteristics – power relational and stability considerations – LNA – power amplifiers – differential amplifiers – distributed power amplifiers and broadband amplifiers.

Unit III: RF Circuits Design

RF Oscillator Design: Fixed frequency oscillator – dielectric resonant oscillator – voltage controlled oscillator – sun element oscillator; RF Mixer Design: Single ended mixer – double ended mixer; RF Filter Resonator and Filter Configuration:

Butterworth and Chebyshev filters – design of microstrip filters.

Unit IV: RF IC Design

Introduction to RFIC: Analog and microwave design versus RFIC design – noise performance estimation – RF technology – receiver with single IF stage metallization – sheet resistance – skin effect –parasitic capacitance and inductance – current handling – metal capacitors – spiral inductors – quality factor – layout in IC – mutual inductance – multilevel – measurement – packaging.

Unit V: RF System Design

Link Design: Fading design – protected and non protected microwave systems – path calculation – spread spectrum microwave system – compatibility – safety coordinate systems – Datam's and GPS – receiver design – receiver architecture dynamic range – Frequency conversion and filtering; Examples of Practical Receivers: FM broadcast – digital cellular – multimeter wave point to point – Direct conversion GSM receiver; RF MEMS: Concept – implementation and applications.

REFERENCES

1. Reinhold Ludwig and Pavel Bretchko, "RF Circuit Design", Pearson Education, 2007.
2. Reinhold Ludwig and Gene Bogdenov, "RF Circuit Design", 2nd Edition,Pearson Education, 2011.
3. David Pozar, "Microwave and RF Design of Wireless Systems", John Wiley, 2008.
4. John Rogers and Calvin Plett, "Radio Frequency Integrated Circuit Design", 2nd edition Artech House, 2010
5. Ferri Losee, "RF systems, Components and Circuits Handbook", Artech House, 2002.
6. Joseph J. Carr, "Secrets of RF Circuit Design", 3rd edition, Tata McGraw Hill, 2004.
7. Vivek Varadhan, K J. Vinoy and Jose, "RF MEMS and Their Applications", Wiley Eastern Edition, 2003.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the basic concepts of RF wireless communications, three terminal devices design and it's challenges.
2. Acquire the detail view of communication protocol and design of RF application to industry and passive component design
3. Analyze and design various transmitters and receivers
4. Understand the basics of radio system design and applications
5. Gain Knowledge in RF system design

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**1**	**2**	**2**		**1**		**1**		**3**		
CO2	**3**	**3**	**3**	**1**	**2**	**2**		**1**		**1**			**3**	
CO3	**3**	**3**	**3**	**1**	**1**	**2**		**1**		**1**		**3**	**3**	
CO4	**3**	**3**	**3**	**1**	**1**	**2**		**1**		**1**		**3**	**3**	
CO5	**3**	**3**	**3**	**1**	**1**	**2**		**1**		**1**		**3**		

ECCSPESC	**OPTICAL NETWORKKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To develop an in-depth understanding, in terms of architecture, protocols and applications, of major optical networking technologies.

- To provide an exposure to solve numerical or analytical problems pertaining to the optical networking technologies
- To initiate the necessary background to perform projects involving optical networks.
- To learn the concepts of virtual topology design
- To learn Next Generation Optical Internet Networks

Unit I: WDM Technology and Issue in WDM Optical Networks

Introduction – Optical Networks – WDM – WDM Optical Networking Evolution - Enabling Technologies for WDM Optical Networks – WDM Optical Network – Architecture – Issues in Wave Length Routed Networks – Next Generation Optical Internet Networks.

Unit II: Wavelength Routing Algorithms

Introduction – Classification of RWA Algorithms Fairness and Admission Control – Disturbed Control Protocols – Permutation Routing and Wavelength Requirements - Wavelength rerouting algorithms - Introduction – Benefits of Wavelength Routing- Issues in Wavelength Routing – Light Path Migration – Rerouting Schemes – Algorithm AG – Algorithm MWPG Rerouting in WDM Networks With Sparse Wavelength Conversion – Rerouting in Emulsifier Networks – Rerouting in Multifiber Unidirectional Ring Networks.

Unit III: Wavelength Convertible Networks

Introduction – Need For Wavelength Converters - Wavelength Convertible Architecture – Routing in Convertible Networks – Performance Evaluation of Convertible Networks – Networks With Sparse Wavelength Conversion – Converter Placement Problem – Converter Allocation Problem.

Unit IV: Virtual Topology Design

Introduction – Virtual Topology Design Problem – Virtual Topology Design Sub Problems – Virtual Topology Design Heuristics – Regular Virtual Topology Design – Predetermined Virtual Topology and Light Path Routes – Design of Multifiber Networks -Virtual Topology Reconfiguration - Introduction – Need for Virtual Topology Reconfiguration – Reconfiguration due to Traffic Changes, Reconfiguration for Fault Restoration.

Unit V: Network Survivability and Provisioning

Failures and Recovery – Restoration Schemes – Multiplexing Techniques – Distributed Control Protocols. Optical Multicast Routing – Next Generation Optical Internet Networks.

REFERENCES

1. Siva Ram Murthy.C and Mohan Gurusamy., "WDM optical networks", Concepts, Design and Algorithms . Prentice Hall India, 2002.
2. Rajiv Ramasami and Kumar N. Sivarajan, "Optical networks" A Practical Perspective , A Harcourt publishers international company, 3rd edition, 2000.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Recognize and evaluate the performance of various enabling technologies used in modern optical networks WDM optical network architecture.
2. Discuss various routing, rerouting algorithms in major optical networking technologies.
3. Explain the need, architecture and routing and placement of wavelength converter in optical networks.
4. Evaluate virtual topology design problems and virtual topology reconfiguration.
5. Recognize the network survivability by various protection schemes.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3										1		
CO2	3	3		2										
CO3	3	3		2								2		
CO4	3	3	2	3										
CO5	3	3										1		

ECCSPESC	WIRELESS SENSOR NETWORKKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the characteristics of access mechanisms in wireless networks and Mobile IP and TCP routing protocols.
- To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of wireless sensor networks.
- To study the challenges and latest research results related to the design and management of wireless sensor networks.
- To focus on network architectures and energy management
- To learn about security related issues.

Unit I: Networks Fundamentals

Introduction to wireless network and M-computing –Fading and shadowing communication – Mobile IP – overview – Network elements - packet delivery – registration – Tunneling and encapsulation – optimization –Traditional TCP and inspection on Mobility – indirect and snooping TCP – 2G/3G – Beyond 3G Networks.

Unit II: Architecture

Introduction to sensor networks – Architectures – design factor – sensor network classifications - characteristics – Modeling of sensor network - WSN as Embedded system – Tiered architectures in sensor network – Forming of tiered network - Draw backs - Power efficient topology in WSN- Issues – Assumptions.

Unit III: Protocols

MAC- Hidden/Exposed terminals – Near/Far terminals – SDMA, FDMA, TDMA and CDMA – infrared transmission – MAC Layer synchronization –power management – roaming – SMACS and EAR algorithm – CSMA –Hybrid TDMA/FDMA – Adhoc networks – Clustering Algorithm – Leach – Teen – Peach Technique.

Unit IV: Security System

Security Protocols –Authentication – Network layer – Security techniques – Security in WSN – Adhoc network – Search Technique – Security management technique - Reliability issues in WSN – Distributed sensor systems – Distributed services – Dynamic adaption – Fault tolerance - pre limiters – classic fault.

Unit V: Energy Management

Introduction – Different power management technology – Design in EEMAC – Reduce communication – Node level energy management – Node Level Processor Oriented Energy Management – Node level I/O device oriented Energy Management – Energy aware routing.

REFERENCES

1. Mohammed Ilyas and Imad mahgoub, “Handbook of sensor networks, compact wireless and wired sensing systems”, CRC press, 2005.

2. Theodore S. Rappaport , "Wireless Communications Principles and Practice", Second Edition, Pearson Education, 2002.
3. Jon S.Wilson, Elseviewer , "Sensor technology handbook," 1st edition, 2004.
4. Taub H. and .Schilling D.L, "Principle of Communication", McGraw-Hill; , 3rd edition, 2007.
5. Simon Haykin, "Communication Systems", John Wiley; ,4th edition, 2006.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Understand the concepts of wireless communication.
2. Acquire knowledge about the various propagation methods and Channel models.
3. Have an enhanced understanding of various transceivers and its multiple access schemes.
4. Gain knowledge in Energy Management Technology
5. Understand the fundamentals of Security in WSN

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1			1						2		
CO2	1	1	1			1								
CO3	1		2	2		2						2		
CO4		1		2		2	3							
CO5		1	1	3		2	3					2		

ECCSPESC	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the mathematical foundations needed for speech processing.
- To highlight the basic concepts and algorithms of speech processing and synthesis.
- To familiarize the students with the various speech signal representation, coding and recognition techniques.
- To study the basic theory of speech recognition
- To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing.

Unit I: Fundamentals of Digital Speech Processing

Introduction – Discrete Time Signals and Systems – Transform Representation of Signals and Systems – Z-transform – Fourier Transform – Discrete Fourier Transform.

Digital Models for Speech Signal: The Process of Speech Production – Acoustic Theory of Speech Production – Lossless Tube Models – Digital Models for Speech Signals.

Unit II: Time Domain Models for Speech Processing

Time-Dependent Processing of Speech – Short Time Average Zero Crossing Rate – Short Time Autocorrelation Function - Pitch Period Estimation using Autocorrelation Function – median Smoothing and Speech Processing.

Unit III: Speech Coding

Introduction-Quantization-Speech quality measure-time-domain waveform coding-Linear predictive coding –Linear Delta Modulation-Adaptive Delta Modulation-Adaptive differential Pulse Code Modulation-Linear Predictive Coders- Synthesis

Based Linear Predictive Analysis-Spectral coders – Sub Band Coders-Adaptive Transform Coders - Vocoders - Vector quantization coders-Code Excited Linear prediction.

Unit IV: Automatic Speech Recognition

Introduction – Basis Pattern Recognition Approach – Preprocessing – Parametric Representation Dynamic time warping – Networks for Speech Recognition - Hidden Markov model - Language models -Artificial neural network - Expert-System approach to Automatic Speech Recognition.

Unit V: Speech Synthesis

Introduction - Principles of Speech Synthesis - Synthesizer Methods – Articulatory Synthesis – Formant Synthesis – Linear Predictive Coding Synthesis – Excitation Modeling – Synthesis of Intonation – Speech Synthesis for Different Speakers – Speech Synthesis in Other Languages – Evaluation of TTS Systems.

REFERENCES

1. D. O' Shaughnessy, "Speech communications", Human and Machine, Second Edition, UniversityPress (India), 2001.
2. L. R. Rabiner and R.W. Schafer, "Digital Processing of Speech Signals", Pearson Education, 2007.
3. L. Rabiner and R.H. Juang, "Fundamentals of Speech Recognition", Pearson education, 2003.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand speech processing fundamentals.
2. Understand algorithms of speech processing and synthesis.
3. Represent various speech signals, coding and recognition techniques
4. Generate coding for Speech Processing
5. Use speech processing in current applications.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	2						3		
CO2	3	1											3	
CO3	2	3	2										2	
CO4	3		3	3		3						1	2	2
CO5	2	2	1	2		1	2		2				2	2

ECCSPESC	SPREAD SPECTRUM COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the basic concepts of spread spectrum communications.
- To familiarize with several spread spectrum techniques and its performance in jamming environments.
- To study Frequency Hopping Ss System
- To gain knowledge on spread spectrum receivers.
- To understand various applications of spread spectrum techniques.
-

Unit I: Introduction

Origin of Spread Spectrum communications - advantages of spectrum spreading - Types of techniques used for spread spectrum - processing gain and other fundamental parameters - jamming methods - linear feedback, shift register and

sequence generation - M-sequence and their statistical properties - correlation properties - non-linear sequences - gold codes - Kasami sequences.

Unit II: Direct Sequence Spread Spectrum System

Coherent direct sequence systems-model of a DS/BPSK system - uncoded bit error probability for arbitrary jammer waveforms - Cheruoff bound-performance under constant power broadband noise jammer - pulse jammer - partial band jammer-multitone jammer - coded DS/BPSK system.

Unit III: Frequency Hopping SS System

Non-coherent FH system model - coherent FH systems - frequency synthesis - performance of FH/QPSK and FH/DPSK systems in partial band jamming - time hopping SS technique.

Unit IV: Synchronization of SS Receivers

Acquisition and tracking in DS SS receivers and FH SS receivers – Sequential estimation – Matched filter techniques of acquisition and tracking – Delay locked loop – Tau-Dither loop.

Unit V: Applications

Code division multiple access - satellite communication – anti-jam military communication - low probability of intercept communication - mobile communication.

