SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

(University established under section 3of UGC Act 1956)
(Accredited with 'A' Grade by NAAC)
Enathur, Kanchipuram – 631 561

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM FOR FULL TIME
B.E ELECTRONICS AND COMMUNICATION ENGINEERING
(Applicable for the Students admitted from 2018-19 onwards)

DEPARTMENT VISION AND MISSION

VISION

To become a centre of Academic Excellence and blended with rich Culture Based Values through Education, Training, research, collaboration and extension agendas with goal standards.

MISSION

To provide training through education and research to the students who are able to compete internationally, Conscious to the universal moral values, Adherent to the professional ethical code and to generate and disseminate knowledge and technologies essential to the local and global needs in the field of Electronics and Communication Engineering.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO'S)

- PEO 1 : Core Competence.
- PEO 2 : Breadth of Knowledge
- PEO 3 : Professionalism
- PEO 4 : Learning Environment Awareness

PROGRAMME OUTCOMES (PO's)

PO1 : Engineering Knowledge:

Apply the Knowledge of mathematics, science, Engineering fundamentals and an Engineering Specialization to the solution of complex engineering problems.

PO2 : Problem Analysis:

Identify formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.

PO3 : Design / Development Of Solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations..

PO4 : Conduct Investigations Of Complex Problems:

Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5 : Modern Tool usage:

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

PO6 : The Engineer and Society:

Apply reasoning informed by the contextual knowledge to assess societal health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : Environment and Sustainability:

Understand the impact of the professional engineering solutions in societal andenvironmental contexts and demonstrate the knowledge of and need for sustainable development.

PO8 : Ethics:

Apply ethical principle and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : Individual and Team Work:

Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

PO10 : Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation make effective presentations and give and receive clear instructions.

PO11 : Project Management and Finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work and member and leader in a team to manage projects and in multidisciplinary environments.

PO12 : Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change.

DEFINITION OF CREDIT:

No of hours per week	No of credits
1 Hr. Lecture (L) per week	1
1 Hr. Tutorial (T) per week	1
1 Hr. Practical (P) per week	0.5

COURSE CODE AND DEFINITION:

COURSE CODE	DEFINITIONS
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities / Social Sciences / Management Courses
PCC	Programme Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
LC	Laboratory Course
MC	Mandatory Courses
PIIC	Project / Industrial Practice / Internship

CREDIT DISTRIBUTION:

SL.NO	CATEGORY	CREDITS
1.	Basic Science Courses (BSC)	29
2.	Engineering Science Courses (ESC)	20
3.	Programme Core Courses (PCC)	72
4.	Professional Elective Courses (PEC)	21
5.	Humanities / Social Sciences / Management Courses (HSMC)	06
6.	Project / Industrial Practice / Internship (PIIC)	14
7.	Open Elective Courses (OEC)	12
8.	Mandatory Course (MC) *	08 *
Total Credits		**174**

- **Not calculated for CGPA**

CURRICULUM FOR FULL TIME BE (ECE) REGULATIONS

(For candidates admitted during the year 2018-19 onwards)

SEMESTER – I

Sl. No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	CHSEN18T10	English	HSMC	2	1	0	3	40	60	100
2.	CBSMAA8T20	Mathematics –I (Calculus and Differential Equations)	BSC	3	1	0	4	40	60	100
3.	CBSPH18T30	Engineering Physics	BSC	3	0	0	3	40	60	100
4.	CESCS18T40	Programming for Problem Solving	ESC	2	1	0	3	40	60	100
Laboratory										
5.	CBSPH18P50	Physics Lab	BSC	0	0	3	2	40	60	100
6.	CESCS18P60	Problem Solving Programming Lab	ESC	0	0	3	2	40	60	100
7.	CESME18P70	Workshop/Manufacturing Practices	ESC	0	0	3	2	40	60	100
			Total	**10**	**3**	**9**	**19**	**-**	**-**	**700**

SEMESTER –II

Sl. No	Subject Code	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	CBSMAF8T10	Mathematics – II (Linear Algebra, Transform calculus and Numerical Methods)	BSC	3	1	0	4	40	60	100
2.	CBSCH18T20	Engineering Chemistry	BSC	3	0	0	3	40	60	100
3.	CESEE18T30	Engineering Graphics and Design.	BSC	1	0	2	3	40	60	100
4.	CMCCH28T50	Basic Electrical Engineering	ESC	3	0	0	3	40	60	100
5.	CESME18P50	Environmental Science and Engineering *	MC*	2	0	0	2 *	40	60	100
Laboratory										
6.	CBSCH18P60	Chemistry Lab	BSC	0	0	3	2	40	60	100
7.	CESEE18P70	Basic Electrical Engineering Lab	ESC	0	0	3	2	40	60	100
Total				**12**	**1**	**8**	**17**	**-**	**-**	**700**

SEMESTER –III

Sl. No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	BECF183T10	Mathematics –III (Probability and Statistics)	BSC	3	1	0	4	40	60	100
2.	BECF183T30	Electronic Devices	PCC	3	0	0	3	40	60	100
3.	BECF183T40	Digital System Design	PCC	3	0	0	3	40	60	100
4.	BECF183T50	Signals & Systems	PCC	3	0	0	3	40	60	100
5.	BECF183T60	Network Theory	PCC	3	0	0	3	40	60	100
6.	BECF183T20	Object Oriented Programming Using C++	ESC	2	1	0	3	40	60	100
7.	BETF183MC2	Sanskrit and Indian Culture *	MC*	2	0	0	2*	40	60	100
8.	BETF183MC3	Soft Skills – I *	MC*	-	0	0	1*	-	-	-
Laboratory										
9.	BECF183P80	Electronic Devices Lab	PCC	0	0	3	2	40	60	100
10.	BECF183P90	Digital System Design Lab	PCC	0	0	3	2	40	60	100
11.	BECF183P70	Object Oriented Programming Lab Using C++	ESC	0	0	3	2	40	60	100
			Total	**19**	**2**	**9**	**25**	**-**	**-**	**1100**

SEMESTER –IV

Sl. No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	CBSMAJ8T10	Mathematics-IV (Calculus, Special Functions & Design of Experiments)	BSC	3	1	0	4	40	60	100
2.	BECF184T20	Analog Electronics	PCC	3	0	0	3	40	60	100
3.	BECF184T30	Analog & Digital Communication	PCC	3	0	0	3	40	60	100
4.	BECF184T40	Microprocessor & Microcontrollers	PCC	3	0	0	3	40	60	100
5.	BECF184T50	Measurements and Instrumentation	ESC	3	0	0	3	40	60	100
6.	BECF184T60	Electromagnetic Fields & Waveguides	PCC	3	0	0	3	40	60	100
7.	BETF184MC4	Soft Skills – II *	MC*	0	0	0	1*	40	60	100
Laboratory										
8.	BECF184P70	Analog Electronics Lab	PCC	0	0	3	2	40	60	100
9.	BECF184P80	Analog & Digital Communication Lab	PCC	0	0	3	2	40	60	100
10.	BECF184P90	Microprocessor & Microcontrollers Lab	PCC	0	0	3	2	40	60	100
Total				**18**	**1**	**9**	**25**	**-**	**-**	**1000**

SEMESTER –V

Sl. No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	BECF185T10	Microwave Engineering	PCC	3	0	0	3	40	60	100
2.	BECF185T20	Computer Architecture	PCC	3	0	0	3	40	60	100
3.	BECF185T30	Digital Signal Processing	PCC	3	0	0	3	40	60	100
4.	BECF185T40	Computer Aided System Design	PCC	3	0	0	3	40	60	100
5.	PEC – I	Professional Elective Course -I	PEC	3	0	0	3	40	60	100
6.	OEC – I	Open Elective Course- I	OEC	3	0	0	3	40	60	100
7.	BETF18MC05	Soft Skills – III *	MC*	-	0	-	1**	-	-	-
Laboratory										
8.	BECF185P60	Electromagnetic Fields & Microwave Lab	PCC	0	0	3	2	40	60	100
9.	BECF185P70	Digital Signal Processing Lab	PCC	0	0	3	2	40	60	100
10.	BECF185P80	Computer Aided System Design Lab	PCC	0	0	3	2	40	60	100
			Total	**18**	**0**	**9**	**24**	**-**	**-**	**1000**

Note: PEC – I - Refer list of PEC – I, OEC – I – Refer list of OEC – I

SEMESTER –VI

Sl.No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	BECF186T10	Control Systems	PCC	3	0	0	3	40	60	100
2.	BECF186T20	Computer Networks	PCC	3	0	0	3	40	60	100
3.	PEC – II	Professional Elective Course -II	PEC	3	0	0	3	40	60	100
4.	OEC – II	Open Elective Course - II	OEC	3	0	0	3	40	60	100
5.	BECF186T30	Principles of Management & Professional Ethics	HSMC	3	0	0	3	40	60	100
6.	BECF186T40	Embedded Systems	PCC	3	0	0	3	40	60	100
7.	BETF18MC06	Soft Skills – IV*	MC*	0	0	-	1**	-	-	-
Laboratory										
8.	BECF186P70	Computer Networks Lab	PCC	0	0	3	2	40	60	100
9.	BECF186P80	Embedded Systems Design Lab	PCC	0	0	3	2	40	60	100
10.	BECF186P90	VLSI Design Lab	PCC	0	0	3	2	40	60	100
Total				**15**	**0**	**9**	**24**	**-**	**-**	**1000**

Note: PEC – II – Refer list of PEC – II, OEC – II – Refer list of OEC – II

SEMESTER –VII

Sl.No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	PEC – III	Professional Elective Course -III	PEC	3	0	0	3	40	60	100
2.	PEC – IV	Professional Elective Course- IV	PEC	3	0	0	3	40	60	100
3.	PEC – V	Professional Elective Course -V	PEC	3	0	0	3	40	60	100
4.	OEC – III	Open Elective Course III	OEC	3	0	0	3	40	60	100
5.	BECF187T50	Optical Communication	PCC	3	0	0	3	40	60	100
Laboratory										
6.	BECF187P60	Optical Communication Lab	PCC	0	0	3	2	40	60	100
7.	BECF187P70	Industrial Visit / Internship Training**		0	0	0	2	40	60	100
8.	BECF187Z80	Mini Project / Project Work [Phase 1]		0	0	0	2	40	60	100
Total				**15**	**0**	**3**	**21**	**-**	**-**	**800**

Note: PEC – III – Refer list of PEC – III, OEC – III – Refer list of OEC – III
PEC – IV – Refer list of PEC – IV, PEC – V – Refer list of PEC – V

**** To be completed before end of VI Semester**

SEMESTER –VIII

Sl.No	SubjectCode	Subject Name	Category	L	T	P	C	IA	EA	TM
1.	PEC – VI	Professional Elective Course VI	PEC	3	0	0	3	40	60	100
2.	PEC – VII	Professional Elective Course VII	PEC	3	0	0	3	40	60	100
3.	OEC – IV	Open Elective Course IV	OEC	3	0	0	3	40	60	100
Laboratory										
4.	BECF188Z40	Project Work - Phase 2	P II	0	0	0	10	40	60	100
Total				**9**	**0**	**0**	**19**	**-**	**-**	**400**

Total Credits: 174

Note: PEC – VI – Refer list of PEC – VI, OEC – IV – Refer list of OEC – IV
PEC – VII – Refer list of PEC – VII,