REFERENCES

1. R.C.Dixion, “Spread spectrum systems”, John Wiley, 1984.
2. M.K.Simon, J.K.Omura, R.A.Schiltz and B.K.Levitt, “Spread spectrum communication”, Vol-I, II&IV, computer science press, USA, 1985.
3. G.R.Cooperand, CD.Mc.Gillem, “Modern communications and spread spectrum”, McGraw Hill, 1986.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Describe the types and advantages of spread spectrum modulation formats.
2. Perform analysis on the performance of spread spectrum modulation formats.
3. Describe the differences and benefits of different types of spreading codes.
4. Analyze the performance of spread spectrum systems in the presence of interference.
5. Analyze the performance of spreading code acquisition and tracking circuits.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		2				1					3	
CO2	3	3	2	2				1				3		
CO3	2	2			2			1						3
CO4	3	2	2					1					3	
CO5	3	3		2				1				3		

ECCSPESC	**MICROWAVE ANTENNAS AND INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand signal propagation at Radio frequencies & to study aperture and reflector antennas.
- To have a knowledge on the concept of Microstrip antennas.

- To introduce to the students the basics of Microstrip Patch Antennas and its analysis
- To learn about the solid state active devices for MICs.
- To study Microwave Solid – State Active Devices for MICS
- To collect ideas in Applications of MICs

Unit I: Aperture and Horn Antennas

Huygen's Equivalence Principle - Radiation from Rectangular and Circular Apertures E-Plane And H-Plane Sectoral Horns – Design Aspects - Radiation From E-Plane Sectoral Horn - Over View of Pyramidal Horn, Conical, Corrugated Horn – Gain Measurement by Standard Horn Antennas.

Unit II: Satellite Antennas

Radiation and Impedance Properties of Parabolic Reflector Antenna And Cassegrain Antenna - Spillover Loss - Corner Reflector - Lens Antenna.

Antenna Arrays**:** Linear Array With Non-Uniform Current Distribution (Dolph-Tchebyscheff Distribution - Taylor Distribution - Design Considerations) - Planar Array - Phased Array - Adaptive Antenna Array.

Unit III: Planar Transmission Lines - Fabrication Aspects of MMIC

Planar Transmission Lines For MICS - Different Types - Micro Strip Line – CPW-CPS, FIN Line - Analysis - Comparison of Micro Strip Line, Fin Lines And Coplanar Lines - Analysis of Fin Lines - Conductor Loss in Fin Lines - Design of Microstrip Lines. Introduction to Coplanar Wave Guide And Coplanar Strips - MMIC Fabrication Techniques.

Unit IV: Microstrip Antennas

Radiation From Micro Strip Patch - Electric And Magnetic Current Distributions - Feeding Techniques - Cavity Model Analysis Of Rectangular And Circular Microstrip Antennas - Design of Rectangular, Circular Microstrip Patch Antennas - Dual-Frequency Micro Strip Antennas - Circularly Polarized Micro Strip Antennas - Broadband and Ultra Wide Band Micro Strip Antennas - Basic Characteristics of Stacked-Electromagnetic Coupled and Aperture Coupled Micro Strip Antennas - Aperture Coupled Stacked Micro Strip Antennas.

Unit V: Microwave Solid – State Active Devices for MICS

Thick and Thin Film Technologies and Materials - Encapsulation and Mounting of Active Devices. Micro Strips on Semiconductor Substrates. Applications of MICs Phased Array Radar System - Satellite T.V. System

REFERENCES

1. Balanis C. A., "Antenna Theory -Analysis & Design", Harper & Row Publisher, 1952.
2. Collin R. E. , "Antennas & Radiowave Propagation", Mcgraw-Hill Intnl, 1985.
3. Garg, R. Bhartia P., Bhal. I & Ittipiboon A. "Microstrip Antenna Design", Handbook, Artech House Publishers, 2000.
4. Samuel Y. Liao.Microwave Devices & Circuits, 3rd edition, 2003.
5. Gupta. K.C. Microwave Integrated Circuits, 1975.
6. Bhat B. Koul S. K. Stripline-Like Transmission Lines For Microwave Integrated Circuits, Wiley Eastern Ltd., New Delhi, 1990.

COURSE OUTCOMES

At the end, the student would be able to

1. Comprehend the concepts of radio wave propagation.
2. Familiarized the concept of satellite antenna and array antennas.
3. Acquire the knowledge on the fabrication of MMIC.
4. Understand the analysis and design of patch antennas.
5. Attain the real time Applications of MICs

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2									3	3	
CO2		2	2									3		
CO3	3	2	2	3		3			3			3		
CO4	3	3	2	2	3	3						3		
CO5		3		2	2	2						3		

ECCSPESC	RF MEMS FOR WIRELESS COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide knowledge on Microsystems fabrication process and Micromachining.
- To understand the fundamentals of RF MEMS circuit elements, MEMS based circuit design
- To gain knowledge in applications to wireless communications.
- To study the theory of MEMS component
- To learn MEMS based circuit design

Unit I: Introduction to RF MEMS Technologies

Need for RF MEMS Components in Communications – Space and Defense Applications – Materials and Fabrication Technologies – Special Consideration in RF MEMS Design.

Unit II: Fabrication Process and Micromachining

Markets for Microsystems and MEMS**,** Substrates and material properties – Doping – Oxidation – Concepts of Bulk Micro machining and Surface Micro machining- Additive Processes – Evaporation and sputtering – Chemical vapor deposition (CVD)- Lithography- Wet etching: Isotropic– Anisotropic – Etch stops- Dry etching: Vapour – Plasma / RIE –DRIE- Other processing techniques and materials: LIGA– Lift-off– Chemical Mechanical Polishing (CMP)– Soft Lithography and polymers – Wafer Bonding – Design rules and Mask making.

Unit III: RF MEMS Components

MEMS Inductors and Capacitors: Micromachined Inductor, Effect of Inductor Layout – Modeling and Design Issues of Planar Inductor – Gap Tuning and Area Tuning Capacitors – Dielectric Tunable Capacitors.

MEMS Phase Shifters: Types – Limitations – Switched Delay Lines – Micromachined Transmission Lines – Coplanar Lines – Micromachined Directional Coupler and Mixer.

Unit IV: RF MEMS Circuit Elements

Enabled Circuit Elements – Capacitors – Inductors – Varactors – MEM Switch- Shunt MEM Switch – Low Voltage Hinged MEM Switch Approaches – Push-Pull Series Switch – Folded – Beam – Springs – Suspension Series Switch – Resonators – Transmission Line Planar Resonators – Cavity Resonators – Micromechanical Resonators – Film Bulk Acoustics Wave Resonators – MEMS Modeling – Mechanical Modeling – Electromagnetic Modeling.

Unit V: Advanced RF MEMS Circuits

Enabled Circuit – Reconfigurable Circuits – The Resonant MEMS Switch – Capacitors – Inductors – Tunable CPW Resonator – MEMS Micro switch Arrays – Reconfigurable Circuits – Double – Stub Tuner – nth Stub Tuner – Filter- Resonator

Tuning System – Massively Parallel Switchable RF Front Ends – True Delay Digital Phase Shifters- Reconfigurable Antennas – Tunable Dipole Antennas – Tunable Microstrip Patch – Array Antenna.

Unit VI: RF MEMS based Circuit Design

Phase Shifters – Fundamentals- X-Band RF MEMS Phase Shifter For Phased Array Applications – Ka-Band and RF MEMS Phase Shifter For Radar Systems Applications- RF MEMS Filters – Ka-Band, Millimeter Wave Micro Machined Tunable Filter – High-Q 8MHz MEM Resonators Filter- RF MEMS Oscillators – Fundamentals – 14GHz MEM Oscillators – Ka-Band Micro Machined Cavity Oscillator- 2.4 GHz MEMS Based Voltage Controlled Oscillator.

REFERENCES

1. Hector J. De Los Santros, "RF MEMS Circuit Design for Wireless Communication" ,Artech House,1st edition, 2002.
2. Vijay K. Varadan, Vinoy K.J, Jose k.A., "RF MEMS and their Applications" , John Wiley and Sons., Ltd., 2002.
3. Gabriel M.Rebeiz, "RF MEMS theory, Design and Technology", Wiley Interscience, 2002.
4. Tai-Ran-Hsu, "MEMS & Microsystems Design and Manufacture", Tata McGraw Hill, New Delhi, 2nd edition 2008.

COURSE OUTCOMES

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

CO1. Explain the need for RF MEMS components in wireless communication, its applications and advantages.

CO2. Explain Microsystems fabrication process and Micromachining.

CO3. Describe MEMS-based implementations of capacitors, inductors, varactors, switches, and resonators, together with their circuit design-oriented models.

CO4. Discuss Reconfigurable RF circuit elements, RF Circuits and RF antennas have been enabled by exploiting the degrees of design freedom afforded by RF MEMS fabrication techniques.

CO5. Examine RF MEMS based circuit implementations of Phase shifters, filters and oscillators via number of case studies.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**												
CO2	**2**													
CO3	**3**	**2**										**3**		
CO4	**3**	**2**		**2**								**3**		
CO5	**3**	**3**		**2**								**3**		

ECCSPESC	**OFDM FOR WIRELESS COMMUNICATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To impart knowledge about OFDM principles and its Implementation.
- To understand coding and interleaving techniques to reduce channel effects.
- To study various synchronization procedures in OFDM.

- To understand various channel estimation techniques and PAPR reduction schemes in OFDM system.
- To gain knowledge on OFDM multiple access schemes and applications of OFDM.

Unit I: Introduction

Wireless channel fundamentals – Multicarrier transmission scheme– OFDM Principles – System Model – Generation of Sub Carrier Using IFFT – Guard Time and Cyclic Extension, Choice of OFDM Parameters – OFDM Signal Processing.

Unit II: Coding, Modulation and Synchronization Techniques

Introduction – Forward Error Correction Coding – Interleaving – Quadrature Amplitude Modulation – Coded Modulation – Synchronization – Sensitivity to Phase Noise , Frequency Offset and Timing Errors – Synchronization Using Cyclic Extension and Special Training Symbols.

Unit III: Channel Estimation and PAPR Reduction in OFDM System

Coherent Detection : One and Two Dimensional Channel Estimators , Special Training Symbols , Decision Directed Channel Estimation – Differential Detection : Differential Detection in the Time and Frequency Domain-Peak to Average Power Ratio (PAPR) reduction in OFDM system: Clipping and peak windowing, PAPR reduction codes, Selective Mapping and Partial Transmit Sequence.

Unit IV: Orthogonal Frequency Division Multiple Access

Frequency Hopping in OFDMA – Difference between OFDMA and MC-CDMA, OFDMA System Description – Channel Coding – Modulation – Time and Frequency Synchronization, Initial Modulation Timing and Frequency Offset Synchronization Accuracy – Power Control – Random Frequency Hopping Operation – Dynamic Channel (Simple and Fast) – Capacity of OFDMA.

Unit V: Application of OFDM

Digital Audio Broadcasting –Terrestrial Digital Video Broadcasting. Wireless LAN Standards: IEEE 802.11 – Hyper LAN and MMAC –Difference between IEEE 802.11, Hyper LAN/2 and MMAC- Magic wand (Wireless ATM project). IEEE 802.11, Hyper LAN/ 2 and MMAC Wireless LAN standards – OFDM parameters, Channelization, OFDM signal processing, Training, Difference between IEEE 802.11, Hyper LAN/ 2 and MMAC.

REFERENCES

1. Richard Van Nee and Ramjee Prasad, “OFDM for Wireless Multimedia Communication”, Artech House, 2000.
2. Mare Engels, “Wireless OFDM systems”, Klumer Academic publishers, 2002.
3. Ye (Geoffrey) Li, Gordon L. Stiiber .” Orthogonal Frequency Division Multiplexing for Wireless Communications”, Springer 2006.
4. Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G. Kang, “MIMO-OFDM Wireless Communications with MATLAB”, John wiley and sons 2010.
5. Ahmad R. S. Bahai, Burton R. Saltzberg, Mustafa Ergen, “Multi carrier Digital communication Theory and applications of OFDM”, Second Edition, Springer 2004.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Describe the concepts of OFDM wireless communication systems.
2. Apply the coding and interleaving procedure to mitigate the channel effects.
3. Evaluate the synchronization techniques, channel estimation techniques and PAPR reduction techniques in OFDM.
4. Describe multiple accesses in OFDM and various applications of OFDM.
5. Analyze the performance of OFDM physical channel in wireless LAN standards.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											3		
CO2		2	3										3	
CO3		1	3										2	
CO4	3		1	1								1	2	2
CO5	2	3		2									2	2

ECCSPESC	MOBILE AD HOC NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the characteristic features of Adhoc wireless networks and their applications to the students.
- To enable the students to understand the functioning of different access and routing protocols that can be used for Adhoc networks.
- To make the students to realize the need for security and challenges
- To learn the role of cross layer design in enhancing the network performance.
- To study about the end-to-end delivery and security

Unit I: Introduction

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

Unit II: Medium Access Protocols

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Unit III: Network Protocols

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

Unit IV: End-to-End Delivery and Security

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Unit V: Cross Layer Design and Integration of Adhoc for 4G

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

REFERENCES

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, “Ad hoc Networking”, Addison-Wesley Professional; 1st edition, 2008.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, “Mobile adhoc networking”, Wiley-IEEE press, 2013.
4. T. Camp, J. Boleng, and V. Davies “A Survey of Mobility Models for Ad Hoc Network Research,” Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

5. V.T. Raisinhani and S. Iyer "Cross layer design optimization in wireless protocol stacks", Computer communication, vol 27 no. 8, 2004.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Understand the basics of mobile ADHOC networks
2. Got the knowledge of MAC and network protocols
3. Realize the need for security and challenges
4. Understand the role of cross layer design in enhancing the network performance.
5. Know the Integration of ad hoc network with other wired and wireless networks

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2												
CO2	3													
CO3	3	2	2			2							3	
CO4	3	2	2	2									3	
CO5	3	3					2						3	

ECCSPESC	HIGH SPEED NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn about the ATM backbone and advanced network architecture for high performance communication networks.
- To acquire knowledge about MPLS architecture, signaling and routing protocols.
- To study the types of VPN and tunneling protocols for security.
- To study the research areas in MPLS
- To learn about Recent Trends In High Speed Networks

Unit I: Introduction

Evolution of high speed networking – Synchronous Digital Hierarchy (SDH), Fibre Optic Network, Synchronous Optical Network (SONET) standards – Wave length division multiplexed (WDM) LAN – Basics of networking technologies – Fast Ethernet, Gigabit Ethernet, Frame relay DSL, ATM, MPLS, wireless networks such as 802.11,802.16,WiMax, 3G & 4G networks. Design considerations in high performance networking.