SUMMARY OF CREDIT DISTRIBUTION

Sl.No.	Course	Semester								Total
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	3	-	-	-	-	3		-	**06**
2.	BSC	9	12	4	4	-	-	-	-	**29**
3.	ESC	7	5	5	3		-	-	-	**20**
4.	PCC	-	-	16	18	18	15	5	-	**72**
5.	PEC	-	-	-	-	3	3	9	6	**21**
6.	OEC	-	-	-	-	3	3	3	3	**12**
7.	P II	-	-	-	-	-	-	4	10	**14**
8.	MC*	-	2*	3*	1*	1*	1*	-	-	**8***
9.	TOTAL	**19**	**17**	**25**	**25**	**24**	**24**	**21**	**19**	**174**

*** Not calculated for CGPA**

AICTE RECOMMENDATIONS

Sl.No.	CATEGORY	CREDITS [AICTE]	CREDITS [SCSVMV-ECE]
1.	Basic Science Course (BSC)	**25**	**29**
2.	Engineering Science Courses (ESC)	**24**	**20**
3.	Programme Core Courses (PCC)	**48**	**72**
4.	Professional Elective Courses (PEC)	**18**	**21**
5.	Humanities/Social Science/ Management Courses (HSMC)	**12**	**06**
6.	Project/ Industrial Practice/ Internship (PIIC)	**15**	**14**
7.	Open Elective Courses (OEC)	**18**	**12**
8.	Mandatory Course(MC)	**-**	**08 ***
	Total Credits	**160**	**174**

- **Not calculated for CGPA**

LIST OF PROFESSIONAL ELECTIVES COURSES [PEC]

Professional Elective Course – I		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF185EA0	Antennas and Propagation
2.	BECF185EB0	Information Theory and Coding
3.	BECF185EC0	Introduction to MEMS

Professional Elective Course – II		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF186ED0	VLSI Design
2.	BECF186EE0	Multimedia Compression Techniques
3.	BECF186EF0	Nano Electronics

Professional Elective Course – III		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF187EG0	Digital Image and Video Processing
2.	BECF187EH0	Wireless Sensor Networks
3.	BECF187EI0	ASIC design
4.	BECF187EJ0	Advanced Microcontrollers

Professional Elective Course – IV		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF187EK0	Mobile Communication and Networks
2.	BECF187EL0	CMOS IC Design
3.	BECF187EM0	Speech and Audio Processing
4.	BECF187EN0	High Speed Electronics

Professional Elective Course – V		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF187EO0	Bio-Medical Electronics
2.	BECF187EP0	Mixed Signal Design
3.	BECF187EQ0	Adaptive Signal Processing
4.	BECF187ER0	RF Design

Professional Elective Course – VI		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF188ES0	Neural Networks and Fuzzy Logic
2.	BECF188ET0	4G LTE Cellular Systems
3.	BECF188EU0	Error Correcting Codes
4.	BECF188EV0	VLSI Testing

Professional Elective Course – VII		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF188EW0	Satellite Communication
2.	BECF188EX0	Radar and Navigational Aids
3.	BECF188EY0	Wavelets and its Applications
4.	BECF188EZ0	Software Defined Radio

LIST OF OPEN ELECTIVES COURSES [OEC]

Open Elective Course – I		
Sl. No	**SubjectCode**	**Subject Name**
1.	BECF185OEA	Disaster Management
2.	BECF185OEB	Cryptography & Network Security
3.	BECF185OEC	PLC & Data Acquisition Systems
4.	BECF185OED	Nano science
5.	BECF185OEE	Autotronics

Open Elective Course – II		
Sl. No	**SubjectCode**	**Subject Name**
4.	BECF186OEF	Remote Sensing & GIS
5.	BECF186OEG	Big data Analytics
6.	BECF186OEH	Computer Integrated Manufacturing
7.	BECF186OEI	Operational Research
8.	BECF186OEJ	3D Printers & Applications

Open Elective Course – III		
Sl. No	**SubjectCode**	**Subject Name**
5.	BECF187OEK	Sensors & Actuators
6.	BECF187OEL	ADHOC Networks
7.	BECF187OEM	Artificial Intelligence
8.	BECF187OEN	Total Quality Management
9.	BECF187OEO	Global Positioning Systems

Open Elective Course – IV		
Sl. No	**SubjectCode**	**Subject Name**
5.	BECF188OEP	Robotics & Automation
6.	BECF188OEQ	HR & Management
7.	BECF188OER	Computer Control of Process
8.	BECF188OES	Cloud Computing
9.	BECF188OET	IOT Architecture & Protocols

Open Elective Course (Optional)		
Sl. No	**SubjectCode**	**Subject Name**
5.	BECF18OECO1	French Primer
6.	BECF18OECO2	German Primer
7.	BECF18OECO3	Japanese Primer

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS FOR FULL TIME

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable for the Students admitted from 2018-19 onwards)

I - SEMESTER

CHSEN18T10 – ENGLISH

UNIT I VOCABULARY BUILDING

The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form Derivatives - Synonyms, antonyms, and standard abbreviations.

UNIT II BASIC WRITING SKILLS

Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence - Organizing principles of paragraphs in documents - Techniques for writing precisely

UNIT III IDENTIFYING COMMON ERRORS IN WRITING

Subject-verb agreement - Noun pronoun agreement - Misplaced modifiers - Articles - Prepositions - Redundancies – Clichés

UNIT IV NATURE AND STYLE OF SENSIBLE WRITING

Describing – Defining – Classifying - Providing examples or evidence -Writing introduction and conclusion

UNIT V WRITING PRACTICES

Comprehension - Précis Writing - Essay Writing

UNIT VI ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab)
Listening Comprehension - Pronunciation, Intonation, Stress and Rhythm - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations

COURSE OUTCOMES

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

SUGGESTED READINGS:

- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan.2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

CBSMAA8T20 - MATHEMATICS I

(Calculus and Differential Equations)

OBJECTIVE:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, differential equations and sequence and series. It aims to equip the students withstandard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics.

UNIT ISEQUENCESAND SERIES

Convergence of sequence and series -Tests for convergence – Comparison, -Ratio- Cauchy's Root-Raabe's test-logarithmic test- Fourier series: Half range sine and cosine series-Parseval's theorem.

UNITII DIFFERENTIALEQUATIONS

Second order linear differential equations with constant coefficients – Cauchy_Euler equation, Legendre equation-Method of variation of parameters-First order partial differential equations: Formation of PDE -solutions of first order linear PDEs.

UNIT-III CALCULUS

Evaluation of definite integral-Applications of definite integrals- To evaluate surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

UNIT-IV MULTIVARIABLE CALCULUS

Multiple Integration – double and triple integrals (Cartesian and polar)-change of order of integration in double integrals – Change of variables (Cartesian and polar) - areas and volumes by double integration-Center of mass and Gravity(constant and variable densities).

UNIT-V NUMERICALMETHODS

Solution of polynomial and transcendental equations – Bisection method-Newton-Raphson method-Regula-Falsi method- Finite differences -Interpolation using Newton's forward and backward difference formulae- Central difference interpolation-Gauss's forward and backward formulae

COURSE OUTCOMES

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

TEXT BOOK:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.

REFERENCE BOOKS:

1. G.B. Thomas and R.L.Finney, Calculus and Analytic geometry, Pearson, 2002.
2. T. Veerarajan, Engineering Mathematics, McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana, Higher Engineering Mathematics, McGrawHill, New Delhi, 2010.N.P. Bali and M. Goyal,
4. A text book of Engineering Mathematics,Laxmi Publications, 2010..
5. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.

CBSPH18T30 - PHYSICS I

UNIT I WAVE OPTICS

Huygens' principle, superposition of waves –Theory of interference of light -Young's double slit experiment. Thin films-Newton's rings, Michelson interferometer-Anti reflection coating. Fresnel and Fraunhofer diffraction– diffraction due to 'n' slits- plane transmission grating. Rayleigh criterion for limit of resolution - resolving power ofgrating

UNIT II QUANTUM PHYSICS

Black body radiation-Planck's law – Energy distribution function, Wave – particle duality-de Broglie matterwaves – Concept of wave function and its physical significance – Heisenberg's Uncertainity Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one dimensional rigid box – tunneling (Qualitative) – Scanning tunneling microscope.

UNIT III PHOTONICS

Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser- spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state laser(Neodymium), gas lasers (CO_2), applications –IR Thermography.

Optical fibre- principle [TIR]-types-material, mode, refractive index-Fibre loss-Expression for acceptance angle and numerical aperture. Application-Communication.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS

Introduction to P-N junction Diode and V-I characteristics, Zener diode and its characteristics,

Introduction to BJT, its input-output and transfer characteristics, SCR characteristics, FET, MOSFET and CMOS characteristics. Basic logic gates - NAND, NOR as Universal building block.

UNIT V NEW ENGINEERING MATERIALS

Dielectric materials: Definition – Dielectric Breakdown – Dielectric loss – Internal field – Claussius Mossotti relation.

Superconducting materials: Introduction – Properties- Meissner effect – Type I & Type II superconductors – BCS theory-Applications.

Nanomaterials: Introduction – Synthesis of nano materials – Top down and Bottom up approach- Ball milling- PVD method- Applications.

Smart materials: Shape memory alloys-Biomaterials (properties and applications)

TEXT BOOKS

1. Optics by Subramaniam N &BrijLal, S Chand & Co. Pvt. Ltd., New Delhi, [unit 1]
2. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand [all units]
3. Quantum Mechanics by Sathyaprakash, PragatiPrakashan, Meerut. [unit 2]
4. Applied Engineering Physics – Rajendran&Marikani (Tata McGraw Hill) [unit 3,5] 2009
5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications [unit 2,3,5] 2012
6. Engineering Physics I & II – G.Senthilkumar, VRB publications [unit 2,3] 2012
7. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan(Scitech) [3,5] 2014
8. Principles of Electronics by V.K.Mehta, (S.Chand) [unit 5]

REFERENCE BOOKS

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi,
2. Quantum Mechanics by V. Devanathan, Narosa, Chennai.
3. Engineering Physics by M.N.Avadhanulu, S.Chand& Company Ltd.
4. Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
5. Optics by R.Agarwal, S.Chand publishers.
6. Basic Electronics by B.L.Theraja, S.Chand publishers.
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, NewYork.

CESCS18T40 - PROGRAMMING FOR PROBLEM SOLVING

UNIT I : Introduction to components of computer system-Generation of programming languages-Types of Computers-Organization of Computers-Types of memory, Number systems- Idea of Algorithm-Pseudo code- Flow Chart with examples.

UNIT II: Introduction to C-Character set, Constants, Variables, Data Types-Operators – Arithmetic expressions and precedence-Decision Making statement - Looping statements.

UNIT III: Arrays and its types-Functions –Parameter passing in functions-call by value- call by reference – Passing array to functions-Recursive function.

UNIT IV: Structures and array of structures –Union, Basic searching –Linear and Binary, Basic sorting,String operations.

UNIT V: Introduction to Pointer, Pointer arithmetic-notion of linked list (no implementation) - File handling.

COURSE OUTCOMES

The student will learn

- ➢ To formulate simple algorithms for arithmetic and logical problems.
- ➢ To translate the algorithms to programs (in C language).
- ➢ To test and execute the programs and correct syntax and logical errors.
- ➢ To implement conditional branching, iteration and recursion.
- ➢ To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- ➢ To use arrays, pointers and structures to formulate algorithms and programs.
- ➢ To apply programming to solve matrix addition and multiplication problems andsearching and sorting problems.
- ➢ To apply programming to solve simple numerical method problems, namely rot findingof function, differentiation of function and simple integration

TEXT BOOKS

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006.
3. Fundamentals of Computing and Programming- V.RameshBabu, R.Samyuktha,M.Muniratham by VRB Publishers 2012 edition.