Unit II: ATM

ATM Protocol architecture – core aspects, ATM Layers- ATM Adaptation layer-synchronous fast packet switching techniques and VP/VC encapsulation- ATM cells – ATM traffic Management - Connection management – Discrete time queue analysis and application to Connection Admission Control (CAC) – Peak Cell rate algorithm – Leaky Bucket algorithm.

Unit III: MPLS

Introduction to MPLS, considerations in the choice of cells VS frames, IP over MPLS architecture &terminology, MPLS forwarding operations, MPLS encapsulation standards, MPLS signaling and routing protocols, research areas in MPLS.

Unit IV: Advanced Networks Concepts

VPN - Remote Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN, MPLS-operation, Routing, tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P Connections.

Unit V: Recent Trends in High Speed Networks

Enabling Differentiated Services using Generalized Power Control Model in Optical Networks - Adaptive Quality of Service Based Power Management - New Worm Exploiting IPV6 and IPV4 - IPV6 - Dual stack Networks - Methodologies and Tools for Exploring Transport Protocols in the Context of High speed Networks - End-to-end Congestion Control for High Speed Networks Based on Population Ecology Models.

REFERENCES

1. W.Stallings, "High Speed Networks and Internet", Pearson ed., 2nd edition, 2002.
2. R.O.Onvural, "ATM Networks-Performance Issues", Artech House, 1995.
3. David E. McDysan, Dave Paw. "ATM & MPLS Theory & Application: Foundations of Multi Service Networking" DOI:10.1036 0072228377;McGraw-Hill publication. 1St edition, 2002.
4. Walrand J. Varatya, High performance communication network Morganb Kaufmann – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000
5. Jeffrey G. Andrews. Anuradha Ghosh. Rias M Uhamed, "Fundamentals of WiMAX understanding broadband Wireless Networking",Prentice Hall,ISBN:0-13-222552-2, 2007.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, 2005, Pearson education.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Demonstrate the knowledge of Wireless networks.
2. Develop an in-depth understanding, in terms of architecture, protocols of major high speed networking technologies.
3. Demonstrate the working of MPLS.
4. Demonstrate the knowledge of network planning and optimization.
5. Outline the protocols for Quality of Service Support.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2	1	3	2									1	3	
CO3			3	1									3	
CO4		2	3	2								3		2
CO5	2			3								3	1	

ECCSPESC	VIRTUAL PRIVATE NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the fundamentals of VPN
- To study the types of VPN and tunneling protocols for security.
- To learn about network security in many layers and network management.
- To impart knowledge on VPN protocols and MPLS VPN.
- To study the applications of VPN

Unit I: Introduction

Introduction to VPN, VPN devices, Types of VPN - Access VPN, Intranet VPN, Extranet VPN, Overlay and Peer-to-peer VPNs, Connection-oriented and connectionless VPNs, Trusted and Secure VPNs-VPN Provisioning - Service provider and customer provisioned VPNs.

Unit II: Layer 2 and Layer 3 VPN

Layer 2 Internetworking, VPN Service, - Benefits of L2VPN, Inter-AS L2VPN,

Supported IETF Standards-Technology Overview-Intranet Corporate-Internet Access-Scaling MPLS VPNs to Multi-AS, Multi-Provider, and Hierarchical Networks-Heterogeneous Networks-Managed Central Services.

Unit III: VPN and Firewalls

Secure VPN Technologies, Trusted VPN Technologies, VPN/Firewall Architecture, VPN/Firewall Security Policy, Advanced Security Policy and System Management Hybrid VPN Technologies, Site-to-Site VPN, Remote Access VPN.

Unit IV: MPLS and MPLS VPN

WAN Topologies- Standard IP based Switching – CEF based Multi-Layer switching-MPLS Characteristics- Frame Mode MPLS Operation – MPLS VPN.

Unit V: VPN Protocols

VPN Protocols, Layer 2 Tunneling Protocol, Internet Protocol Security, Internet Key Exchange (IKE) Protocol, VPN Hacking, Voice over IP Attack – Authentication Header-Encapsulation Security Payload (ESP) - IPSEC Protocol Suite – Generic Routing Encapsulation (GRE).

REFERENCES

1. W.Stallings, "High Speed Networks and Internet", Pearson ed., 2nd edition, 2002.
2. R.O.Onvural, "ATM Networks-Performance Issues", Artech House, 1995.
3. David E. McDysan, Dave Paw. "ATM & MPLS Theory & Application: Foundations of Multi Service Networking" DOI:10.1036 0072228377;McGraw-Hill publication. 1St edition, 2002.
4. Walrand J. Varatya, High performance communication network Morganb Kaufmann – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000
5. Jeffrey G. Andrews. Anuradha Ghosh. Rias M Uhamed, "Fundamentals of WiMAX understanding broadband Wireless Networking",Prentice Hall,ISBN:0-13-222552-2, 2007.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, 2005, Pearson education.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Understand the types of VPN and tunneling protocols for security.
2. Familiarize about network security in many layers and network management.
3. Acquire knowledge on VPN protocols and MPLS VPN.
4. Collect designs and applications of VPN
5. To have knowledge in network management

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3					3						3		
CO2	2								3			3		
CO3			3	3								2		
CO4	3	2	3	2		3				2		3		
CO5	2	3	3	2		2			3			3	3	

ECCSPESC	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Introduce how IoT has become a game changer in the new economy where the customers are looking for integrated value
- Bring the IoT perspective in thinking and building solutions

- Introduce the tools and techniques that enable IoT solution and Security aspects

Unit I: Introduction

Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, People &Process, Hype cycle, IOT Market, Trends& future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT

Unit II: Architectures

Overview of IOT components ;Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT

Unit III: Sensor and Interfacing

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc

Unit IV: Protocols and Cloud

Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI , I2C, IIOT protocols –COAP, MQTT,6lowpan, lwm2m, AMPQ IIOT cloud platforms : Overview of cots cloud platforms, predix, thingworks, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaas.

Unit V: Privacy, Security and Governance

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security

Unit VI: IOT Analytics and Applications

IOT Analytics : Role of Analytics in IOT, Data visualization Techniques, Introduction to R Programming, Statistical Methods. Internet of Things Applications : Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
5. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
6. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012

TEXT BOOKS

1. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Bernd Scholz-Reiter, Florian, Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

COURSE OUTCOMES

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

1. Describe IOT,IIOT

2. Explain various architecture of IoT and IIoTand their components
3. Understand, design and develop the real life IoT applications using off the shelf hardware and software
4. Realize the importance of Data Analytics in IoT
5. Study various IoT platforms and Security

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											2		
CO2	3	3										2		
CO3	3	2	2											
CO4	3	3	2											
CO5	3	2										2		

ECCSPESC	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the concepts related to Electromagnetic interference in PCBs
- To provide solutions for minimizing EMI in PCBs
- To learn EMI standards in the design of PCBs
- To learn various EMI coupling principles, EMI standards and measurements
- To provide knowledge on EMI control techniques and design procedures to make EMI compatible PCBs

Unit I: EMI/EMC Concepts

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

Unit II: EMI Coupling principles

Conducted, radiated and transient coupling; Common ground impedance coupling ; Common mode and ground loop coupling ; Differential mode coupling ; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.

Unit III: EMI Control Techniques

Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.

Unit IV: EMC Design of PCBs

Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

Unit V: EMI Measurements and Standards

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards.

REFERENCES

1. V.P.Kodali, ―Engineering EMC Principles, Measurements and Technologies, Wiley- IEEE Press, Newyork,2001.
2. Henry W.Ott.,‖Noise Reduction Techniques in Electronic Systems‖, A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
3. Bemhard Keiser, ―Principles of Electromagnetic Compatibility‖, 3rd Ed, Artech house, Norwood, 1986.

4. C.R.Paul,‖Introduction to Electromagnetic Compatibility‖ , John Wiley and Sons, Inc.,2nd edition,2010.
5. Don R.J.White Consultant Incorporate, ―Handbook of EMI/EMC‖ ,Vol I-V, 1988.

COURSE OUTCOMES

1. Understand the concept of EMI/EMC.
2. Familiarized the EM coupling principles.
3. Comprehend the EMI control techniques.
4. Understand the concept of minimizing EMI in PCBs
5. Analyze Electromagnetic, standards and measurement

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3			3				3		3		
CO2	3	2	2	2		3			3	3		3		
CO3	3	3	2			2		3	3			3		
CO4	3	2	2	2								2		
CO5	3	2	3	3										3

ECCSPESC	ADVANCED ELECTROMAGNETIC THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the students about the transmission lines and wave guides.
- To discuss about the theory of microstrips and strip lines.
- To obtain a broad understanding of surface waveguides
- To study the theory of microwave cavities.
- To study the orthogonal properties

Unit I: Transmission Lines

General solutions for TEM, TE and TM waves obtained from reduced Maxwell's Equations. In homogeneously filled parallel plate transmission-line: Derivation of E.M. fields for the dominant E-mode followed by low-frequency and high frequency solutions.

Unit II: Waveguides

General solutions for E_{nm} and H_{nm} modes in a rectangular waveguide; including waveguide parameters. Anisotropic dielectrics -Power for H_{nm} modes. Derivation of the attenuation constant for the H_{io} or H_{10}mode.TE_{mo} modes of a partially loaded waveguide, TE_{nm} and TM_{nm} modes in a circular waveguide, TE_{nm} modes in a coaxial transmission line.

Unit III: Microstrips and Strip Lines

Vector and scalar potential function formulation for microstrip transmission line with anisotropic substrate material - Low frequency solutions; inductance per unit length; capacitance per unit length; propagation constant; and the characteristic impedance - An approximate electrostatic solution for Microstrip Transmission line with perfectly conducting walls; equivalent dielectric constant - Microstrip attenuation - An approximate electrostatic solution for an enclosed strip-line.

Unit IV: Surface Waveguides

TE_n and TM_n modes of a grounded dielectric slab surface waveguide. Phase, group and energy flow velocities. An introduction to Ridge Waveguides and FIN lines. E.M. fields: Resonant frequencies and Q for TE_{10l} modes of a rectangular cavity.

Unit V: Microwave Cavities

Electromagnetic fields; resonant frequencies and Q for TE_{nml} modes of a circular cavity.$TE_{01\delta}$ mode of the cylindrical dielectric resonator. Fabry-Perot resonators - A general microwave cavity - Cavity field expansion in terms of short circuit modes.

Electric field expansion in a general cavity; Orthogonality properties. Magnetic field expansion in a general cavity; Orthogonality properties.

REFERENCES

1. Prof. Robert E. Collin, "Foundations for Microwave Engineering", Second Edition; McGraw Hill International Edition, Second Edition, 2000.
2. Prof. David M. Pozar , Microwave Engineering, An Indian Adaptation: Theory and Techniques, Wiley India, 2020

COURSE OUTCOMES

On completion of this course the students will be able to

1. Understand clearly about the transmission lines
2. Describe the detailed theory about the waveguides
3. Elaborate the theory of micro strips and strip lines
4. Understand broadly about surface waveguides
5. Understand broadly about microwave cavities

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										3		
CO2													2	
CO3			2									3	2	
CO4			1	1								2	2	
CO5	3	3	3	3	2									1

ECCSPESC	RF COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the fundamental concepts of RF wireless communications.
- To explore the students about the protocols and modulation techniques.
- To introduce transmitter and receiver system design techniques and analysis.
- To understand the basics of radio system design and applications.
- To study about WLAN

Unit I: Introduction

Elements of Wireless communications – Mechanism of Radio wave propagation- Open field propagation – Diffraction – Scattering – Path loss - Multipath Phenomena – Flat fading - Diversity technique – Noise.

Antennas and Transmission Lines -Antenna characteristics-Types of antennas- Impedance matching – Measuring techniques.

Unit II: Communication Protocols and Modulation

Base band data format & protocol – Base band coding – RF frequency & Bandwidth – Modulation and Demodulation: Phase shift keying - Nyquist bandwidth - QPSK constellation diagram and 16- QAM constellation diagram- Spread spectrum: Frequency hopping spread spectrum & direct sequence spread spectrum– RFID.

Unit III: Transmitters and Receivers

Transmitters - RF Source: Saw resonators & oscillators, Crystal oscillators, Synthesizer control – Modulation: ASK & FSK of Saw oscillators – Amplifiers – Filtering – Antenna Receivers - Tuned radio frequency – Super regenerative receiver – Super heterodyne receiver – Direct conversion receiver – Digital receivers – Repeaters.

Unit IV: Radio System Design

Range of radio system – Sensitivity – Finding range from sensitivity - Super heterodyne image & spurious response – Inter modulation distortion and dynamic range – Demodulation – Internal receiver noise – transmitter design – Bandwidth –

Antenna Directivity – Power source.

Unit V: Applications and Technologies

Wireless local area network (WLAN): Wi-Fi, Network architecture, IEEE 802.11 a, b, HIPERLAN – Bluetooth: Transceiver and timing – Zigbee: Architecture, characteristics, Frame structure, applications, comparison of Bluetooth with Zigbee – Conflict and Compatibility – Ultra wideband technology.

REFERENCES

1. Alan Bensky, "Short Range Wireless Communication Fundamentals of RF System Design and Application", 3rd edition, 2019.
2. Theodore S. Rappaport , "Wireless Communications Principles and Practice", Second Edition, Pearson Education, Asia, 2002.
3. Jon B. Hagen, "Radio Frequency Electronics", Cambridge University press, Cambridge, 2nd edition,2005.
4. Ian Hickman, "RF Hand Book, Elsevier Science, 4th edition, 2006.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the basic concepts of RF wireless communications
2. Acquire the detail view of communication protocol
3. Analyze and design various transmitters and receivers
4. Understand the basics of radio system design and applications
5. To Gain knowledge in Ultra Wide Band technology and its applications

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**						**1**	**1**	**1**		**3**		
CO2	**3**	**3**						**1**	**1**	**1**		**3**	**2**	
CO3	**3**	**3**	**3**	**3**				**1**	**1**	**1**		**2**	**3**	
CO4	**2**	**3**	**3**	**2**				**1**	**1**	**1**		**2**	**1**	
CO5	**2**	**1**	**1**	**1**				**1**	**1**	**1**		**1**		

ECCSPESC	**ADVANCED DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Unit I: Fundamentals of Digital Image Processing

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing.

Unit II: Segmentation

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods.

Unit III: Feature Extraction

First and second order edge detection operators, Phase congruency, Localized feature Extraction detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors

Autocorrelation, Co-occurrence features, Run length features, Fractal model based features, Gabor filter, wavelet features.

Unit IV: Registration and Image Fusion

Registration Preprocessing, Feature selection points, lines, regions and templates Feature correspondence Point pattern matching, Line matching, region matching Template matching, Transformation functions Similarity transformation and Affine Transformation. Resampling Nearest Neighbour and Cubic Splines Image Fusion Overview of image fusion, pixel fusion, Multiresolution based fusion discrete wavelet transform, Curvelet transform. Region based fusion.

Unit V: 3D Image Visualization

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Education, Inc., 4th edition,2018
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson Education, Inc., 2015
3. Rick S. Blum, Zheng Liu," Multisensor image fusion and its Applications", Taylor & Francis,2006.

COURSE OUTCOMES

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

1. Understand image formation and the role human visual system play in perception of gray and color image data.
2. Apply image processing techniques in both the spatial and frequency domains.
3. Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
4. Understand the concepts of image registration and image fusion.
5. Develop coding for 3D images based on its applications

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2												2
CO2	3	2	2											2
CO3	3	2	3											2
CO4	3	2												2
CO5	3	3	3	2								2		3

ECCSPESC	DIGITAL VIDEO PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To introduce the fundamentals of video processing.
- To study the concepts of motion estimation and its general methodologies.
- To learn the basics of video coding and its methods.
- To understand the error control techniques in video processing
- To study the applications of video processing in the wireless networks.

Unit I: Introduction to Video Processing

Principles of colour video processing - Video display - Composite versus component video - Progressive and interlaced scan - Sampling of video signals.

Unit II: Motion Estimation

Two dimensional - Optical flow - General methodologies - Pixel based motion

estimation - Block matching algorithm - Deformable block matching algorithm - Mesh based motion - estimation - Global motion estimation - Region based motion estimation - Multiresolution - motion estimation - Three dimensional - Feature based Motion Estimation - Direct motion – Estimation - Iterative model.

Unit III: Basic of Video Coding

Categorization of video coding schemes - Information Theory for source coding - Binary encoding - Scalar quantization - Vector quantization - Wave form based coding - Block-based transform coding - Predictive coding - Temporal prediction and transform coding.

Unit IV: Error Control in Video Communications

Overview of approaches - Video applications and communication – networks - Transport level error control - Error resilient encoding - Decoder error concealment - Encoder-decoder interactive error control - Error resilience Tools in H.263 and MPEG-4.

Unit V: Streaming Video over the Internet and Wireless IP Networks

Architecture for video streaming systems - Video compression - Application layer QoS control for streaming – video Continuous media Distribution services - Streaming servers - Media synchronization - Protocols for streaming video - Streaming video over wireless IP networks.

REFERENCES

1. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, 'Video Processing and Communications', Prentice Hall, 2002.
2. Alan C. Bovik, 'The Essential Guide to Video Processing', Elsevier Science, second edition, 2009.
3. Jens R. Ohm, 'Multimedia Communication Technology: Representation, Transmission and Identification of Multimedia Signals , Springer, 2004.
4. M. E. Al-Mualla, C. N. Canagarajah and D. R. Bull, "Video Coding for Mobile Communications: Efficiency, Complexity and Resilience", Elsevier Science, Academic Press, 2002.
5. Murat Tekalp, 'Digital Video Processing', Prentice Hall, 2nd edition,2015.

COURSE OUTCOMES

On completing this course the students should be able to:

1. Understand the basic concepts and characteristics of video processing.
2. Understand the concepts of motion estimation and basics of video coding.
3. Analyze the error control in video communications and its applications.
4. Understand the basics of video compression and its applications in the wireless networks.
5. Gain knowledge in the applications of video processing in the wireless networks

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**												
CO2	**3**	**2**												
CO3	**3**	**3**	**2**	**2**									**2**	
CO4	**3**	**2**												
CO5	**3**	**2**	**2**									**2**		**3**

ECCSPESC	WIRELESS COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the various terminologies, principles used in wireless communication networks.
- Overview of wireless communication networks area and its application.
- To appreciate the contribution of wireless communication networks to technological growth.
- To study the theory of Ad-Hoc wireless networks
- To compare various wireless networks

Unit I: Physical and Wireless MAC Layer Alternatives

Wired transmission techniques- design of wireless modems, power efficiency, out of band radiation, applied wireless transmission techniques, short distance base band transmission, UWB pulse transmission, broad Modems for higher speeds, diversity and smart receiving techniques, random access for data oriented networks, integration of voice and data traffic.

Unit II: Wireless Network Planning and Operation

Wireless networks topologies, cellular topology, cell fundamentals signal to interference ratio calculation, capacity expansion techniques, cell splitting, use of directional antennas for cell sectoring, micro cell method, overload cells, channels allocation techniques and channel borrowing techniques, DCA, mobility management, radio resources and power management securities in wireless networks.

Unit III: Wireless Personal Area Networks

Introduction to Bluetooth, WPAN Device Architecture, Protocol Stack, Network Connection Establishment, Topology Applications, Low Rate and High Rate WPAN, Wireless Sensor Network, Protocol Stack, IEEE 802.15.3Zig bee Technology – IEEE 802.15.4 Ultra Wideband.

Unit IV: Wireless Local Area Networks

Introduction to Wireless LANs, LAN Equipment, Topologies, Technologies, Architecture and Services, MAC Sub Layer – IEEE 802.11Standards, Interference between Bluetooth and IEEE 802.11, HIPERLAN, Introduction to IEEE 802.16, 802.22, Rural Area Networks – Wi-Max Protocols.

Unit V: Ad-Hoc Wireless Networks

Characteristics of Ad-hoc Networks, Classifications of MAC Protocols-Table driven and Source initiated On Demand routing protocols, DSDV, AODV, DSR, Hybrid Protocols, TCP over Ad-hoc Wireless Networks.

REFERENCES

1. Kaveh Pahlavan, Prashant Krishnamoorthy, “Principles of Wireless Networks”, A United Approach – Pearson Education, 2002.
2. X.Wang and H.V.Poor, “Wireless Communication Systems”, Pearson education, 2004.
3. M.Mallick, “Mobile and Wireless design essentials”, Wiley Publishing Inc. 2003.
4. P.Nicopolitidis, M.S.Obaidat, G.I. papadimitria, A.S. Pomportsis, “Wireless Networks”, John Wiley & Sons, 2003.
5. Theodore S. Rappaport , “Wireless Communications Principles and Practice”, Second Edition, Pearson Education, 2002.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Analyze the design considerations of wireless MAC layer.
2. Formulate wireless network planning and operation techniques.
3. Discuss various WLAN and WWAN standards.
4. Analyze the design considerations of wireless networks.
5. Compare various wireless networks based on its performance.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3												
CO2		2								2				
CO3	3	2		1									3	
CO4	3	2	3										3	
CO5	3	3		2									3	

ECCSPESC	VLSI FOR WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study the design concepts of low noise amplifiers.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of CDMA in wireless communication.
- To learn about next generation CDMA system.

Unit I: Components and Devices

Integrated inductors, resistors, MOSFET and BJT AMPLIFIER DESIGN: Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain - Control Amplifiers – Power Amplifiers

Unit II: Mixers

Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion – Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise – A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer – Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer – A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer.

Unit III: Frequency Synthesizers

Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).

Unit IV: Sub Systems

Data converters in communications, adaptive Filters, equalizers and transceivers.

Unit V: Implementations

VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System.

REFERENCES

1. B.Razavi ,"RF Microelectronics" , Prentice-Hall , 2nd edition, 2013.
2. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2nd edition, 2011.
3. Thomas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits', Cambridge University Press ,2nd edition, 2003.
4. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design - Circuits and Systems", Kluwer Academic Publishers, 2000.
5. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 2nd edition, 2017.
6. J. Crols and M. Steyaert, "CMOS Wireless Transceiver Design," Boston, Kluwer Academic Pub., 1997.

COURSE OUTCOMES

Upon completion of the course the students will be able to

CO1. Design the Low Noise Amplifier which includes wideband, narrow band Gain control and power amplifiers

CO2. Describe the types of mixer and its parameters

CO3. Describe the working of mixers in RF receivers and its parameters.

CO4. Discus the concepts of RF sub systems.

CO5. Explain the concepts and issues related to VLSI architecture for wireless communication in which can be efficiently implemented in real time.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2		3									3		
CO2	3	3										3		
CO3	3											2		
CO4	3											3		
CO5		3		2								3		

ECCSPESC	FPGA BASED WIRELESS COMMUNICATION SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To enable the students to learn about the FPGA architecture and the programming technologies.
- To introduce to the students the modeling techniques of VHDL.
- To evaluate the performance using simulation and testing of systems.
- To study the concept behind software radio and the design of digital signal processing blocks.
- To learn the applications of FPGA on communication system

Unit I: FPGA Architecture and Programming Technologies

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology – mapping for FPGAs, Xilinx XC4000 – ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Case studies: Altera MAX 5000 and 7000 – Altera MAX 9000 – Spartan II and Virtex II FPGAs – Apex and Cyclone FPGAs. Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology.

Unit II: Verilog HDL

Data types and operators – Gate Level Modeling – Data Flow Modeling – Behavioral Modeling-structural modeling –Design of combinational logic and sequential logic circuits-Design of Memory module and Finite state machines-test benches.

Unit III: Logic Synthesis, Simulation and Testing

Design systems – Logic Synthesis – types of simulation –boundary scan test – fault simulation – automatic test pattern generation.

Unit IV: Software Radio

Block Diagram of Software Radio –Numerically controlled oscillator – Digital Up converters / Down Converters – Sampling schemes-Coherent Modulator and Demodulator – Incoherent Demodulation – digital approach for I and Q generation-Filter design (CIC) – baseband processing techniques.

Unit V: System Design

Design of Digital signal processing blocks – FFT, IFFT, FIR filters – crest factor

reduction, digital pre distortion blocks – Turbo coders – OFDM modulators/demodulators, Network security – AES encryption – decryption modules – SOC design – Design Methodologies – Processes and Flows.

REFERENCES

1. M.J.S.Smith, "Application Specific Integrated Circuits, Addison –Wesley Longman Inc., 1997.
2. Parag. K. Lala, Digital System Design using Programmable Logic Devices , BSP, 2003.
3. Samir Palnitkar, " Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003.
4. Jeffrey H Reed, "Software Radio: A Modern Approach to Radio Engineering", Prentice Hall, 2002.
5. Uwe Meyer Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2007.

COURSE OUTCOMES

On completion of the course the students will be able to

CO1. Describe the FPGA architecture and the programming technologies.

CO2. Develop Verilog Code to realize digital circuits.