REFERENCE BOOKS

1. Let Us 'C' - YashawantKanetkar, (Unit 2 to 5), BPB publications, 10th Edition, 2010
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Venugopal.K and Kavichithra.C, "Computer Programming", New Age International Publishers, First Edition, 2007.
4. Kernighan B.W and Ritchie,D.M , The C programming language: second edition,Pearson education,2006

CBSPH18P50 - PHYSICS LABORATORY

List of Experiments (Any SEVEN)

1. Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum.
2. Determination of Young's Modulus.
3. (a) Determination of Wavelength of Laser light using transmission grating.
   (b) Measurement of numerical aperture of an optical fiber.
4. Determination of radius of curvature of the given lens using Newton's Rings.
5. Determination of Velocity of sound waves in liquid using Ultrasonic interferometer.
6. Determination of wavelength of prominent colours of mercury spectrum using grating.
7. Determination of number of lines per meter of the grating using normal incidencemethod.
8. Determination of refractive index of the given prism using minimum deviation method.
9. Determination of emissivity of the surface of a black body.
10. Basic logic gates- Verification of truth tables
11. NAND-Universal building block
12. NOR-Universal building block
13. Zener diode- I-V characteristics
14. Study of LCR circuit

REFERENCE

1. Practical Physics - Ouseph and Rangarajan.
2. Engineering Practical Physics-K. Srinivasan.
3. Engineering Practical Physics - M.N. Avadhanulu.
4. Experimental Physics – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)

CESCS18P60 - PROGRAMMING FOR PROBLEM SOLVING LABORATORY

1. Basic programs in data types.
2. Evaluate Expressions using library Function.
   a. πr^2
   b. (A+B+(2C/3A)+A2+2B)
   c. √S(S-A) (S-B) (S-C)
   d. LOG ($x^3+y^3+z^3$)
3. Problems in Decision making statements.
   i. Find the Biggest among 3 numbers.
   ii. Find Even or odd
   iii. Arithmetic operations using Switch - Case Statements.
4. Problems in looping statements.
   i. Find the Sum of digits using (i) For loop (ii) While loop
   ii. Generate the Fibonacci series
   iii. Check whether the number is prime or not.
5. Find the Linear Search.
6. General sorting.
7. Matrix Manipulation-Addition, Subtraction and Multiplication.
8. String operations-string copy, string reverse, string concatenate.
9. Swapping of numbers using call by value, call by reference.
10. Find factorial using recursive functions.
11. Numerical methods-Quadratic Equation.
12. Display the student information & marks using Structure & Unions.
13. Demonstrate array of structures.
14. Pointer Arithmetic and Array access using Pointers.
15. Basic File Operations

LABORATORY OUTCOMES

- ➢ To formulate the algorithms for simple problems
- ➢ To translate given algorithms to a working and correct program
- ➢ To be able to correct syntax errors as reported by the compilers
- ➢ To be able to identify and correct logical errors encountered at run time
- ➢ To be able to write iterative as well as recursive programs
- ➢ To be able to represent data in arrays, strings and structures and manipulate them through a program
- ➢ To be able to declare pointers of different types and use them in defining self-referential structures.
- ➢ To be able to create, read and write to and from simple text files.

CESME18P70 - WORKSHOP/MANUFACTURING PRACTICES

LIST OF EXPERIMENTS

SL NO	MANUFACTURING/ FABRICATION LAB	EXPERIMENT NAME
1	MACHINE SHOP	TURNING (PLAIN & STEP) AND FACING PRACTICE
2		DRILLING PRACTICE
3	FITTING SHOP	V- FITTING
4		SQUARE FITTING
5	CARPENTRY SHOP	HALF LAP T- JOINT
6		HALF LAP CROSS JOINT
7	WELDING SHOP	LAP JOINT - ARC WELDING PROCESS
8		BUTT JOINT – GAS WELDING PROCESS
9	SMITHY SHOP	FABRICATION OF ROUND ROD
10	CASTING	PREPARATION OF GREEN SAND MOLD USING A GLAND PIECEPATTERN
11	ELECTRICAL AND ELECTRONICS LAB	TWO LAMPS IN SERIES CONTROLLED BY ONE WAY SWITCH
12		TWO LAMPS IN PARALLEL CONTROLLED BY ONE WAY SWITCH

COURSE OUTCOMES

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials

SUGGESTED TEXT/REFERENCE BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,

II SEMESTER

CBSMAF8T10 – MATHEMATICS II

Objectives

This course aims at familiarising the prospective engineers with techniques in Linear Algebra, Transform Calculus and Numerical Methods. To understand the fundamental concepts in the above said topics. To develop the ability to evaluate the problems in transform calculus and its application in varies areas.

Unit 1: Matrices (10 hours)

Rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonalmatrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem, Orthogonal transformation and quadratic to canonical forms.

Unit 2: Numerical Methods- (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first order equations. Milne's predicator corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Unit 3: Transform Calculus- I

Laplace Transforms : Definition, Properties of Laplace transforms: Linearity Property, First shifting property, Change of scale property – Transforms of derivatives - Transforms of integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace transform - Inverse transforms: Method of partial fractions – Other methods of finding inverse - Convolution theorem (Without proof) Application to differential equations

Unit 4: Transform Calculus- II

Fourier integral theorem (without proof) - Fourier Sine and Cosine integrals – Complex form of Fourier integral - Fourier transform – Fourier sine and Cosine transforms – Properties of Fourier Transforms: Linear property, Change of scale property, Shifting property -Parseval's identity for Fourier transforms (without proof) – Application of transforms to boundary value problems: Heat conduction, Vibrations of a string, Transmission lines

Unit 5: Transform Calculus- III

Standard z-transforms of $1, a^n, p^n$ – Linearity property – Damping rule – Shifting rules – Multiplication by n - Initial and final value theorems (without proof) – inverse z –transforms – Convolution theorem (without proof) – Convergence of z-transforms – Two sided z- transform – Evaluation of inverse z-transforms: Power series method, Partial fraction method, inversion integral method.

Prescribed Book

1) Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

Reference Book

1) Alan Jeffrey, Advanced Engineering Mathematics, Academic Press
2) Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3) Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company

CBSCH18T20 – CHEMISTRY I

Aim: Making the students to realize the importance and utility of chemistry in various fields

Objective:

- To learn the basics of atomic structure, bonding, analytical methods and various types ofreactions in organic chemistry.

Outcome:

The students will be able to

- Analyze microscopic chemistry in terms of atomic and molecular orbitals andintermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations
- Distinguish the ranges of the electromagnetic spectrum used for exciting differentmolecular energy levels in various spectroscopic techniques.
- Rationalize periodic properties.
- List major chemical reactions that are used in the synthesis of various organic molecules.

Unit I: Atomic structure (15 Lectures)

Comparison between Rutherford's model of atom and Bohr's model - Bohr-Sommerfeld model (Concepts only)-its limitations - de Broglie theory-Heisenberg's uncertainty principle - Schrodinger's wave equation (derivation not needed)-significance of $\Psi$and Ψ^2 –shapes of different orbital's –Aufbau principle-Pauli Exclusion Principle- Hund'srule. Electronic configuration of atoms- Mosley's law – Modern periodic table - periodic properties: atomic size- ionization energies- electron affinity- electro negativity.

Unit II: Chemical Bonding **(**15 Lectures)

Types of bonds – ionic - covalent – coordinate bond - Molecular Orbital Theory –types of molecular orbitals- energy level diagrams- e^-ns filling in MO – bond order – MO diagrams of H_2,He_2, N_2, O_2, CO and HF molecules- Metallic bond – band theory of solids (primitive treatment only) and the role of doping on band structures - Hybridization – definition - geometry of the molecules- CH_4, C_2H_4, C_2H_2- Molecular forces-Ionic, dipolar, van der waals interactions.

Unit III: Thermal and electrochemical equilibria (15Lectures)

Thermodynamic functions: State functions, Path functions, Internal energy, enthalpy, entropy and free energy-Gibbs Helmholtz equation and its applications. Feasibility of reaction - Ellingham diagrams.

Types of electrodes- Standard electrodes-Standard hydrogen electrode, standard calomel electrode, Single electrode potential , electrochemical series - galvanic cell - emf - Nernst equation and its applications - Glass electrode, Potentiometric acid base titrations and Solubility equilibria-Corrosion-types- Chemical corrosion-electrochemical corrosion-factors influencing and control measures.

Unit IV: Spectroscopic techniques and applications (15 Lectures)

Electromagnetic radiations – wavelength – frequency – energy of a radiation – electromagnetic spectrum – changes brought about by the radiations– components of a spectrometer – rotational spectra of diatomic molecules – rigid and non-rigid rotor models (energy expressions only)- selection rule– schematic instrumentation – types of vibrations in molecules (CO_2, H_2O) – vibrational spectra (primitive treatment) – selection rule- instrumentation and applications – electronic transitions – electronic spectra — Beer-Lambert's law- instrumentation and applications– NMR – principle – chemical shift - instrumentation – NMR spectra of CH_4 – CH_3OH – xylene isomers – MRI (Introduction only)

Unit V: Stereochemistry & Organic Reactions (15 Lectures)

Stereochemistry - Representation of 3D structures - Fisher projection, Newman and Sawhorse projection formulae – Ethane, 3-bromo-2-butanol Conformation of Ethane, Butane& Ethylene glycol, , Symmetry and Chirality - Stereo isomers, Enantiomers, Diastereomers. Configuration - R-S system. Optical activity - Lactic acid, Tartaric acid- Geometrical isomerism – *cis-trans*& E-Z notations.

Organic Reactions – Substitution - S_N^1& S_N^2(simple examples, mechanism not expected)–electrophilic substitutions – Friedel Crafts alkylations - Additions – 1,2-addition **–** types-addition of HX -Elimination – E^1& E^2 (Examples only, mechanism not expected) - Oxidations – *CIS*-hydroxylation with OsO_4, Reductions – Clemmensen&wolff-Kishner reductions, Cyclization – Diels Alder, Ring-Opening – Nylon-6 from caprolactum.

Synthesis of most commonly used drugs – Aspirin,Paracetamol.

Text Books

1. Textbook of Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons, Delhi, 2013. (For units Iand II)
2. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania,ShobanLalNagin Chand & Co., Jalandhar, 2000. (For units III and IV)
3. Advanced Organic Chemistry, B. S. Bahl and ArunBahl, S.Chand, Delhi, 2012. (For unitV).

Reference Books

1. Engineering Chemistry, P.C. Jain and Monika Jain, DhanpatRai Publishing Co Pvt. Ltd.,New Delhi, 2008.
2. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
3. Textbook of Engineering Chemistry,S.S.Dara &S.S. Umare, S.Chand, Delhi, 2004.
4. Fundamentals of Molecular Spectroscopy,C.N.Banwell and Elaine.M.McCash, 4th Edition, McGraw Hill Education, 2017.
5. Physical Chemistry, P. W. Atkins and Julio De Paula, 10th Edition, Oxford University Press,2014.

CESEE18T30 – ENGINEERING GRAPHICS & DESIGN (THEORY &LAB)

Traditional Engineering Graphics:
Principles of engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing;. Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction toBuilding Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen Concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering**,** Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone - Auxiliary Views; Development of surfaces of Right Regular Solids
- Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module 6: Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status

Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such asWC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics: TMH Publication.
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

Goals & Outcomes:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

CMCCH28T50 – BASIC ELECTRICAL ENGINEERING

UNIT I DC CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II AC CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, realpower, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III TRANSFORMERS

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit,losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformerconnections.