CO3. Develop synthesizable codes, simulate and generate test pattern to test the systems

CO4. Explain RF components in implementation of software radio

CO5. Realize DSP algorithms, Modulation and encryption techniques using FPGA.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											3		
CO2	2		3									3		
CO3	3		3									2		
CO4	3	2										3		
CO5	2	3	3	2								3	3	

ECCSPESC	MILLIMETER WAVE COMMUNICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the fundamentals of Millimeter wave devices and circuits.
- To understand the various components of Millimeter wave Communications system.
- To know the antenna design at Millimeter wave frequencies.

Unit I: INTRODUCTION

Millimeter wave characteristics- millimeter wave wireless, implementation challenges, Radio wave propagation for mm wave: Large scale propagation channel effects, small scale channel effects, Outdoor and Indoor channel models, Emerging applications of millimeter wave communications.

Unit II: MM WAVE DEVICES AND CIRCUITS

Millimeter wave generation and amplification: Peniotrons, Ubitrons, Gyrotrons and Free electron lasers. HEMT, models for mm wave Transistors, transistor configurations, Analog mm wave components: Amplifiers, Mixers, VCO, PLL. Metrics for analog mm wave devices, Consumption factor theory, Trends and architectures for mm wave wireless, ADC's and DAC's.

Unit III: MM WAVE COMMUNICATION SYSTEMS

Modulations for millimeter wave communications: OOK, PSK, FSK, QAM, OFDM, Millimeter wave link budget, Transceiver architecture, Transceiver without mixer,

Receiver without Oscillator, Millimeter wave calibration, production and manufacture, Millimeter wave design considerations.

Unit IV: MM WAVE MIMO SYSTEMS

Massive MIMO Communications, Spatial diversity of Antenna Arrays, Multiple Antennas, Multiple Transceivers, Noise coupling in MIMO system, Potential benefits for mm wave systems, Spatial, Temporal and Frequency diversity, Dynamic spatial, frequency and modulation allocation.

Unit V: ANTENNAS FOR MM WAVE SYSTEMS

Antenna beamwidth, polarization, advanced beam steering and beam forming, mm wave design consideration, On-chip and In package mm wave antennas, Techniques to improve gain of on-chip antennas, Implementation for mm wave in adaptive antenna arrays, Device to Device communications over 5G systems, Design techniques of 5G mobile.

REFERENCES

1. K.C. Huang, Z. Wang, "Millimeter Wave Communication Systems", Wiley-IEEE Press, March 2011.
2. Robert W. Heath, Robert C. Daniel, James N. Theodore S. Rappaport, Murdock, "Millimeter Wave Wireless Communication", Prentice Hall, 2014.
3. Xiang, W; Zheng, K; Shen, X.S; "5G Mobile Communications: Springer, 2016.

COURSE OUTCOMES

1. Ability to understand Millimeter devices and circuits
2. Ability to design antenna for Millimeter wave frequencies
3. Knowledge of Millimeter wave technology

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3										2		
CO2	2	2								2		2		
CO3	3	3	2		3		3					3		

ECCSPESC	ERROR CONTROL CODING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the fundamentals of error correcting codes.
- To study the concepts of linear block codes.
- To learn the basics of cyclic codes, Syndrome Encoding Circuit and BCH codes
- To understand the error correction / detection techniques in Convolutional codes
- To study the burst error correcting codes and error correcting / detecting systems.

Unit I: Introduction to Coding

Brief description of a digital communication system, Cause of errors and need for error control coding, broad classes of error and classes of error correcting codes, general expression of the probability of error in a binary symmetric Gaussian channel, Principle of maximum likelihood decoding - Block Codes - Decoding Tables.

Turbo codes-Introduction-Encoding-Decoding of Turbo codes-Distance Properties of

Turbo codes-Convergence of Turbo codes-HARQ schemes in Turbo codes.

Unit II: Linear Block Codes

Definitions - Generator Matrix - Parity-Check Matrix - Error-Correcting - Capability of a Linear Code - Syndrome- definition, most likelihood principle of error detection - Hamming distance, minimum distance, minimum weight, error detecting & error correcting capabilities - The Standard Array - Construction, Error Detection with Syndrome.

Unit III: Cyclic Codes

Description of Cyclic Codes - Encoding with (n-k)-Stage Shift Register - Definition, generator polynomial, properties of cyclic code and generator polynomial - Generator matrix, parity check matrix, their properties and interrelations - Design and operation of encoder - Design and operation of syndrome circuit - Cyclic Hamming code.

Unit IV: BCH Codes and LDPC Codes

Description of Codes - Decoding of the BCH Codes - Implementation of Error Correction

Non-binary BCH Codes and Reed-Solomon Codes

Low Density Parity Check Codes-Introduction-Encoding –Decoding of LDPC codes-Belief Propagation Algorithm on BSC and AWGN channel.

Unit V: Convolutional codes

Definition, encoder, generator sequences, generator matrix, principle of constructing code words, numerical examples, code rate, constraint length, fractional rate loss - Finite state machine analysis of coder, state diagram, code tree, Trellis - Principle of maximum likelihood decoding of convolutional code, Viterbi algorithm, Error Detection / Correction using Trellis codes - Simulation tests of for data transmission through Gaussian binary symmetric channel - Distance properties of convolutional codes.

Unit VI: Burst Error Correcting Codes:

Shortened cyclic code, Hadamard code, Golay code, Kasami decoder - Single-Burst-Error-Correcting Codes - Burst-and-Random-Error-Correcting Codes – Error Detecting and Correcting Systems Design and Hardware Implementation

REFERENCES

1. Shu Lin, "An Introduction to Error-Correcting Codes", Prentice-Hall, 1st edition, 1970.
2. Shu Lin, Daniel J. Costello, Jr. Error Control Coding Fundamentals and Applications, Prentice Hall, 2nd edition, 2004.
3. Wakerly, John, "Error Detecting Codes, Self-Checking Circuits and Applications." North-Holland, 1978.
4. Peterson, W. W. and E.J. Weldon, Jr., "Error-Correcting Codes", the M.I.T. Press, Cambridge, MA 2nd edition, 2014.
5. Roft Johannesson and K. S. Zigangirov, “Fundamentals of Convolutional Coding” ,2nd edition,2015.
6. Gareth A. Jones & J. Mary Jones, “Information and Coding Theory”, Springer.2000.
7. Richard B. Wells, “Applied Coding and Information Theory for Engineers”, Pearson Education, 1st edition, 1998.
8. Salvatore Gravano, “Introduction to Error Control Codes” Oxford, 2007.

COURSE OUTCOMES

After completing this course the students should be able to:

1. Understand Block Codes and Maximum Likelihood Decoding.
2. Understand Decoding Tables, Hamming Weight and Distance and Error Correction vs Detection.
3. Understand Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code.
4. Understand Binary Cyclic Codes, encoding with (n-k)-Stage Shift Register and Syndrome Calculations and Error Detection.
5. Understand BCH Codes and the encoding / decoding techniques.

6. Understand Burst Error Codes and its applications.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2										2	
CO2	3	2	2										2	
CO3	3	2	2										2	
CO4	3	2	2										2	
CO5	3	2	2										2	
CO6	3	2	2										2	

ECPESCN	NANO MATERIALS AND NANO ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To expose the students about the basics of Nanotechnology and its applications.
- To provide adequate knowledge on Nanomaterial properties, Quantum Mechanics and Nano electronics.
- To expose the knowledge on Nano electronics devices and its applications.

Unit–I

Introduction to nano materials - Preparation/Synthesis: History of nano materials - Influence on properties by "nano - structure induced effects" - Some present and future applications of Nano materials, Approaches for synthesis of nanostructures - Processes for producing ultrafine powders - Chemical Synthesis - Physical Synthesis – Bio mimetic processes.

Unit–II

Characterization and Properties of Nano materials: Structural Characterization - X-ray diffraction, Scanning electron microscopy, Transmission electron microscopy, Scanning probe microscopy - Mechanical - Introduction - Property changes due to nano structuring - Strengthening and Toughening Mechanisms – Chemical – Sensors – catalysis – Magnetic- Magnetic Properties of small atomic clusters – Why interest in nano-scale magnetic materials- Classifications of magnetic nanomaterial – Optical-Absorption of light in semiconductor materials - Optical properties of a translucid object.

Unit-III

Quantum Mechanics: Schrodinger – Time Dependent / Independent Equation- Electron to Electron Interactions-Differential to Matrix Equation-Choosing Matrix Parameters-Non-Equilibrium Green's Functions (NEGF)-Conductance Functions for Coherent Transport-Elastic Dephasing-Quantum of Conductance-2D Conductor as ID Conductors in Parallel.

Unit–IV

Fundamentals of Nano Electronics: The New Ohm's Law-The Bottom-Up Approach-Electrons Flow-Ballistic and Diffusive Transport-Diffusion Equation for Ballistic Transport-Conductivity, Drift-electrostatics- smart contacts. Nano transistors-current equation, physics of Ballistic MOSFET – characteristics.

Unit–V

`Carbon Nanotubes :Graphene band structure, properties. Synthesis of Carbon Nanotubes – The Structure of Carbon Nanotubes, Carrier Concentration – Electronic properties of Nanotubes – Electron Transport in ballistic conductor – 98 Carbon Nanotube Electronics: Theory of CNT P-N junction - Carbon Nanotube Transistors – density of states - Schottky Barrier – Ohmic Contacts– Schottky Contacts –Subthreshold Short- Channel Effects.

TEXT BOOKS

1. Nanostructures &Nanomaterial: Synthesis, Properties and Applications, Guozhong Cao, Imperial College Press - World Scientific Publishing Co. Ltd, London - 2004.
2. Lessons from Nano electronics. A New Perspective on Transport-
3. SupriyoDatta, Purdue University, USA, 2012.

REFERENCES

1. Janos H. Fendler, Nanoparticles and Nanostructured films: Preparation, Characterization and Applications, ISBN: 3527294430, Wiley VCH, 1998.
2. Kenneth J. Klabunde, Nanoscale materials in chemistry, ISBN: 0471383953, John Wiley & Sons, 2001.
3. Zhon Ling Wang, Characterization of Nano phase materials, ISBN:3527298371, Wiley-VCH Verlag GmbH, 2000.
4. The physics of Carbon Nanotube Devices, ISBN: 978-0-8155-1573-9 François Léonard, 2009 by William Andrew.

COURSE OUTCOMES

1. Will get to know the future of electronics and its applications. (Unit I, II & IV)
2. Updates the students with the recent advancements in the nanotechnology. (Unit I, II & IV)
3. To introduce the students the concepts of quantum mechanics for analysis of nano electronic devices. (Unit III)
4. To understand Nano-material (Unit V)

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										2	2	
CO2	2											2		
CO3	3		2									3	2	
CO4		3		2								2	2	

ECPESCN	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To expose the students to the fundamentals Micro electromechanical systems.
- To teach the fundamental concepts MEMS Fabrication process.
- To study the design concepts of MEMS devices.
- To compare types and Functionalities of various methods of micromachining.

Unit–I : Miniaturization of Systems

Need for miniaturization, Microsystems versus MEMS, Need for micro fabrication, smart materials, Structure and Systems, Application of smart material and Micro system. Scaling in mechanical domain, Scaling in Electrostatic domain, Scaling in thermal domain.99

Unit–II : Micromachining Technology

Silicon as a material for micromachining-Crystal Structure , Silicon Wafer Preparation- Thin Film Deposition –Evaporation, Sputtering, CVD, Epitaxial Growth, Thermal Oxidation-Lithography – Photolithography , Lift-Off Techniques-Etching – Isotropic Etching, Anisotropic Etching, Etch Stops, Dry Etching – Silicon Micromachining – Bulk , Surface Micromachining – Specialized Materials for Microsystems-Polymers, Ceramic Materials- Advanced Process Of Micro fabrication-Wafer Bonding Techniques, Special Micro fabrication Techniques.

Unit–III : Silicon Capacitive Accelerometer

Overview, advantages of silicon capacitive accelerometer , typical applications, an example of a prototype, material used, fabrication process, principle of operation. Piezoresistive pressure sensor**:** overview, advantages of piezoresistive pressure sensor, typical applications, material used, fabrication process, principle of operation, An example commercial Products.

Unit–IV : Modelling of Solids in Microsystems

The simplest Deformable Element: a bar- Transversely deformable Element: a beam- energy methods for elastic bodies- Bimorph effects.

Unit–V : MEMS Actuators and their Applications

Actuation mechanisms – Electrostatic actuation – Electrostatic cantilever actuators – Electrostatic comb drives – Feedback stabilization of electrostatic actuators - lectrostatic micro grippers – Electrostatic relays and switches – Thermal actuation – Thermal expansion of solids – Thermal array actuators –Piezoelectric actuation.

TEXT BOOKS

1. G.K.Ananthasuresh, K.J.Vinoy,S.Gopalakrishnan, K.N.Bhat,V.K.Aatre, Micro and smart systems.
2. Tai-Ran-Hsu, MEMS & Microsystems Design and Manufacture, Tata McGrawHill, New Delhi, 2002.

REFERENCES

1. Stephen D. Senturia, Microsystem Design, Springer International Edition,2001.
2. Chang Liu, Foundations of MEMS, (ILLINOIS ECE Series), Pearson Education International,2006.
3. S.M. Sze, Semiconductor Sensors, John Wiley and Sons, 1994.
4. Gregory T.A. Kovacs, Micro machined Transducers, WCB McGraw Hill, 1998.

COURSE OUTCOMES

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

1. The fundamentals of Micro electromechanical systems and their applications will be studied. (Unit I)
2. The fundamental concepts of MEMS Fabrication process will be gained. (Unit II)
3. The design concepts of MEMS devices will be developed. (Unit II, III & IV)
4. The Functionalities of various methods of micromachining involved in different MEMS devices will be studied. (Unit V)

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										2	2	
CO2	2											2		
CO3	3		2									3	2	
CO4		3		2								2	2	

ECPESCN	FUNDAMENTALS OF NANO ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the idea of quantum mechanics which is totally different from classical mechanics
- To impart knowledge of the structure of carbon nanotubes and its properties
- To make the students to understand principles, properties and applications of carbon nanotubes devices
- To study about generation of CNTFETs and its fabrication techniques
- To familiarize the students to model the nano electronic devices

Unit I: Quantum Mechanics

Principles of quantum mechanics – Wave Particle Duality - The Uncertainty Principle - Schrodinger – Time Dependent / Independent Equation- Electron in free space -The Infinite Potential Well -Extensions of the Wave Theory to Atoms: The One-Electron Atom- Formation of Energy Bands- The Kronig-Penney Model- The k-Space Diagram-The k-Space Diagrams of Si and GaAs.

Unit II: Carbon Nanotube (CNT)

The Structure of Carbon Nanotube s- Graphene band structure, properties. Synthesis of Carbon Nanotubes – electronic, vibrational, mechanical and optical properties of CNT- Applications of CNT. Fabrication of Fullerene (C60). Functionalization of Carbon Nanotubes: covalent functionalization of CNTs-non covalent functionalization of CNTs- modification of CNTs via mechnochemical reactions - electrochemical deposition, electroless deposition; plasma activation of CNTs.

Unit III: Carbon Nanotube devices

Carrier Concentration – Electronic properties of Nanotubes – Electron Transport in ballistic conductor – Carbon Nanotube Electronics: Theory of CNT P-N junction - Carbon Nanotube Transistors – density of states - Schottky Barrier – Ohmic Contacts– Schottky Contacts –Subthreshold, Short- Channel Effects.

Unit IV: CNT Transistors

Generation of CNTFETs – Bottom gate transistor- Top gate transistor – Cylindrical gate transistor, Fabrication Techniques : Di-Electrophoresis method - Solution deposition – Imprint Techniques.

Unit V: Modelling of Nano Conductors and Transistors

The New Ohm's Law-The Bottom-Up Approach-Electrons Flow-Ballistic and Diffusive Transport-Diffusion Equation for Ballistic Transport-Conductivity, Drift-electrostatics- smart contacts. Nano transistors-current equation, physics of Ballistic MOSFET – characteristics.

Text Books:

1]. Semiconductor Physics and Devices Basic Principles, Third Edition, Donald A. Neamen, McGraw-Hill,2003.

2]. Lessons from Nanoelectronics. A New Perspective on Transport-Supriyo Datta, Purdue University, USA,2012.

3]. The Physics of Carbon Nanotube Devices, ISBN: 978-0-8155-1573-9 François Léonard, 2009 by William Andrew.

4]. Michael J. O'Connell, "Carbon Nanotubes: Properties and Applications, ISBN: 9780849327483, CRC Press, 2006

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. Understand the basics of quantum mechanics with reference to electron.
2. Gain in depth knowledge of the structure of carbon nanotubes and its properties
3. Understand principles, properties and applications of carbon nanotubes devices for Nanoelectronics.
4. Acquire the knowledge of CNTFETs and its fabrication techniques
5. Model and fabricate a CNT based nano electronic device using various fabrication techniques with the thorough knowledge of material and device properties.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										2	2	
CO2	2											2		
CO3	3		2									3	2	
CO4		3		2								2	2	
CO5	3	2										3	2	

ECPESCN	FUNDAMENTALS OF IC PACKAGING, ASSEMBLY AND TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the importance on Integrated Circuit Packaging.
- To impart the knowledge on various manufacturing process technologies.
- To understand the design considerations on electrical, thermal and mechanical parameters.
- To test and analyse the performance characteristics of Integrated Circuit Packages.
- To study and understand various emerging technologies in the field of Integrated Circuit Packaging.

Unit I: Overview of IC Packaging Technology

IC Packaging Roadmap – Technology Driving Forces – Rent's Rule – Hermetic Vs Non – hermetic Packages – Multidiscipline Issues.

Unit II: Manufacturing Considerations

Die Attach Technology – Die Interconnect Technology – Die Coating – Plastic Package Manufacturing Process – Ceramic Package Manufacturing Process – Metal Can Package Manufacturing Process – Multichip Module – Environmental Control: ESD & Clean room Classification – Quality and Reliability Issues.

Unit III: Design Considerations: Electrical

Reflection Noise – Crosstalk Noise – Switching Noise Signal Attenuation and Dispersion – Thermal: Thermal Resistance – Heat Flow Mechanisms **–** Mechanical: Coefficient of Thermal Expansion (CTE) – Thermal Stress and Strain Distribution Management.

Electrical Test: Electrical Performance Testing – Electrical Test Methods – Electrical Analysis.

Unit IV: Emerging Technologies

Ball Grid Array, Chip – scale package (CSP) – Flip Chip, Direct Chip Attach (DCA) and Wafer Scale package (WSP) – 3D Packaging – Known Good Die.

REFERENCES

1. J.H. Lau, W. Nakayama, J. Prince and C.P. Wong, Electronic Packaging: Design, Materials, Process, and Reliability, *McGraw Hill*, 1998.
2. G.D. Giacomo, Reliability of Electronic Packages and Semiconductor Devices, *McGraw – Hill*, 1996.
3. J.C. Whitaker, The Electronics Handbook, *CRC Press*, 1996.
4. Tummala, R.R. and Rymaszewski, E.Micro electronics Packaging Handbook. Van Nostrand Reinhold, New York, 1989.

COURSE OUTCOMES

Upon completing the course, the student should have

1. Understood the importance and issues of Integrated Circuit Packaging.
2. Acquired the expertise in the manufacturing of various Integrated Circuit Packages.
3. Understood the design considerations on various physical parameters.
4. The ability to test and analyse the performance characteristics of Integrated Circuit Packages.
5. Acquired the knowledge of various emerging Integrated Circuit Package technologies.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										2	2	
CO2	2											2		
CO3	3		2									3	2	
CO4		3		2								2	2	
CO5	3	2										3	2	

ECPESCN	AVIONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To provide knowledge in the basic concepts of aerospace engineering including Aerodynamics, Aircraft performance, stability & control, Aircraft Structures and Propulsion.
- To provide knowledge on analysis of longitudinal/lateral/directional motions.

Unit I CONFIGURATION OF AIRPLANE AND BASIC AERO DYNAMICS

How an Airplane flies - Components of an airplane and their functions - Airfoils and streamlines - Forces acting on an airplane - Lift and drag – Types of Drag– Speed and power – International Standard Atmosphere. Wind Tunnel Testing Techniques for Forces and Moments.

Unit II AIRCRAFT PERFORMANCE

Straight and level flight– Conditions for minimum Drag and minimum power– Climbing and gliding –Range and Endurance – Take off and Landing – V-n diagram.

Unit III: STABILITY AND CONTROL

Concepts of static and dynamic stability and control– Yaw and sideslip – Dihedral effect – Rudder requirements – Directional and spiral divergence – Dutch roll– Autorotation and spin.

Unit IV: AIRCRAFT STRUCTURES

Introduction to Aircraft structures - Loads - Types of construction - Design feature of Aircraft materials.

Unit V: PROPULSION

Aircraft propulsion, Rocket propulsion, power plant classification, Principles of operation, Areas of their application.

TEXT BOOKS:

1. Kermode, A.C, _Mechanics of Flight' English Book Store, New Delhi, 1982.
2. Van Sickle Neil, D _Modern Airmanship' VanNostr and Reinhol, New York,1985.
3. Megson T.H. 'Aircraft Structures for Engineering Student's II Edition, Edward Arnold, Kent, U.S.A. 1990.

REFERENCES:

1. Cary R .Spitzer, ―The Avionics Handbook‖ , CRC Press, 2000.
2. Collinson R.P.G. ―Introduction to Avionics‖ , Chapman and Hall, 1996.
3. Middleton, D.H. ―Avionics Systems‖ , Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
4. Jim Curren, ―Trend in Advanced Avionics‖ , IOWA State University, 1992.

COURSE OUTCOMES

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

1. Understand the fundamentals of aircrafts
2. The students will explain the available basic concepts of aeronautical engineering to the engineers and the necessary mathematical knowledge that are needed in modeling physical phenomena involved.
3. The students will also have an exposure on various topics such as Lift, Drag, aircraft performance, structure and propulsion and will be able to deploy these skills effectively in the understanding of concepts relating to an aircraft.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2										2	2	
CO2	2											2		
CO3	3		2									3	2	
CO4		3		2								2	2	
CO5	3	2										3	2	

ECPESCN	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the principles of satellite and its architecture.
- To learn about the link establishment of satellite.
- To learn different satellite services.

UNIT I:Introduction to Satellite Communication

Principles and architecture of satellite Communication, Brief history of Satellite systems, Advantages, disadvantages, applications and frequency bands used for satellite communication. Satellite Construction, Satellite obits, Telemetry, Tracking, command and monitoring (TTC & M), Attitude and orbit control system(AOCS), Communication sub-system, and power sub-systems.

UNIT II: Orbital Mechanics

Kepler's laws, Orbital equations, orbital parameters, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concepts of Solar day and Sidereal day, Eclipse, sub satellite point, sun transit outage Launching procedures and Launch Vehicle.

UNIT III: Satellite Link Design

Basic Transmission theory, satellite uplink and downlink analysis, Calculation of System noise temperature for satellite receiver, noise power calculation, drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Propagation characteristics and frequency considerations.

UNIT IV: Access Techniques

Types- FDMA concepts –Inter modulation and back off-SPADE system, TDMA concept - Frame and burst structure , Satellite switched TDMA, CDMA concept - VS and SH CDMA system, Random multiple access techniques – Packet switching, Transmit- Receive Earth stations.

UNIT V: Satellite Services

Fixed satellite services - Broadcast satellite services - Satellite TV systems - Domestic satellite systems(INSAT,INTELSAT series), Mobile satellite services –GSM, Global positioning satellite systems, INMARSAT,VSAT, ATM over satellite, Role of future satellite networks.

TEXT BOOKS

1. Timothy Pratt Charles W.Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill,2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009.

REFERENCES

1. Pritchend and Sciulli,"Satellite Communication Systems Engineering" PHI1986.
2. Robert M.Gagliendi., "Satellite Communication" John wiley and sons,1988.
3. Richharia M, "Satellite Communication System Design and Analysis" McGraw - Hill Professional; 2nd edition,1999.

4. Agarwal B.N., "Design of Geo Synchronous Space craft" Prentice Hall,1986.

COURSE OUTCOMES

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

CO1. Describe the architecture of satellite systems as a means of high speed,

high range communication system.

CO2. State various aspects related to satellite systems such as orbital equations

CO3. Solve numerical Problems related to orbital motion.

CO4. Design link budget for the given Parameters and conditions.

CO5. Illustrate earth station technology and multiple access schemes

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**									**1**		**3**	**3**	**3**
CO2	**2**							**1**				**3**	**3**	**3**
CO3			**3**	**3**	**2**							**3**	**3**	**3**
CO4			**3**	**3**	**2**							**3**	**3**	**3**
CO5			**3**	**3**								**3**	**3**	**3**

OPEN ELECTIVES

ECCSOESC	BUSINESS ANALYTICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships
- Between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Unit I: Business analytics

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit II: Trendiness and Regression Analysis

Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit III: Organization Structures of Business analytics

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit IV: Forecasting Techniques

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit V: Decision Analysis

Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

REFERENCES

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications, Pearson FT Press. 2014.
2. James Evans, Business Analytics, Persons Education , 3rd edition 2020.

COURSE OUTCOMES

1. Students will demonstrate knowledge of data analytics.

2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.
5. To become familiar with processes needed to develop, report, and analyze business data

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2				2								
CO2	2	2		3										
CO3	2	2				3		2						3
CO4	3		2					2						3
CO5	3	3	2	3										3

ECCSOESC	INDUSTRIAL SAFETY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To Understand the concept of Industrial Safety
- To Provide useful practical knowledge for work place safety
- To Identify, Evaluate and control all the hazards to prevent people from mitigate harm.

Unit I: Industrial safety

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.

Unit II: Fundamentals of maintenance engineering

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit III: Wear and Corrosion and their prevention

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit IV: Fault tracing

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit V: Periodic and preventive maintenance

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common

troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

REFERENCES

1. Higgins & Morrow, Maintenance Engineering Handbook, Da Information Services.1987
2. Keith Mobley , Lindley Higgins , Darrin Wikoff ,"Maintenance Engineering Handbook", McGraw-Hill Education; 7th edition, 2008.
3. H. P. Garg, Maintenance Engineering, S. Chand and Company, revised edition, 2010.
4. Audels, Pump-hydraulic Compressors, Mcgraw Hill Publication.1949.
5. Winterkorn, Hans, Foundation Engineering Handbook, Chapman & Hall London.