UNIT IV ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque- speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT V POWER CONVERTERS AND ELECTRICAL INSTALLATIONS

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

COURSE OUTCOMES

- ➢ To understand and analyze basic electric and magnetic circuits
- ➢ To study the working principles of electrical machines and power converters. Tointroduce the components of low voltage electrical installations

TEXT BOOKS

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

REFERENCE BOOKS:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

CBSCH18P60 – CHEMISTRY- I LAB

Aim: To make the students familiar with the way of systematic experimenting in the laboratory

Objective:
To learn the basics and perform experiments involving volumetric analysis, colligativeproperties, simple synthesis and other instrumental techniques.

.**Outcome:**
After the course the students will be able to

- Estimate rate constants of reactions from concentration of reactants/products as afunction of time
- Measure molecular/system properties such as surface tension, viscosity, Conductance ofsolutions, redox potentials, chloride content of water.
- Synthesize a small drug molecule
- Analyze a salt sample

Any ten experiments of the following

1. Determination of surface tension and viscosity of a liquid or a solution
2. Thin layer chromatography / Paper chromatography for separation of a mixture.
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water by volumetry.
5. Determination of M.wt of a non-volatile solute by Rast's method.
6. Determination of the rate constant of the reaction between $K_2S_2O_8$ and KI – Clock reaction method.
7. Conductometry -Verification of Debye-Huckel-Onsager equation for a strong electrolyte.
8. Potentiometry -Determination of formal redox potential of Fe^{3+}/Fe^{2+} couple
9. Synthesis of Nylon 66 by interfacial polymerization method.
10. Determination of Saponification/acid value of oil.
11. Systematic qualitative analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces – computational experiment.
14. Chemical oscillations- Potentiometric study of the oscillations of Belousov-Zhabotinsky reaction
15. Determination of the partition coefficient of I_2 between water and CCl_4
16. Verification of Freundlich isotherm for adsorption of acetic acid / oxalic acid by charcoal.
17. Determination of isoelectric point of Gelatin sols by using capillary viscosmeter.

Text Books

1. Advanced Practical Physical Chemistry, J.B.Yadhav, Krishna Prakasan Media, 2016.
2. Experiments in Applied Chemistry, Sunita Rattan, S.K. Kataria& Sons, 2012.

CESEE18P70 – BASIC ELECTRICAL ENGINEERING LAB

List of Experiments

1. Study of Electric Motors (AC & DC Motors)
2. Load Test on Single Phase Induction Motor
3. Load Test on Three Phase Induction Motor
4. Load Test on Single Phase Transformer
5. Load Test on Three Phase Alternator
6. Speed Control of DC Motor
7. Speed Control of Three Phase Induction Motor (Pole Changing Method)
8. Study of Multi meter, CRO and LCR Meter
9. Measurement of Voltage, Current and Power.
10. Verification of Kirchoff's Law
11. Verification of Thevenin's Theorem
12. B·H Curve of a Magnetic Material
13. Rectifier Circuit Analysis (AC – DC)
14. Inverter Circuit Analysis (DC – AC)
15. Chopper Circuit Analysis (DC – DC)
16. Series and Parallel RLC Circuit Analysis

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters

BECF183T10 – MATHEMATICS - III

III – SEMESTER

L	T	P	C
4	1	0	4

Prerequisite

Collection of data, Counting Techniques**,** Permutation and combination

Objectives

The objective of this course is to familiarize the students with statistical and probability techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems inthe discipline.

Unit 1: Basic Probability:

Probability spaces, conditional probability, Independent random variables, sums of independent random variables, Bayes' Theorem, Discrete and Continuous one dimensional random variables - Expectations, Moments, Variance of a sum, Moment generating function,Tchebyshev's Inequality.

Unit 2: Probability Distributions:

Discrete Distributions – Binomial, Poisson and Negative Binomial distributions, ContinuousDistributions - Normal, Exponential and Gamma distributions.

Unit 3: Basic Statistics:

Measures of Central tendency: Averages, mean, median, mode, Measures of dispersion – Range, Mean deviation, Quartile deviation and Standard deviation, Moments, skewness andKurtosis, Correlation and regression – Rank correlation.

Unit 4: Applied Statistics:

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolasand more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Unit 5: Small samples:

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Outcomes

- Understand the fundamental knowledge of the concepts of probability
- Understand and to have knowledge of the basic concepts of distribution that can be appliedin engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real lifeproblems.
- Apply the basic concepts of statistics in the field of agriculture and statistical qualitycontrol.
- Have the notion of sampling distributions and statistical techniques used in engineeringand management problems.

Suggested Books:

1. T. Veerarajan, Probability, Statistics and Random Processes, Third edition, Tata McGraw-Hill, NewDelhi, 2010.
2. S.P. Gupta, Statistical Methods, 31st edition, Sultan chand and sons, New Delhi, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
6. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.Wiley, 1968.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2010.

BECF183T30 – ELECTRONIC DEVICES III - SEMESTER

L	T	P	C
3	1	0	3

Prerequisite: Basic knowledge of electronic components and laws such as KCL, KVL, etc

OBJECTIVES:

- The student should be made to Learn about biasing of BJTs and MOSFETs
- Design and construct amplifiers
- Construct amplifiers with active loads
- Study high frequency response of all amplifiers

Unit-1 Semiconductor Materials: Elemental & compound semiconductor materials , Bonding forcesand Energy bands in intrinsic and extrinsic silicon, Charge carrier in semiconductors , carrier concentration, Junction properties, Equilibrium condition, biased junction, Steady state condition, breakdown mechanism (Rectifying Diodes, Zener Diodes), Metal Semiconductor Junction. Special diodes: Tunnel diodes, Varactor diodes, Schottky diode, Photo diodes, Photo detector, LED, Solar cell.

Unit-2 Diode Circuits: Ideal and Practical diode, Clipper, Clamper. Power Supply: Rectifiers-Half wave, Full wave, Bridge rectifier, filter circuits, Voltage regulation using shunt & series regulator circuits, Voltage regulation using IC 723

Unit-3 Fundamentals of BJT: Construction, basic operation, current components and equations, CB,CE and CC configuration, input and output characteristics, Early effect, Region of operations: active,cut-off and saturation region. BJT as an amplifier and switch - Photo transistor, Uni-junctionTransistor (UJT) and Thyristors: UJT: Principle of operation, characteristics, UJT relaxation oscillator.

Unit-4 Small Signal Analysis: Small signal Amplifier, Amplifier Bandwidth, Hybrid model, analysisof transistor amplifier using h-parameter, Multistage Amplifier: Cascading amplifier, Boot-strappingTechnique, Darlington amplifier and Cascode amplifier, Coupling methods in multistage amplifier, Low and high frequency response, Hybrid π model, Current Mirror circuits.

Unit-5 FET Construction- JFET: Construction, n-channel and p-channel, transfer and drain characteristics, parameters, Equivalent model and voltage gain, analysis of FET in CG, CS and CD configuration. Enhancement and Depletion MOSFET drain and transfer Characteristics. **Integrated**
Circuit Fabrication Process: oxidation, diffusion, ion implantation, photolithography, etching,chemical vapor deposition, sputtering, twin-tub CMOS process.

OUTCOMES:

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

- Design circuits with transistor biasing.
- Design simple amplifier circuits.
- Analyze the small signal equivalent circuits of transistors and Design and analyze large signalamplifiers.

TEXT BOOK:

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –2 nd Edition, Tata Mc Graw Hill, 2009.

REFERENCE BOOKS:

1. Millman & Halkias, “Electronic Devices And Circuits”, TMH. 2013
2. Salivahanan, Kumar & Vallavaraj, “Electronic Devices and Circuits”, TMH. 2016
3. Boylestad & Neshelsky, “Electronic Devices & Circuits”, PHI.2012
4. Schilling & Belove, “Electronic Circuits, Discrete & Integrated”, TMH.2011
5. R.S.Sedha,”Text book of Applied Electronics”, Second edition, S Chand publishing, 2008
6. Adel S. Sedra & Kenneth C. Smith, “Microelectronic Circuits”, OUP.2007
7. R. A. Gayakwad, “Op-Amps And Linear Integrated Circuits”, PHI, 2010
8. Theodore F. Bogart, Jeffrey S. Beasley, “Guillermo Rico Electronic Devices & Circuits”.2014

BECF183T40 – DIGITAL SYSTEM DESIGN

III - SEMESTER

L	T	P	C
3	1	0	3

Prerequisite: Basic electronics, Boolean algebra and Number systems.

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequentialcircuits

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions –Quine-McCluskey method of minimization.

Logic Gates: AND,OR,NOT,NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND –NOR implementations – Multilevel gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

UNIT II COMBINATIONAL CIRCUITS

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer
– decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation – Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment -Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV MEMORY DEVICES

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timingwave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell – Programmable Logic Devices – ProgrammableLogic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

Synchronous Sequential Circuits**:** General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

Asynchronous Sequential Circuits**:** Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG

OUTCOMES:

Students will be able to:

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Execute simple HDL codes for the circuits.

TEXT BOOK:

1. M. Morris Mano, "Digital Design", 4e, Prentice Hall of India Pvt. Ltd., 2008 / PearsonEducation (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John Yarb rough, "Digital Logic Applications and Design", Thomson Learning, 2006Char
3. les H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition,TMH,2006
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003
7. A.Ananda Kumar, Fundamentals of digital circuits, second edition, PHI learning private limited,2009.

BECF183T50 – SIGNALS AND SYSTEMS

III - SEMESTER

L	T	P	C
3	1	0	3

Prerequisite: Basic knowledge on Mathematics which includes Fourier seriesand Laplace Transform

OBJECTIVES:

- To understand the properties and representation of discrete and continuous signals
- To understand the sampling process and analysis of discrete systems using z-transforms
- To study the analysis and synthesis of discrete time systems

UNIT-I CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous Time Signals (CT signals), Discrete time signals (DT signals) step, ramp, pulse,impulse, exponential, Classification of CT and DT signals - periodic, aperiodic, random signals - CT systems and DT systems, Basic properties of systems - Linear Time invariant systems and properties

UNIT-II ANALYSIS OF CONTINUOUS TIME SIGNALS

Fourier Series Analysis- Representation of periodic signals in trigonometric and exponential form, Spectrum of CT signals-Fourier Transform and Laplace Transform in signal analysis

UNIT-III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS

Differential Equation - Block diagram Representation, Impulse response, Convolution Integral-Frequency response, Fourier and Laplace Transforms in analysis, State variable equations and Matrix representation of systems

UNIT-IV ANALYSIS OF DISCRETE TIME SYSTEMS

Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform

UNIT-V LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS

Difference equations, Block Diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State variable equations and matrix representation of systems

OUTCOMES:

Students will be able to:

- Understand the properties and representation of continuous and discrete time signals.
- Analyze the discrete time systems using z-transforms.