COURSE OUTCOMES

1. Understanding of Safety principles.
2. Ability to do Hazard analysis.
3. Ability to do event tree and fault tree analysis.
4. Maintenance of mechanical and electrical instruments
5. Understanding the concept and Importance of repair recycle.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2						3				3		
CO2									3	2		3	3	
CO3						2								1
CO4	2			1							2	2	2	2
CO5			3										2	2

ECCSOESC	**OPERATIONS RESEARCH**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES

- To solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
- To Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.
- To Develop mathematical skills able to carry out sensitivity analysis

Unit I: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit II: Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit III: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit IV: Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric

Programming.

Unit V: Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES

1. H.A. Taha, Operations Research, An Introduction, PHI, 10th edition, 2017.
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

COURSE OUTCOMES

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

1. Demonstrate the knowledge of optimization techniques.
2. Solve linear programming problems using appropriate techniques.
3. Solve non linear programming.
4. Develop mathematical models associated with network flows and related real life applications.
5. Understand the usage of game theory and Simulation for Solving Business Problems.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**											**3**		
CO2			**3**	**3**									**2**	
CO3	**1**			**3**	**3**									**3**
CO4	**2**	**3**						**2**					**2**	
CO5	**1**		**2**	**3**								**1**		**3**

ECCSOESC	**COST MANAGEMENT OF ENGINEERING PROJECTS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES

- To reduce the costs expended by an organization while strengthening the strategic position of the firm.
- To help streamline the transactions between corporate support departments and the operating units.
- To co-ordinate the buyer –supplier interactions by devise transfer pricing systems.
- To manage cost and also enhance profit consciousness.

Unit I: Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II: Project

Project meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as

conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents

Unit III: Project team
Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit IV: Cost Behavior and Profit Planning Marginal Costing
Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Unit V: Budgetary Control
Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

REFERENCES

1. Srikant Datar, Madhav Rajan , Horngren's Cost Accounting A Managerial Emphasis, , Pearson; 17th edition , 2017.
2. Charles T. Horngren and George Foster, Advanced Management Accounting, Prentice Hall 13th edition, 2008.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, Pearson; 3rd edition, 1998.
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting, PHI, 3rd edition, 2012.
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.5th edition, 2017.

COURSE OUTCOMES
At the end of the course, the student should be able to
1. Understand cost accounting knowledge, such as terminology and fundamental principles and methods.
2. Apply course material to new situations.
3. Solve problems and make decisions based on the results of the solutions to the problems.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2		3					2				3		
CO2	3				3		3			3		3		
CO3		3				2						2		

ECCSOESC	COMPOSITE MATERIALS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To train students to be able to design composite structures.

- To select composite materials and conduct stress analysis of selected practical applications.
- To be familiar with the properties and response of composite structures.
- To illuminate the knowledge and analysis skills and applying basic laws in mechanics to the composite materials.

Unit I: Introduction

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Unit II: Reinforcements

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

Unit III: Manufacturing of Metal Matrix Composites

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Unit IV: Manufacturing of Polymer Matrix Composites

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

Unit V: Strength

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

REFERENCES

1. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, Material Science and Technology – Vol 13 – Composites, VCH, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam, Materials Science and Engineering, An introduction. John Wiley & Sons, NY, Indian edition, 2007.
3. Ed-Lubin, Hand Book of Composite Materials, Springer, reprint 2014.
4. K.K.Chawla, Composite Materials.Springer,2006.
5. Deborah D.L. Chung, Composite Materials Science and Applications.Springer,2nd edition,2010.
6. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, Composite Materials Design and Applications. CRC Press, 2002

COURSE OUTCOMES

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

1. Explain the mechanical behaviour of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behaviour at micro and macro levels.
3. Determine stresses and strains relation in composite materials

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			3					3				2		
CO2	2			3	2									
CO3		3								2		3		

ECCSOESC	WASTE TO ENERGY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To enable students to understand the concept of waste to energy.
- To link legal, technical and management principles for production of energy from waste
- To learn about the best available technologies for waste to energy.
- To facilitate the students in developing skills in the decision making process.

Unit I: Introduction to Energy from Waste

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit II: Biomass Pyrolysis

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III: Biomass Gasification

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV: Biomass Combustion

Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit V: Biogas

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES

1. Desai, Ashok V., Non Conventional Energy, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S., Biogas Technology - A Practical Hand Book - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1988.
3. Challal, D. S., Food, Feed and Fuel from Biomass, IBH Publishing Co. Pvt. Ltd., 1991.
4. Y. WereKo-Brobby and E. B. Hagan, Biomass Conversion and Technology, John Wiley & Sons, 1996.

COURSE OUTCOMES

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

1. Apply the knowledge about the operations of waste to energy plants.
2. Analyze the various aspects of waste to energy management systems.
3. Carryout Techno-economic feasibility for waste to energy plants.

4. Apply the knowledge in planning and operations of waste to energy plants.
5. Identify sources of energy from bio-chemical conversion

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2		3					2						
CO2	3			2	3									
CO3		3					3	2		1				
CO4			2				2			2				
CO5		1			1									

ECCSOESC	WIRELESS INTELLIGENT NETWORKS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To enable the students to study the fundamentals of mobile communication concepts
- To enable the students to study the fundamentals of wireless intelligent networking standards.
- To introduce the concept of intelligent networking and migration from point solutions to network based solutions.
- To expose the students to WIN services, architectures
- To learn Advantages and applications of Wireless Intelligent Networking.

Unit I: Fundamentals of Mobile Communications

Fundamental Mobile Communication Concepts – Wireless System Architecture – Mobile Network Standards – Wireless Intelligent Networking Standards – Evolution to Third – Generation Wireless Standards – Overview of SS7 Network Signaling – Signaling in a Wireless Network – Intelligent Networking.

Unit II: Introduction to Cellular Mobile Systems

Spectrum Allocation, Basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems. Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity

Unit III: Wireless Intelligent Networking

Origins of Intelligent Networking – Wireless Intelligent Networking, WIN, CAMEL – Relationship of wireless Intelligent Networking Standards – Migration from Point solutions to Network- Based Solutions – Impetus for Migration, Advantages and Operational Challenges of Network – Based Solutions.

Unit IV: WIN Capabilities

Intelligence in Telecommunication Networks – Fixed Network Intelligence – Mobile Network Intelligence– Standardized Intelligence for Mobile Networks (WIN, CAMEL) – Phased Development of Standards- Pre WIN, WIN Phase – I, II, III, CAMEL – Phase I, II, Trigger detection points – WIN and CAMEL operational Issues.

Unit V: WIN Services

Intelligent Networking solutions to Wireless Fraud – Pre call Validation – Cloning Fraud – Roamer Verification and Reinstatement – Network Based HLR – Long term Strategic Advantages – Wireless and Wire line Services – Emulation of Basic Wireless Features – Emulation of Wire line IN Services – Integration of Wire line and Wireless Services – Emergence of Wireless Specific Services – Emergence of Data

Prominence – Access to Web Information.

REFERENCES

1. Theodre S Rappaport , "Wireless Communications: Principles and Practices", Pearson India, 2003.
2. Gerry Christensen, Paul G.Florack, Robert Duncan, "Wireless Intelligent Networking", Artech House Publishers 2001.
3. Johan Zuidweg, "Next generation Intelligent Networks", Artech House Communication Library, Edition I, August 15, 2002.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Acquire knowledge about fundamentals of mobile communication
2. Analyse the concepts of cellular communication
3. Understand the basic concepts in wireless intelligent networks
4. Acquire the concepts in WIN capabilities, services and architecture
5. Collect ideas on latest applications of wireless communication.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3								3		
CO2		2			3							3	3	
CO3		3	3									2	2	
CO4	3		1	1								2	2	
CO5	2	2	2	2										1

ECCSOESC	SYSTEM MANAGEMENT AND SECURITY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To study fundamentals of network management
- To discuss about the various models for defining the systems.
- To understand the concepts and terminology associated with SNMP.
- To learn to the concepts and architecture behind standards based network management.
- To explore the different encryption methods and security based mechanisms.

Unit I: Network Management

Organisational Model – Information Model – Communication Model – Encoding Structure – Macros Functional Model – Configuration management - Fault management - Performance management – Event Correlation techniques – Security Management – Accounting Management – Report Management – Policy based Management - Service Level management.

Unit II: Internet Management

SNMP – Organisational Model – System overview – Information Model – Communication model - Functional Model – SNMP Proxy Server – Management Information – Protocol Remote Monitoring.

Unit III: Broad Band Network Management

Broad band Networks and Services – ATM technology – VP,VC, ATM Packet – Integrated services – ATM LAN simulation – Virtual LAN – ATM network management – ATM network references Model – Integrated local management

interface – ATM management information base – ATM management interface – ATM digital Exchange interface management.

Unit IV: Key Encryption

Conventional Encryption Model – Stegnography – Block Cipher – Encryption algorithms – key distribution – RSA algorithm – Diffie – Hellman Key exchange – Elliptic curve Cryptology – Message Authentication – Digital Signatures – Key management.

Unit V: System Security

IP Security – Security Architecture – Security Pay load – Web Security requirement – Secure electronic transaction – Dual Signature – Intruders – Viruses – Worms – Trusted Systems – Antivirus Techniques – Digital Immune Systems.

REFERENCES

1. Mani Subramaniar, "Network Management Principles and Practice"– Addision Wesly New York. Pearson Education,2010.
2. Salah Alidarous, Thomas Plevayk, "Telecommunications network management technologies Implementations ", Eastern Economy Edition, IEEE Press New Delhi 1998.
3. Lakshmi G. Raman "Fundamentals of Telecommunication network Management", Eastern Economy Edition, IEEE Press New Delhi 1999.
4. William Stallings, "Cryptology and network security" 4th edition PHI New Delhi 2005

COURSE OUTCOMES

On completion of this course the students will be able to

1. To understand about the various models for defining the systems.
2. To understand the concepts and terminology associated with SNMP.
3. Acquired the concepts and architecture behind standards based network management.
4. To analyze the different encryption methods and security based mechanisms
5. To gain knowledge in Digital Immune systems

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**2**											
CO2	**2**		**3**				**2**			**2**				
CO3	**2**			**2**				**2**						**3**
CO4	**3**	**3**	**2**											**3**
CO5	**3**	**2**		**3**										**3**

ECCSOESC	**EMBEDDED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES

- To make the students to understand the issues and challenges in embedded system design.
- To know the concepts of embedded processor architecture and memory models.
- To explore the software platform for implementing the embedded system
- To study the different types of peripherals and bus devices.
- To study about Special considerations in an RTOS and CPU management.

Unit I: Introduction
Introduction to Embedded Computing, Issues and Challenges in Embedded System Design, Trends: SoC, custom designed chips, configurable processors and multi-core processors.

Unit II: Embedded Processor Architecture
General concepts – Instruction Set Architecture, Levels in architecture, Functional description – hardware/software trade-off Introduction to RISC architecture, pipelining, Instruction issue and execution, Instruction formats, Addressing modes, Data alignment and byte ordering, Introduction to VLIW and DSP processors.

Unit III: Memory and Cache
Memory model – hierarchy and management - virtual memory concepts, protection, cache and SPM, Introduction to the cache coherency problem. Programming with HCS12**:** C Programming examples for interrupts, UART, Input and Output in HCS12 processor.

Unit IV: Embedded System Software
Components of an embedded software system, system boot up and downloading code, System memory map (allocating sections through linker command file), Programming peripherals and ISRs, Embedded tool chain Mixing C and Assembly-concurrent software- memory management and system initialization.

Unit V: Peripherals and Bus Devices
SRAM, DRAM, SDRAM, DDR, NOR and NAND Flash, Ethernet, TPU, UART, USB, I2C bus, SPI bus, CAN bus. C Programming examples for Interrupts, I2C, CAN, TPU and Ethernet in Cold Fire processor Embedded Operating Systems: OS-less system, Introduction to RTOS- Special considerations in an RTOS, CPU management.

REFERENCES

1. John. L. Hennessy and David. A. Patterson, “Computer Architecture”, Morgan Kaufmann publisher, 6th edition, 2017.
2. Sinha, Muthukumar and Darshak, “Embedded System Design – A Practical Approach.
3. Frank Vahid and Tony Givargis, “Embedded system design”, John Wiley & Sons, International Edition 2003.
4. Han-Way Huang, An Introduction to Hardware and Software Interfacing,” The HCS12/9S12.Delmar cengage Learning, First Edition 2005.
5. Michael Barr and Anthony Masasa, “Programming Embedded Systems”. O’relly & Associates Inc. 2006.

COURSE OUTCOMES
On completion of the course the students will be able to

1. Explain the issues, challenges and trends in embedded system design.
2. Explain Instruction set architecture its classifications.
3. Describe a memory module and management in embedded system and analyze its operation by interfacing with a given CPU organization and instruction.
4. Explain programming tools in embedded devices that manages various hardware devices and systems and Develop C programs in Cold Fire processors.
5. Explain Embedded operating system and RTOS.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2													
CO2	2	2												
CO3	3	3												
CO4	2	2	3									2		
CO5	2													

ECCSOESC	MULTIMEDIA COMMUNICATION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To know about the image enhancement techniques and the image compression procedures.
- To understand the basic concepts of VoIP technology
- To study about multimedia networking.

Unit I: Multimedia Components

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

Unit II: Audio and Video Compression

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding, MP3; Video compression – principles-H.261-H.263-MPEG 1, 2, 4.

Unit III: Lossless Compression

Compression principles-source encoders and destination encoders—entropy encoding –source encoding -text compression –static Huffman coding dynamic coding –arithmetic coding –Lempel Ziv-Welch Compression.

Unit IV: VOIP Technology

Basics of IP transport, VOIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service-CODEC Methods-VOIP applicability.

Unit V: Multimedia Networking

Multimedia networking - Applications - streamed stored and audio -making the best Effort service - protocols for real time interactive Applications - distributing multimedia beyond best effort service - secluding and policing Mechanisms - integrated services differentiated Services - RSVP.

REFERENCES

1. Fred Halshall, “Multimedia communication - applications, networks, protocols and standards”, Pearson education, 2007.
2. Tay Vaughan, “Multimedia: Making it work”, 8th edition ,TMH, 2011.
3. Kurose and W.Ross, “Computer Networking –A top down approach”, Pearson education, 6th edition, 2013.
4. KR. Rao, ZS Bojkovic, DA Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the system design principles of multimedia communications systems.
2. Compare various coding techniques for audio and video type of data.
3. Illustrate various coding techniques.
4. Illustrate the Internet technologies for multimedia communications.
5. Discuss about various multimedia networking.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											2	3	
CO2				2									3	
CO3	1		3	2									3	
CO4		2		3								1	2	
CO5	1	2		3										3

ECCSOESC	SOFT COMPUTING TECHNIQUES	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- Artificial Intelligence, Various types of production systems, characteristics of production systems.
- Neural Networks, architecture, functions and various algorithms involved.
- Fuzzy Logic, Various fuzzy systems and their functions.
- Genetic algorithms, its applications.
- Optimization Techniques applied to various applications

Unit I: Soft Computing and Artificial Intelligence

Introduction To Soft Computing, Soft Computing Vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing. Introduction to Artificial Intelligence, Various Types of Production Systems, Characteristics of Production Systems, Breadth First Search, Depth First Search Techniques, Other Search Techniques Like Hill Climbing, Best First Search, A* Algorithm, AO* Algorithms and Various Types of Control Strategies. Knowledge Representation Issues, Prepositional and Predicate Logic, Monotonic and Non Monotonic Reasoning, Forward Reasoning, Backward Reasoning, Weak & Strong Slot & Filler Structures, NLP.

Unit II: Neural Network

Structure and Function of a Single Neuron: Biological Neuron, Artificial Neuron, Definition of ANN, Taxonomy of Neural Net, Difference B/W ANN and Human Brain, Characteristic and Applications of ANN, Single Layer Network.

Unit III: Perceptron and Counter Propagation Network

Perceptron Training Algorithm, Linear Separability, Widrow and Hebb's Learning Rule/Delta Rule, ADALINE, MADALINE, AI V/S ANN. Counter Propagation Network- Architecture, Functioning and Characteristics of Counter Propagation Network.

Unit IV: Fuzzy Logic Controller

Functional Diagram - Fuzzification - Membership Value Assignments Using Intuition - Membership Functions - Defuzzification: Max-Membership Principle - Centroid Method - Weighted Average Method - Inference Engine – Knowledge Base - Rule Base - Case Studies.

Unit V: Genetic Algorithm, Hybrid Soft Computing Techniques and Applications

Optimization – Traditional Optimization Methods – Concept of Evolutionary Algorithm – Genetic Algorithm – Encoding and Decoding of Variables – GA Operators – Reproductions – Cross Over – Mutation – Fitness Function –Fitness Scaling.

Neuro-Fuzzy Hybrid Systems – Genetic Neuro Hybrid Systems – Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems – Simplified Fuzzy ARTMAP – Applications: A Fusion Approach of Multispectral Images With SAR, Optimization of Traveling Salesman Problem Using Genetic Algorithm Approach, Soft Computing Based Hybrid Fuzzy Controllers.

REFERENCES

1. S.N. Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley Publications, 3rd edition, 2013.
2. S, Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.
3. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory & Applications, PHI Publication. 1995
4. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, First Edition, 1998.
5. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, First Edition, 2009.
6. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2017
7. Martin T Hagen, Neural Network Design, Nelson Candad, Second Edition, 2008.

COURSE OUTCOMES

At the end of the course the students can able to

1. Learn about soft computing techniques and their applications.
2. Analyze various neural network architecture.
3. Define the fuzzy systems
4. Analyze the genetic algorithms and their applications.
5. Know various Optimization Techniques applied to various applications

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			2	3		3								3
CO2											2	3	3	2
CO3		3						2		3		3		1
CO4	3		3	1		2						2	2	
CO5										1				

ECCSOESC	CLOUD COMPUTING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- Gives the idea of evolution of cloud computing
- Provides knowledge about its services available today
- Helps to the design and development of simple cloud service.
- Focused on some key challenges and issues around cloud computing.

Unit I: Introduction

Cloud-Definition, Benefits, Usage Scenarios, History of Cloud Computing - Cloud

Architecture - Types of Clouds - Business Models Around Clouds – Major Players in Cloud Computing - Issues in Clouds - Eucalyptus - Nimbus - Open Nebula, Cloud Sim.

Unit II: Cloud Services

Types of Cloud Services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as Services. Service Providers - Google, Amazon, Microsoft Azure, IBM, Sales Force.

Unit III: Collaborating using Cloud Services

Email Communication over the Cloud - CRM Management - Project Management- Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.

Unit IV: Virtualization for Cloud

Need For Virtualization – Pros And Cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine Monitor – Virtual Machine Properties - Interpretation And Binary Translation, HLL VM - Hypervisors – Xen, KVM, Vmware, Virtual Box, Hyper-V.

Unit V: Security, Standards and Applications

Security in Clouds: Cloud Security Challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed Management Task Force – Standards for Application Developers – Standards for Messaging – Standards for Security, End User Access to Cloud Computing, Mobile Internet Devices and The Cloud.

REFERENCES

1. John Rittinghouse & James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate, Que Publishing, August 2008.
3. David E.Y. Sarna Implementing and Developing Cloud Application, CRC press , 1st edition, 2018.
4. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
5. Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing : A Practical Approach, Tata McGraw-Hill 2010.

COURSE OUTCOMES

Upon Completion of the course, the students will be able to

1. Understand clearly about the introduction of cloud computing
2. Acquired knowledge about its services
3. Design and development of simple cloud service.
4. Implement Practical applications using cloud
5. Gain knowledge on some key challenges and issues around cloud computing

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3			3								2		
CO2												1	2	
CO3	2		3										2	
CO4		2		1								1	2	
CO5		2			2									3

ECCSOESC	CRYPTOGRAPHY SYSTEMS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To explore the use of developments in cryptography systems for effective data transfer.
- To deal with the underlying principles of cryptography and network security.
- To provide an extensive coverage of the techniques and methods needed for the proper functioning of the ciphers.
- To study the concept of the construction and cryptanalysis of block ciphers, stream ciphers and hash functions.
- To describe the IP security architecture and methods to overcome the ill effects of attacks.

Unit I: Network Security Concepts

Classical security - Techniques and Computer Network Security Concepts - Confidentiality and Security, Security Policy and Operations Life Cycle, Security System Development and Operations - The Attack Process - Attacker Types - Vulnerability Types - Attack Results - Attack Taxonomy.

Unit II: Encryption

Basic encryption techniques - Concept of cryptanalysis - Shannon's theory - Perfect secrecy - Block ciphers - Cryptographic algorithms - Features of DES - Stream ciphers - Pseudo random sequence generators – linear complexity - Non-linear combination of LFSRs - Boolean functions

Unit III: Crypto Systems

Private key and Public key crypto systems - One way functions - Discrete log problem - Factorization problem - RSA encryption - Diffie Hellmann key exchange - Message authentication and hash functions –Digital signatures - Secret sharing - features of visual cryptography - other applications of cryptography.

Unit IV: Crypt Analysis

Hash functions and message digests, public key encryption, authentication, digital signatures, zero knowledge interactive protocols, elliptic curve cryptosystems, formal verification, hard problems.

Unit V: IP Security

Overview, IP security architecture, authentication, header, security payload, security associations, key management, web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature, intruders, viruses, worms, firewall design, trusted systems, antivirus techniques, digital immune systems.

REFERENCES

1. Douglas A. Stinson, “Cryptography, Theory and Practice”, 2nd edition, Chapman & Hall, CRC Press Company, Washington.
2. William Stallings, “Cryptography and Network Security”, 4th edition, Prentice Hall of India, New Delhi, 2005.
3. Koblitz N, “A Course on Number Theory and Cryptography”, Springer Verlag, 2nd edition 2012.
4. Menezes A. et. al, “Handbook of Applied Cryptography”, CRC Press, 1996.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Describe network security services and mechanisms..
2. Demonstrate the knowledge in principles of cryptography and network security.
3. Identify an extensive coverage of the techniques and methods needed for the proper functioning of the ciphers.
4. Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions.

5. Demonstrate various network security applications, IPSec, Firewall, and Web Security.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**3**										**2**		
CO2	**1**	**3**										**2**	**3**	
CO3				**2**								**1**	**2**	
CO4			**2**	**3**										**3**
CO5	**3**	**2**	**2**									**3**		

AUDIT COURSES

ECCSACSC	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to:

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

Unit I: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit III: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit IV: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit V: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press,8th edition,2017.
3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book . 3rd edition 2020.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2nd edition,2016

COURSE OUTCOMES

At the end of the course students will be able to

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

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1										3				
CO2										3				
CO3										3				
CO4										3				

ECCSACSC	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Unit I: Repercussions of Disasters and Hazards

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Economic Damage, Loss of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit II: Disaster Prone Areas in India

Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit III: Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit IV: Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit V: Disaster Mitigation

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.2007
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi. 2004.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi. 2007

COURSE OUTCOMES

At the end of the course students will be able to

1. Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

2. Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries
4. Analyse the risk assessment process
5. Understand the standards of disaster mitigation.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						3	2							
CO2						3	1							
CO3						2	2	2						
CO4						2		3						
CO5							3	2	2					

ECCSACSC	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences Order, Introduction of roots, Technical information about Sanskrit Literature Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.2020.

COURSE OUTCOMES

Students will be able to

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

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1										3				
CO2										3				
CO3										3				

ECCSACSC	VALUE EDUCATION	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

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

Unit I: Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

Unit II: Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline

Unit III: Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Character and Competence – Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

REFERENCES

1. Chakroborty, S. K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi,1998.

COURSE OUTCOMES

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1								3	3			2		
CO2								2	3			3		
CO3								3	3	2	2	3		

ECCSACSC	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

- To Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit I: History of Making of the Indian Constitution and Philosophy of the Indian Constitution

History, Drafting Committee, (Composition & Working)**,** Philosophy of the Indian Constitution: Preamble, Salient Features

Unit II: Contours of Constitutional Rights & Duties

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit III: Organs of Governance

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit IV: Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit V: Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

REFERENCES

1. The Constitution of India, 1950 (Bare Act), Government Publication. As on 9th November,2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2016.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE OUTCOMES

After completion of the course, students will be able to

CO1. Recognize the significance of the Constitution as the fundamental law of the land and describe the composition of the Constituent Assembly and the role of the Drafting Committee and the objectives of the Constituent Assembly

CO2. Describe the Preamble to the Constitution and its relevance.

CO3. Explain the three principal organs of governance namely the executive, the legislature and the judiciary and analyze the functions of them.

CO4. Explain the organizational structure and role of Local Administration.

CO5. Explain the role of Election commission of India and Institute and Bodies for the welfare of SC/ST/OBC and women.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	**POs**											**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1						**2**								
CO2						**2**								
CO3						**2**								
CO4						**2**								
CO5						**2**								

ECCSACSC	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Unit I: Introduction and Methodology

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?, Theory of change. Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community., Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Research gaps and future directions

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

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1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES

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

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

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1										3				
CO2										3				
CO3										3				

ECCSACSC	STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

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

Definitions of Eight parts of yoga. (Ashtanga)

Yam and Niyam.
Do`s and Don'ts in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam
i) Various yoga poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects-Types of pranayama

REFERNCES

1. 'Yogic Asana for Group Training-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

COURSE OUTCOMES

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)														
Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						3								
CO2						1								

ECCSACSC	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS.	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

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

Neetisatakam - Holistic development of personality: Verses- 19,20,21,22 (wisdom),

Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's)

Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42, Chapter 4-Verses 18, 38, 39, Chapter18 – Verses 37, 38, 63.

REFERENCES

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES

Students will be able to

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

Mapping Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific outcomes (PSOs)

Course Outcomes (COs)	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						2			3	2				
CO2						2			3	2				
CO3						2			3	2				