TEXTBOOKS:

1. P.Ramesh Babu & R.Anandanatarajan, signals and systems, 4th edition, scitechpublication private limited, 2009.
2. Allam V. Oppenheim, S.Wilsky and S.H.Nawab, Signals and systems, PearsonEducation,2007

REFERENCES:

1. Robert A.Gabel and Richard A.Roberts, Signals & Linear Systems, John Wiley & Sons 2004
2. Simon Haykins and Barry Van Veen, Signals and Systems, John Wiley & Sons, 2004

BECF183T60 – NETWORK THEORY

III - SEMESTER

L	T	P	C
3	1	0	3

Prerequisite: Mathematics – II & Basic Electronics Engineering

OBJECTIVES:

- To create circuits involving different active and passive elements.
- To analyze the behavior of the circuit's response in time domain.
- To analyze the behavior of the circuit's response in frequency domain.
- To interpret the significance of network function

Unit-1 Network Analysis

Mesh analysis (DC and AC circuits)-super mesh analysis-nodal analysis (DC and AC circuits)-super nodal analysis- source transformation technique-duals and duality –Wye-deltatransformations

Unit-2 Network Theorem

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power Transfer theorem, reciprocity theorem, compensation theorem, Millman's Theorem and Tallegen's theorem as applied to DC and AC. Circuits

Unit-3 Two port Networks and filters design

Z parameter, Y parameter, h parameter, ABCD parameter, g parameter, Inter relationship ofdifferent parameters-inter connection of two port networks-classification of filters-constant klow pass and high pass filters-m-derived low pass and high pass filters-band pass filter-bandelimination filter .

UNIT-4 Transient and S-Domain analysis

Steady state and transient response-DC response of an R-L,R-C and R-L-C circuit-sinusoidalresponse of R-L,R-C and R-L-C circuit-concept of complex of frequency-poles and zeros of network function-significance of poles and zeros-properties of driving point and transfer function.

UNIT-5 Network Synthesis

Hurwitz polynomial-positive real function, frequency response of reactive one port-synthesisof reactive one port by Foster's Method & Cauer method- synthesis of R-L Network by Foster's Method & Cauer method- synthesis of R-C Network by Foster's Method & Cauer method

OUTCOMES:

Students will be able to:

- Analyze the behavior of different circuits and their response using various circuit analysis toolsand theorems
- Apply and analyze the circuits in time domain and frequency domain.
- Understand basic concepts regarding the system definition mathematically and associatednetwork function.
- Interpret the concept of Network synthesis.

Text Book:

1. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 2000

Reference Books:

1. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education, 2004
2. Van Valkenburg,"Network analysis", Prentice hall of India, 2000.
3. Edminister J.A., "Theory and Problems of Electric Circuits", Schaum's outline series McGraw HillBook Company, 2nd Edition, 2000.
4. Hyatt W.H. and Kemmerly, "Engineering Circuits Analysis", McGraw- Hill International Editions,1993.

BECF183T20 – OBJECT ORIENTED PROGRAMMING III - SEMESTER

Pre-Requisite:

Basic Knowledge on C Programming

Objectives of the course

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.

UNIT – I NEED FOR OBJECT ORIENTED PROGRAMMING

Characteristics of object oriented language -objects, classes, Inheritance, Reusability, creating new data types, Polymorphism and overloading. C++ programming basis – Data types, Manipulators, Cin, Cout, Type conversion, arithmetic operators, Loops and decisions.

UNIT – II CLASS AND OBJECTS

A simple class, C++ Objects as physical Objects, C++ Objects as Data Types, Constructors, destructors, objects as function arguments, overloaded constructors, member functionsdefined outside the class, inline functions, and Returning objects from Functions.

UNIT – III ARRAYS

Defining & accessing Array elements, arrays as class member data, array of Objects. Operator Overloading: Overloading Unary Operators, Operator Arguments, Return Values, nameless Temporary objects, postfix notations. Overloading Binary Operators - Arithmetic operators, Concatenating Strings, Multiple overloading Comparison operators, Arithmetic Assignment Operators

UNIT – IV INHERITANCE-DERIVED CLASS AND BASE CLASS

Derived class constructors, overriding member functions, Class Hierarchies, Abstract base class, Public and private inheritance, Levels of inheritance, Multiple inheritance. Memory management – new and delete operator, a string class using new, Pointers to Objects – Referring to Members, another Approach to new, An array of pointers to Objects.

UNIT V VIRTUAL FUNCTIONS

Pure virtual functions, Late Binding, Abstract Classes, Virtual base classes. Friend Functions – Friend Classes, Friends for functional Notation. Static Functions investigating destructors. Assignment and copy –initialization- overloading the assignment operator, the copy constructor, the pointer - Templates, function templates, class template

Course Outcomes

After taking the course, students will be able to:

- Specify simple abstract data types and design implement at ions, using abstractionfunctions to document them.
- Recognize features of object -oriented design such as encapsulation, polymorphism,inheritance, and composition of systems based on object identity.
- Name and apply some common object-oriented design patterns and give examples oftheir use.
- Develop applications using OOPs Concept.

TEXT BOOKS:

1. Object Oriented Programming in Microsoft C++ - Robert Lafore, Galgotia Publications 1998
2. Let us C++ - Yaswant Kanitkar, 2000

REFERENCES:

1. Object Oriented Programming in C++ - C. Balagurusamy, Tata McGraw Hill, 2002.
2. Teach yourself C++ - Herbertsehildt, OSBORNE/MH, 2002.

BECF183P80 – ELECTRONIC DEVICES LABORATORY **III - SEMESTER**

L	T	P	C
0	0	3	2

OBJECTIVES:

- To analyze the characteristics of Semiconductor devices
- To construct semiconductor devices for practical applications.
- To design of amplifiers and analyze their characteristics
- To analyze the frequency response characteristics of small signal amplifier

LIST OF EXPERIMENTS

1. Study of Labview / Multisim / PSPICE/ ELVIS
2. CRO Operation and its Measurements.
3. P-N Junction Diode Characteristics (Forward bias & Reverse bias)
4. Zener Diode Characteristics

a. Part A: V-I Characteristics
b. Part B: Zener Diode act as a Voltage Regulator

5. BJT Characteristics (CE Configuration)

a. Part A: Input Characteristics
b. Part B: Output Characteristics

6. FET Characteristics (CS Configuration)

a. Part A: Drain (Output) Characteristics
b. Part B: Transfer Characteristics

7. LED and PHOTODIODE Characteristics
8. SCR Characteristics
9. UJT Characteristics
10. Clipper and Clamper Circuits
11. Design and Simulate basic Common Source / Common Gate / Common DrainAmplifier
12. BJT-CE Amplifier
13. FET-CS Amplifier

OUTCOMES:

- Construct and evaluate the Performance characteristics of various semiconductor devices
- To integrate the semiconductor devices for Practical Applications
- Design of amplifier circuit and analyze the design of frequency response of thesmall signal amplifier.

BECF183P90 – DIGITAL SYSTEM DESIGN LABORATORY III - SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

- To understand, the logical behaviors of digital circuits and apply themin appropriate applications.
- To analyze the operation of logic gates and flip-flops.
- To Design and Construct Hazard Free digital circuits.

LIST OF EXPERIMENTS

1. Study of Multisim and LT spice.
2. Study of Gates & Flip-flops.
3. Half Adder and Full Adder.
4. Encoders and Decoders.
5. Multiplexer and De-multiplexer.
6. Magnitude Comparator (2-Bit) and Code Converter.
7. Synchronous Counters.
8. Ripple Counter and Mod – N Counter.
9. Shift Register – SISO / SIPO/ PIPO/ PISO
10. Design of Memory Devices
11. Design of Hazard Free Switching circuits.
12. Design of Mealy and Moore Circuits.

OUTCOMES:

- Verify the truth table for logic gates and Flip-flops
- Design and test of combinational and Sequential Circuits.
- Design of Hazard Free Switching Devices and integrate high configuration digitalcircuits.

BECF183P70 - OBJECT ORIENTED PROGRAMMING LABORATORY USING C++

III - SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVE:

- To demonstrate the use of switch, constructor, destructor and pointer
- To illustrate the use of inline functions, copy constructor and operator overloading
- To demonstrate the use of inheritance, pure virtual functions, unary operator, binaryoperator and friend function

LIST OF EXPERIMENTS

1. Illustrate class & objects
2. To demonstrate the use of Switch –Case statement and to perform arithmeticoperations.
3. To demonstrate the use of constructor and destructor.
4. To demonstrate the use of this pointer
5. To enter the records of n number of students and then display them using nestedstructure.
6. Illustrate the use of inline functions
7. Illustrate the use of Copy Constructor
8. Illustrate operator overloading
9. To demonstrate the concept of polymorphism applied to the member functions.
10. To demonstrate the use of Inheritance.
11. To demonstrate the use of Demonstration of New & Delete Operator
12. To demonstrate the Pure Virtual Function
13. To demonstrate the use of unary operator
14. To demonstrate the use of Binary operator
15. To demonstrate the use of Friend Function.
16. To demonstrate the use of class template

OUTCOMES:

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

- Understand case statement and perform arithmetic operations
- Illustrate operator overloading, demonstrate unary and binary operator

CBSMAJ8T10 – MATHEMATICS – IV

IV - SEMESTER

L	T	P	C
4	1	0	4

Pre-requisite: Knowledge of Mathematics – I and Mathematics - II

Course Objectives:

- To understand the topics in Calculus, Ordinary Differential Equations of higher order and Design of Experiments
- To solve Ordinary differential equations in Engineering

Unit I: Calculus

Homogeneous Functions-Total derivative - Change of variables-Jacobian-Taylor's theorem for function of two variables-Maxima and Minima of functions of two variables-Lagranges method of undermined multipliers

Unit II: Multi Variable Calculus

Directional derivatives-Gradient-curl and divergence-Problems on Green-Gauss and Stokes theorems-orthogonal curvilinear coordinates-Simple applications involving cubes, sphere and rectangular parallelepipeds

Unit III: Special Functions -I

Validity of series solution - Series solution when x=0 is an ordinary point - Frobenius method(Series solution when x=0 is a regular singularity) - Bessel's equation (Bessel's functions ofthe first and second kind) - Recurrence formulae for Jn(x) - Expansions for J0 and J1: Valueof J1/2 - Generating function for Jn(x) - Equations reducible to Bessel's equation – Orthogonality of Bessel functions

Unit IV: Special Function-II

Legendre's Equation – Rodrigue's Formula – Legendre Polynomials – Generating Function for $P_n(x)$-Recurrence formula for $P_n(x)$-Orthogonality of Legendre Polynomials – Hermite Polynomials-Recurrence formulae-Rodrigue's formula-Orthogonality of Hermite polynomials

Unit V: Design of Experiment

Design of experiments – Completely randomized design: Analysis of variance for one factorof classification – Randomized block design: Analysis of variance for two factors ofclassification – Latin square design.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publishers, New Delhi,2011.
2. Gupta S.P, "Statistical Methods", 28th Edition, Sultan Chand and Sons., New Delhi, 1997

Reference Books:

1. Alan Jeffrey, "Advanced Engineering Mathematics", First Edition, Academic Press, 2001
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, John Wiley & Sons,2011.
3. Gerald C.F and Wheatley P.O, "Applied Numerical Analysis", Seventh Edition, Addison-WesleyPublishing Company, 2004.

Course Outcomes:

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

- Apply Calculus, Ordinary Differential Equations and Design of Experiments appropriate inthe field of Electronics Engineering
- Solve for differential equations in Engineering Applications.

BECF184T20 – ANALOG ELECTRONICS

IV - SEMESTER

L	T	P	C
3	0	0	3

Pre-requisite: Basic Knowledge of Electronic Devices

Course Objectives:

- To develop fundamental knowledge about need for biasing & it's various methods.
- To analyze small signal equivalents circuits & high frequency analysis of BJT & FET.
- To analyze methods of constructing feedback amplifiers, oscillators & tuned amplifiers.
- To understand basic concepts of operational amplifier and its various applications.
- To know about various analog switches and different A/D and D/A convertors.

Unit I: Amplifier Models: Diode Circuits, Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, lowfrequency transistor models, estimation of voltage gain, input resistance, output resistance etc., Design procedure for particular specifications, Low frequency analysis of multistage amplifiers.

Unit II: Power & Feedback Amplifiers: High frequency transistor models, frequency response of single stage and multistage amplifiers, Cascode amplifier. Various classes of operation (Class A, B, AB, C etc), their power efficiency and linearity issues - Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc. calculation with practical circuits, concept of stability, gain margin and phase margin.

Unit III: Oscillators & Differential Amplifiers: Review of the Basic Concept, Barkhausen criterion,RC oscillators (Phase shift, Wien Bridge etc), LC oscillators (Hartley, Colpitts, Clapp etc), Non- sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: Design of differential amplifier for a given specification, designof gain stages and output stages, compensation.

Unit IV: OP-AMP Applications: Review of Inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications- Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Unit V: DAC & ADC: Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, Resistorstring etc. Analog to- digital converters (ADC): Single slope, Dual slope, Successive approximation,
Flash etc - Switched capacitor circuits: Basic concept, practical configurations, application inamplifier, integrator, ADC etc.

Text Books & Reference Books:

1. J.V. Wait, L.P. Huelsman & GA Korn, "Introduction to Operational Amplifier theory and applications",McGraw Hill, 1992
2. J. Millman and A. Grabel, "Microelectronics", 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, "The Art of Electronics", 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press, V Edition, 2004.
5. Paul R. Gray and Robert G.Meyer, "Analysis and Design of Analog Integrated Circuits", JohnWiley, 3rd Edition, 1992.

Course Outcomes:

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

- Determine the configuration and apply the characteristics of diodes and transistors.
- Design and analyze various Rectifier and Amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators
- Characterize the functioning of OP-AMP and design OP-AMP based circuits
- Design ADC and DAC circuits.

BECF184T30 – ANALOG & DIGITAL COMMUNICATION IV - SEMESTER

L	T	P	C
3	1	0	3

Pre-requisite: Basic Knowledge of Electronic Devices, Digital System Design,Signals & Systems

Course Objectives:

- To analyze & compare different analog modulation schemes – efficiency & bandwidth
- To Analyze the behavior of communication systems in the presence of noise
- To Investigate pulse modulation systems and analyze their system performance
- To Analyze different modulation schemes and compute bit error performance

UNIT-1 AMPLITUDE AND ANGLE MODULATION

Review of signals and systems-Frequency domain representation of signals-Amplitude modulation systems-DSB-SC, SSB and VSB modulation-Superhetrodyne Receiver-Angle modulation- Representation of FM and PM signals-Relationship between FM and PM-Narrow band and widebandFM-Transmission bandwidth of FM wave- Generation and detection of FM wave

UNIT-2 INFORMATION THEORY AND NOISE

Entropy – Discrete memoryless channels – Channel capacity – Hartley Shannon Law – Source Coding theorem – Huffman & Shannon-Fano codes - Noise in amplitude and frequency modulation systems- Pre-emphasis and De-emphasis - White noise – Narrowband noise -Threshold effect in anglemodulation

UNIT-3 PULSE MODULATION

Sampling process -Pulse Amplitude Modulation (PAM)-Pulse Position Modulation (PPM)- Quantization Process-Pulse Code Modulation (PCM)-Delta Modulation-Differential Pulse Code Modulation-Line codes - Noise consideration in PCM-Time Division Multiplexing-DigitalMultiplexers

UNIT-4 BASEBAND MODULATION TECHNIQUES

Baseband transmission of digital data-Inter Symbol interference (ISI) problem-Nyquist channel-Binary Amplitude shift keying (ASK)-Phase-Shift Keying (PSK)-Frequency Shift Keying (FSK)- Quadrature Amplitude Modulation(QAM)-Continuous phase modulation and Minimum shift keying-Elements of detection theory-optimum detection of signals in noise-coherent communication with waveform-Probability of error calculation.

UNIT-5 DEMODULATION OF DIGITAL SIGNALS

Digital Modulation tradeoffs-optimum demodulation of digital signal over band limited channels- Maximum likelihood sequence detection (Viterbi receiver)-Equalization techniques - Synchronization and carrier recovery of digital modulation.

TEXT BOOKS:

1. Haykin.S and Michel Moher," Introduction to Analog and Digital communication", Secondedition, John Wiley and sons Inc, 2012
2. Prokis J.G.," Digital communications", 4th edition, Tata McGraw Hill, 2000.
3. Taub H and Schilling D.L., "Principles of Communication systems", Tata McGraw Hill, 2001.
4. Dr.Sanjay Sharma, "Analog and Digital communication", seventh edition, K KATARIA & SON'S publication, 2017.

Course Outcomes:

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

- Compare different analog modulation schemes for their efficiency and bandwidth.
- Analyze the behavior of communication systems in the presence of noise
- Investigate pulse modulation systems and analyze their system performance
- Compute bit error performance of various modulation schemes.

BECF184T40 – MICROPROCESSORS AND MICROCONTROLLERS IV - SEMESTER

Pre - requisite: Basic knowledge of Digital System Design

Course Objectives:

- To Study the Architecture of 8085 and 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To Study about communication and bus interfacing.
- To Study the Architecture of 8051 microcontroller.
- To get exposed to RSIC processors and design ARM microcontroller based systems

UNIT- I 8085 MICROPROCESSOR

Microprocessor architecture and its operation, memory, I/O devices, 8085 microprocessor –Core architecture - Various registers- Bus Timings, Multiplexing and De-multiplexing of Address Bus, Decoding and Execution, Instruction set – Classification, Instruction Format, Addressing Modes, 8085 Interrupt Process, Hardware and Software Interrupts**.**

UNIT- II 8086 MICROPROCESSOR

Core Architecture of the 8086 - Memory Segmentation, Minimum mode Operation and Maximum Mode Operation, Instruction Set of the 8086 processor- Classification - Instruction Format Addressing modes, Simple Assembly Language Programs - Arithmetic operations, Data transfer, String Manipulation, Searching and Sorting

UNIT- III I/O INTERFACING

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial Communication interface – D/A and A/D Interface - Timer – Keyboard /display controller –Interrupt controller – DMA controller – Programming and applications Case studies: TrafficLight control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT-IV MICROCONTROLLER

Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits – Instruction set- Addressing modes - Assembly language programming - Programming 8051Timers, Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing -ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation

UNIT-V ADVANCED MICROPROCESSOR & MICROCONTROLLER

Advanced coprocessor Architectures- 286, 486, Pentium -RISC Processors- RISC Vs CISC,RISC properties and evolution- ARM Processor – CPU: programming input and output supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPUperformance- CPU power consumption

TEXTBOOKS:

1. R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085/8080A", Penram International Publishing, Third Edition, 1996.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware andsoftware interface" Morgan Kaufman Publishers, Fourth Edition, 2011.
3. Douglas Hall, "The Microprocessors and its Interfacing", Tata McGraw Hill, Third Edition, 2012.
4. Kenneth J. Ayala, "The 8051 Microcontroller: Architecture Programming & Applications", Penram International Publishing, Second Edition, 1996
5. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2011.
6. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
7. Doughlas V. Hall, "Microprocessors and Interfacing, Programming and Hardware", Second Edition, TMH, 2012.
8. John P. Hayes, "Computer Architecture and Organization", Third illustrated Edition, Tata McGraw Hill, 2007.

Course Outcomes:

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

- Execute programs using assembly language
- Design interfacing peripherals like, I/O, A/D, D/A, timer etc.
- Develop systems using different microcontrollers
- Characterize RSIC processors and design ARM microcontroller based systems

BECF184T50 - MEASUREMENTS & INSTRUMENTATION

IV SEMESTER

L	T	P	C
3	1	0	3

Pre-requisite: Basic Knowledge of Electrical and Electronics Engineering

Objectives:

- To introduce the basic functional elements of Instrumentation
- To introduce the fundamentals of Electrical and Electronic Instruments

UNIT-I BASIC MEASUREMENTS CONCEPTS AND ERRORS

Measurements Systems – Static and dynamic Characteristics – Units and standards of MeasurementsSystems - Types of Errors, Accuracy, Precision, Reproducibility, Repeatability and Noise, Analog Instruments – Galvano Meter, D'Arsonaval Galvanometer, Moving Coil Instruments, PMMC - Ammeter, Voltmeter& Ohm Meter, Moving Iron Instruments, Electrodynamometer.

UNIT – II DATA DISPLAY AND RECORDING SYSTEMS

Oscilloscope: CRO – CRT, Deflection System, Specifications, Controls, Storage Oscilloscope, DigitalStorage, Sampling Oscilloscope. Graphic Recording Instruments: Strip Chart Recorders, X_Y Recorder, Plotters.

UNIT – III DIGITAL INSTRUMENTS AND SIGNAL GENERATORS

Digital Voltmeter system, Digital Multi meter, Digital Frequency Meter System- SIGNAL GENERATORS: LF Signal Generators, Function Generators, Pulse Generators, RF Signal Generators, Sweep Signal Generators, Sweep Frequency Generators, Frequency Synthesizers

UNIT – IV WAVEFORM ANALYSERS AND RADIO RECEIVERS

Distortion Meter, Spectrum Analyzer, Digital Spectrum Analyzer - Radio Receiver Measurement: Receiver Basics and Parameters, Measuring Sensitivity, Selectivity and Image Response

UNIT – V TRANSDUCERS

Classification of Transducers- Resistance – Potentiometer, Strain gauges, Resistance Thermometers, Thermistor. Inductive Transducers: LVDT, RVDT. Capacitive Transducers: Piezoelectric, Photoelectric transducers, Digital Transducers – Encoder, Shaft Encoder, Optical Encoder.

TEXT BOOKS:

1. A.K. Sawhney: "A Course in Electrical and Electronic Measurements and Instrumentation", 18th Edition, Dhanpat Rai Publications, 2001.
2. David A Bell, "Electronic Instrumentation and Measurements", Second Edition, PHI, 2003
3. Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, Third Edition, PearsonEducation, 2003.

REFERENCES:

1. Albert D. Helfrick and William D.Cooper "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. Copper D, "Electronic Instrumentation and Measurement Techniques", II Edition, PHI, 1978.
3. James W. Dally, William F. Riley, Kenneth G. McConnell, "Instrumentation for Engineering Measurements", 2nd Edition, John Wiley, 2003.
4. Doeblin: "Measurement Systems - Application and Design", IV Edition, McGraw-Hill, 1990.
5. Jones L.D. and Foster Chin A." Electronic Instruments and Measurements", Second Edition, JohnWiley and Sons, 1991.
6. Alan. S.Morris, "Principles of Measurements and Instrumentation", 2nd Edition,Prentice Hall of India, 2003.

Course Outcomes:

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

- Use various types of Electrical Instruments
- Use various types of Electronic Instruments

BECF184T60 – ELECTROMAGNETIC FIELDS & WAVEGUIDES IV SEMESTER

L	T	P	C
3	1	0	3

Pre-requisite: Basic Knowledge of Physics and Mathematics

Course Objectives:

- To understand characteristics and wave propagation of Transmission lines
- To study the basics of static Electric and Magnetic Fields and Associated laws
- To understand the reflection and transmission of waves at media interface
- To analyze wave propagation on metallic waveguides
- To understand the radiation characteristics of an antenna

Unit 1: Basics of Electromagnetics

Vector algebra-Coordinate Systems-Vector differential operator-Gradient-Divergence-Curl- Divergence Theorem-Stokes theorem-Coulombs law-Electric field intensity-Electric flux density-Gauss law and its applications-Biot Savart Law-Ampere's law-Faradays law- Maxwell's Equations in Integral and differential form-Electric and magnetic boundary conditions at the media interface.

Unit 2: Electromagnetic Waves

Uniform Plane Waves-Uniform plane wave propagation-Wave propagation in conducting medium-Wave Polarization-Reflection by perfect conductor (normal and oblique incidence)- Reflection by perfect insulator(normal and oblique incidence)-plane waves in arbitrary direction- Brewster angles-Total internal reflection-poynting vector and power flow-Power loss in plane conductor.

Unit 3: Transmission Lines: Equations of Voltage and Current on TX line- Propagation constant-characteristic impedance-reflection phenomenon-standing waves-Input impedance of dissipation less transmission line-open and short circuited line-power and impedance measurement on TX line-λ/8,λ/4&λ/2 line-λ/4 impedance transformer-Smith chart and its applications-single and double stub matching.

Unit 4: Guided Waves and Wave Guides

Waves between parallel planes-TE waves-TM waves-Characteristic of TE and TM waves-TEMwaves-Velocities of propagation-Attenuation in parallel plane Guides-Rectangular wave guide-TEand TM waves in rectangular waveguide-Impossibility of TEM wave in rectangular wave guide.

Unit5: Radiation

Solution for potential functions-Radiation from oscillating dipole -Power radiated by oscillating dipole- antenna parameters-Gain- directivity-Effective aperture-Radiation Resistance-Bandwidth- Beam width-Input impedance-Matching Baluns-Monopole and dipole antenna.

Text/Reference Books:

1. Sadiku MH," Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009.
2. E.C. Jordan & K.G. Balmain, "Electromagnetic Waves & Radiating Systems", SecondEdition, Prentice Hall of India, 1968.
3. John D Ryder," Network lines and fields", Prentice Hall of India, New Delhi, 2005
4. David K. Cheng, "Field and Wave Electromagnetics", Second Edition, Prentice Hall of India,1989
5. Sandeep Wali," Electromagnetic theory", first edition, Macmillan Publishers Private limited, 2011.

Course Outcomes:

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

- Determine the characteristics and wave propagation on HF transmission lines.
- Apply impedance transformation on Transmission lines.
- Use transmission line sections for realizing circuit elements
- Characterize uniform plane wave.
- Calculate reflection and transmission of waves at media interface.
- Analyze wave propagation on metallic waveguides in modal form.
- Determine the radiation and radiation characteristics of an antenna.

BECF184P70 – ANALOG ELECTRONICS LABORATORY IV Semester

L	T	P	C
0	0	3	2

OBJECTIVES:

- To understand the basics of linear integrated circuits and available ICs
- To understand characteristics of operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To analyze the frequency response characteristics of Amplifiers.

LIST OF EXPERIEMENTS

1. Characteristics of Op amp – IC 741
2. Inverting and Non-inverting amplifier using IC 741
3. Measurement of op-amp characteristics
4. Instrumentation amplifier and Differential Amplifier using IC741
5. Integrator and Differentiator using IC 741
6. Schmitt Trigger using IC 741
7. ADC / DAC using IC 741
8. Astable & Monostable Multivibrator using IC 555
9. RC Phase shift oscillator and Wien bridge oscillator using BJT
10. Hartley & Colpitts oscillator using BJT
11. Frequency Response of Class B Push Pull Amplifier using BJT
12. Frequency Response of Voltage Series Feedback Amplifier using BJT
13. Phase Locked Loop (PLL)

OUTCOMES:

- Design oscillators and amplifiers using operational amplifiers.
- Design filters using Op-amp and perform experiment on frequency response.
- Analyze the working of PLL and use PLL as frequency multiplier.
- Analyze the performance of oscillators and Multivibrators.

BECF184P80 – ANALOG AND DIGITAL COMMUNICATION LABORATORY

IV Semester

L	T	P	C
0	0	3	2

OBJECTIVES

- To construct basic circuits of Analog and Digital communication system.
- To Design and construct experiments for performing modulation and sampling.
- To analyze the Performance characteristics of both analog and Digital CommunicationSystems.

LIST OF EXPERIMENTS

1. Study of Multisim, VisSim and MATLAB
2. AM modulator and Demodulator.
3. DSB-SC modulator and Demodulator.
4. SSB modulator and Demodulator.
5. FM modulator and Demodulator.
6. PAM modulator and Demodulator.
7. PPM & PWM Modulator
8. Pre-emphasis and De-emphasis in FM.
9. Signal Sampling and Reconstruction (Sampling Theorem)
10. Pulse Code Modulation and Demodulation
11. Delta modulation and Adaptive Delta modulation.
12. Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK) modulator andDemodulator.
13. Phase Shift keying (PSK) and Binary Phase Shift Keying (BPSK) Modulator andDemodulator.

OUTCOMES

- Apply the practical knowledge to construct Analog and Digital communication.
- Evaluate Analog and Digital modulated waveform in time /frequency domain.
- Analyze and evaluate the performance of Analog and Digital communication systems.

BECF184P90 – MICROPROCESSOR AND MICRO CONTROLLER LABORATORY

IV-Semester

L	T	P	C
0	0	3	2

OBJECTIVES:

- To Study the Architecture of 8086 microprocessor and perform various arithmetic andlogical operations.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To analyze the communication between Peripherals and bus interfacing.
- To Execute Programs using 8051 Microcontroller.

LIST OF EXPERIMENTS

8086 Microprocessor Experiments

1. Basic Arithmetic and Logical operations using 8086.
2. Code conversion, decimal arithmetic and Matrix operations.
3. Floating-point operations, string manipulations, sorting and searching.
4. Counters and Time delay.
5. Password Checking, Print RAM size and System Date

8086 Microprocessor - Peripherals and Interfacing Experiments

6. Traffic Light Control and Stepper Motor Control.
7. Digital Clock.
8. Keyboard and Display.
9. Serial and Parallel Interface.
10. A/D and D/A Interface and Waveform Generation.

8051 Microcontroller Experiments

11. Basic Arithmetic and Logical Operations.
12. Square program, Cube program and Finding 2's complement of a number.
13. Unpacked BCD to ASCII.

OUTCOMES

- Design and implement programs on 8086 Microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Integrate Microprocessor and Microcontroller and Peripherals for Various Applications.

BECF185T10 - MICROWAVE ENGINEERING V SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Electromagnetic Fields and Waveguides, Network Theory

OBJECTIVES:

- To inculcate the basics and representation of RF and microwave networks.
- To instill knowledge on the properties of various microwave components.
- To deal with the principles of microwave system design
- To deal with the microwave measurement techniques
- To introduce the application areas of microwave Systems

UNIT I INTRODUCTION TO MICROWAVES (9 Hrs)

History of microwaves, Microwave frequency bands; Applications of microwaves: Civil and Military,Medical, EMI/ EMC. Mathematical model of microwave transmission-Concept of mode, Features ofTEM, TE and TM modes, Losses associated with microwave transmission, Concept of impedance inmicrowave transmission. Analysis of RF and microwave transmission lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line, Microwave network analysis- Equivalentvoltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering parameters, Properties of S parameters

UNIT II PASSIVE AND ACTIVE MICROWAVE DEVICES (9 Hrs)

Microwave passive components: Terminations- Variable short circuit, Attenuator, Phase shifters, Directional coupler, Magic Tee, Power divider, Resonator. Microwave active components and circuits: Diodes, Transistors, Oscillators, Mixers.

Microwave semiconductor devices: Gunn diodes, IMPATT diodes, Schottky barrier diodes, PIN diodes. Microwave tubes: Klystron, TWT, Magnetron.

UNIT III MICROWAVE DESIGN PRINCIPLES (9 Hrs)

Impedance transformation, Impedance matching, Microwave filter design, RF and Microwave amplifier design, Microwave power amplifier design, Low noise amplifier design, Microwave mixer design, Microwave oscillator design. Microwave antennas- Antenna parameters, Antenna for groundbased systems, Antennas for airborne and satellite borne systems, Planar antennas.

UNIT IV MICROWAVE MEASUREMENTS (9 Hrs)

Power, frequency and impedance measurement at microwave frequency, Network analyzer and measurement of scattering parameters, Spectrum analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of microwave antenna parameters

UNIT V MICROWAVE SYSTEMS (9 Hrs)

Radar, Terrestrial and Satellite communication, Radio aids to navigation, RFID, GPS. Modern trendsin microwaves engineering- Effect of microwaves on human body, Medical and Civil applications ofmicrowaves, Electromagnetic interference and Electromagnetic compatibility (EMI & EMC), Monolithic microwave ICs, RFMEMS for microwave components, Microwave imaging.

Total: 45 Hrs

OUTCOMES:

1. At the end of the course, students will demonstrate the ability to:
2. Illustrate the concepts of propagation and analysis in RF and Microwave networks
3. Understand various microwave system components and their properties.
4. Analyze / synthesis the microwave systems
5. Appreciate that during measurements of microwave systems, the different mathematicaltreatment is required compared to general circuit analysis
6. Design microwave systems for different practical application

TEXT BOOKS:

1. R.E. Collins, "Foundations for microwave engineering", Second edition, Wiley-IEEE press,2001 (Units I, II and III)
2. Annapurna Das and Sisir K Das, “Microwave engineering”, Tata McGraw-Hill Pub.Co. Ltd.,2017. (Units III, IV and V)

REFERENCES:

1. David M. Pozar, “Microwave engineering,” John Wiley and sons, Fourth edition, 2011.
2. Gupta K.C. and Bahl I.J., “Microwave circuits,” Artech house
3. Samuel. Y. Liao, “Microwave circuit analysis and amplifier design”, Third edition, Pearson,2003.
4. Ulrich L. Rohde and David P. Newkirk, “RF / Microwave circuit design for wirelessapplications”, John Wiley, 2000.
5. Gentili C., “Microwave amplifiers and oscillators”, North oxford academic, 1986.
6. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and wave propagation”,Fourth edition, Tata McGraw-Hill, 2006.

BECF185T20 – COMPUTER ARCHITECTURE V SEMESTER

PRE-REQUISITE:

L	T	P	C
3	0	0	3

Digital System Design, Microprocessors & Microcontrollers

OBJECTIVES:

To make students understand the basic structure and operation of digital computer.

- To familiarize with implementation of fixed point and floating-point arithmetic operations.
- To study the design of data path unit and control unit for processor.
- To understand the concept of various memories and I/O systems and interfacing.
- To introduce the parallel processing technique and multi-core processors.

UNIT I STRUCTURE OF COMPUTERS AND INSTRUCTIONS (9 Hrs)

Classification of computers and their characteristics –Functional units- Eight ideas — Performance, Instructions: Operations - Operands – Instruction representation – Logical operations – Decision making operations – Procedures: Stacks, Ques and Subroutines - Program translation.

UNIT II ARITHMETIC FOR COMPUTERS (8 Hrs)

Addition and Subtraction – Multiplication – Division – Floating Point arithmetic Operations – IEEE 754 floating point formats - Sub-word Parallelism

UNIT III PROCESSOR DATAPATH AND CONTROL UNITS (9 Hrs)

Fundamental concepts–Instruction execution –-Multiple bus organization – Data path–Hardwired control-Micro-programmed control, Pipelining – Pipelined data path and control, Data Hazards - Control Hazards – Exception handling

UNIT IV MEMORY AND I/O SYSTEMS (9 Hrs)

Memory Hierarchy – Review of memory technologies – Cache memory – Measuring and improving cache performance – Virtual memory - TLB‘s. Accessing I/O Devices – Interrupts – Direct Memory Access, Bus structure – Bus operation – Arbitration – Interface circuits - Standard I/O Interfaces – PCI, SCSI and USB.

UNIT V PARALLELISM (10 Hrs)

Parallel processing challenges, Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures, Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors. Introduction to Multiprocessor Network Topologies

Total: 45 Hrs

OUTCOMES:

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

1. Understand the basics structure of computers and instructions.
2. Illustrate the fixed point and floating-point arithmetic for ALU operation.
3. Discuss about implementation schemes of data-path and control units and pipelineperformance.
4. Explain the concept, interfacing and organization of of various memories and I/O systems.
5. Discuss parallel processing technique and unconventional architectures.

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design:The Hardware/Software interface", Fifth Edition, Morgan Kauffman / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organizationand Embedded Systems", Sixth Edition, McGraw Hill, 2012.

REFERENCES:

1. Miles J. Murdocca and Vincent P. Heuring, ―Computer Architecture and Organization: AnIntegrated approach‖, Second edition, Wiley India Pvt Ltd, 2015.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance",Eighth Edition, Pearson Education, 2010.
3. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill,2012.

BECF185T30 – DIGITAL SIGNAL PROCESSING V SEMESTER

PRE-REQUISITE:
Signal & Systems, Digital System Design

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multi-rate signal processing and its applications.

UNIT I DISCRETE FOURIER TRANSFORM (9 Hrs)

Review of discrete-time signals and systems – Discrete Fourier Transform (DFT) and its properties, Circular convolution, Linear filtering using DFT, Filtering long data sequences - overlap-savemethods - Overlap-add, Fast Fourier Transform (FFT) algorithms – Fast computation of DFT –Radix-2 decimation in time FFT - Decimation in frequency FFT – Linear filtering using FFT.

UNIT II DESIGN OF FINITE IMPULSE RESPONSE FILTERS (9 Hrs)

Structures for FIR systems – Transversal and Linear phase structures, Design of FIR filters – Symmetric and Anti-symmetric FIR filters, Design of linear phase FIR filters using Windows(Rectangular, Hamming and Hanning windows) and Frequency sampling methods

UNIT III DESIGN OF INFINITE IMPULSE RESPONSE FILTERS (9 Hrs)

Structures for IIR systems – direct, cascade, parallel forms, Comparison of FIR and IIR, Analog filters – Butterworth filters - Chebyshev type – I filters (upto 3rd order), Analog transformation of prototypeLPF to BPF/BSF/HPF, Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z-transform method.

UNIT IV FINITE WORD LENGTH EFFECTS (9 Hrs)

Representation of fixed and floating point numbers, ADC quantization -truncation and rounding - quantization noise, Coefficient quantization Error – Product quantization error – Overflow error - Round-off noise power, Limit cycle oscillation due to product round-off error- Limit cycle oscillationdue to overflow in digital filters – Principle of scaling.

UNIT V MULTI-RATE SIGNAL PROCESSING (9 Hrs)

Introduction to multi-rate signal processing – Decimation – Interpolation- Sampling rate conversion by a rational factor - Polyphase decomposition of FIR filter – Multistage implementation of samplingrate conversion – Design of narrow band filters–Applications of multi-rate signal processing

OUTCOMES: **Total: 45 Hrs**

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

1. Apply DFT and FFT algorithms for the analysis of digital signals and systems.
2. Design FIR filters for various applications.
3. Design IIR filters for various applications.
4. Characterize the effects of finite precision representation on digital filters.
5. Design multi-rate filters.

TEXT BOOKS:

1. John G.Proakis and Dimitris G. Manolakis, “Digital signal processing - Principles, algorithmsand applications”, Pearson education / Prentice hall, Fourth edition, 2007.

REFERENCES:

1. Sanjay K.Mithra, “Digital signal processing - A Computer based approach”, Tata McGraw-Hill, 2007.
2. M.H.Hayes, “Digital signal processing”, Schum’s outlines, Tata McGraw Hill, 2007.
3. A.V.Oppenheim, R. W. Schafer and J. R. Buck, “Discrete-time signal processing”, Pearson, 2004.
4. I.C.Ifeachor and B.W.Jervis, “Digital signal processing – A practical approach”, Pearson 2002
5. L.R. Rabiner and B. Gold, “Theory and application of digital signal processing”, Prentice Hall, 1992.

BECF185T40 – COMPUTER AIDED SYSTEM DESIGN V SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Network Theory, Electronic Devices, Analog Electronics and Digital System Design

OBJECTIVES:

- To learn electronic design automation techniques for designing analog circuits at circuit levelusing PSPICE.
- To understand the concept of Analog and digital modelling in time and frequency domain inPSPICE.
- To introduce electronic design automation (EDA) techniques for designing digital circuits at gatelevel using VHDL.
- To study EDA techniques for designing digital circuits at gate level using Verilog HDL.
- To learn EDA techniques for designing digital circuits at switch level using Verilog HDL andsynthesis concepts.

UNIT I OVERVIEW OF EDA AND PSPICE (9 Hrs)

Evolution of EDA tools, typical design flow of VLSI IC circuits (ASIC Flow), Design capture and design verification tools, Analog Circuit Techniques: Overview of PSPICE, Types of simulation - DC, AC, Transient, Monte Carlo, Parametric and others, Simulation devices- Laplace devices, Energysources, Passive components, Semi-conductors, ICs, Special devices – voltage markers, Initialconditions, etc.

UNIT II MODELING FOR SIMULATION IN PSPICE (8 Hrs)

Modelling of digital circuits in SPICE, Analog modelling in the frequency domain and time domain, Models for RLC, Diode, BJT, JFET and MOSFET.

UNIT III VHDL (9 Hrs)

Introduction to VHDL – Entities and architectures, Behavioural modelling – Concurrent and sequential processing – if, case, loops, next, exit, wait, and assert statements, Structural modelling – Port map, components and generics. Delay models –Inertial, transport and delta delays. Data types- Variables, signals, constants, arrays, VHDL operators, Functions, Procedures, Packages, Libraries andConfigurations, Simple programming examples of combinational and sequential circuits

UNIT IV VERILOG HDL (9 Hrs)

Introduction to Verilog - Modules and module instances, design blocks and stimulus blocks, Data types and operators, Modelling – Gate level (Structural) modelling, Dataflow modelling- continuousassignments, Behavioural modelling- initial, always, blocking and non-blocking statements. System tasks -display, monitor, time and stop. Tasks and functions, Simple programming examples of combinational and sequential circuits

UNIT V ADVANCED TOPICS IN VERILOG HDL AND SYNTHESIS (10 Hrs)

Delay modelling- distributed, lumped, and pin-to-pin, rise / fall / turn-off, min / typical / max delays.Switch level modelling – PMOS, NMOS and CMOS. Simple programming examples of switch levelmodelling- CMOS Inverter, CMOS Nand, CMOS Nor gates, CMOS Multiplexers and CMOS latches.Introduction to Verilog synthesis flow: Definition of terms – Technology mapping, Library cells, andTechnology libraries.

Total: 45 Hrs

OUTCOMES:

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

1. Understand the concepts of the simulation components and analysis for electronic devices andcomponents in PSPICE.
2. Develop the analog and digital modelling concepts in frequency and time domains inPSPICE.
3. Develop programs for combinational and sequential logic circuits by identifying the differentabstraction and delay models for digital circuits in VHDL
4. Develop programs for combinational and sequential logic circuits by applying the differentabstraction and delay models for digital circuits in Verilog HDL.
5. Develop programs for combinational and sequential logic circuits at switch level in VerilogHDL and understand Verilog synthesis flow.

TEXT BOOKS:

1. Muhammad Rashid, "Introduction to PSPICE using Orcad for circuits and electronics", Thirdedition, Pearson education, 2003.
2. Douglas L. Perry, "VHDL –Programming by Example", Fourth edition, TMH, 2002
3. Samir Palnitkar, "Verilog HDL –A guide to Digital Design and Synthesis", Second edition,Pearson Education, 2004

REFERENCES:

1. Neil Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design", Second edition,Addison Wesley, 1998.
2. Charles H Roth, Jr., "Digital Systems Design using VHDL", Second edition, ThomsonLearning, 2008.
3. Joseph Cavanagh, "Verilog HDL-Digital design and modelling", CRC press, 2007

BECF185P60 – ELECTROMAGNETIC FIELDS & MICROWAVE LABORATORY

V SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

- To understand the principle of Electric field and Magnetic field on variousconductors.
- To understand the working Principle of various type of Microwave Oscillators.
- To know the behavior of microwave components and parameters.
- To practice microwave measurement procedures

LIST OF EXPERIMENTS:

1. Determination of Electric Field Pattern Between Two Circular Electrodes
2. Determination of Electric Field between Parallel Conductors
3. Measurement of Electric Field and Potential Inside the Parallel Plate Capacitor
4. Measurement of Capacitance and Inductance of Transmission Lines
5. Determination of Magnetic Field Outside A Straight Conductor
6. Determination of Magnetic Field of Coils
7. Verification of Faraday's law of Magnetic Induction.
8. Determination of Velocity of electromagnetic waves for the given Co-axial Cable.
9. Reflex klystron or Gunn diode characteristics and basic microwave parameter measurementsuch as VSWR, frequency, wavelength.
10. Directional Coupler Characteristics.
11. Radiation Pattern of Horn Antenna.
12. S-parameter Measurement of the following microwave components (Isolator, Circulator, EPlane Tee, H Plane Tee, Magic Tee)
13. Attenuation and Power Measurement

OUTCOMES:

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

- Understand the working principle of microwave components
- Know about the behaviour of microwave components
- Learn about the characteristics and measurements of E and H Fields.

BECF185P70 – DIGITAL SIGNAL PROCESSING LABORATORY V SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

The student should be made to:

- To implement Linear and Circular Convolution.
- To implement FIR and IIR filters.
- To study the architecture of DSP processor
- To demonstrate Finite word length effect

LIST OF EXPERIMENTS:

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of sequences (functional & random) & correlation.
2. Linear and Circular Convolutions.
3. Spectrum Analysis using DFT.
4. FIR filters design.
5. IIR filters design.
6. Multi-rate Filters.
7. Equalization Techniques.

DSP PROCESSOR BASED IMPLEMENTATION

8. Study of architecture of Digital Signal Processor.
9. MAC operation using various addressing modes.
10. Linear Convolution.
11. Circular Convolution.
12. FFT Implementation.
13. Waveform generation.
14. IIR and FIR Implementation.
15. Finite Word Length Effect.

OUTCOMES:

- Students will be able to carry out simulation of DSP systems
- Students will be able to analyze Finite word length effect on DSP systems
- Students will be able to demonstrate the applications of FFT to DSP
- Students will be able to implement adaptive filters for various applications of DSP

BECF185P80 - COMPUTER AIDED SYSTEM DESIGN LABORATOTY V SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

- To Construct RC circuits, OPAMPS, Combinational and Sequential circuitsUsing PSICE
- To Simulate and Implement sequential and combinational digital circuits using HDL

PSPICE:

(Modelling, Design, Simulation and Analysis using Schematic / Circuit file / both)

1. Study of PSPICE
2. RC circuits – Transient and AC analysis
3. MOS Device Characterization and CMOS Inverter Characteristics – DC analysis
4. Diode based circuits (like, Rectifiers, Clampers, etc.,) – Transient, Worst-case, MC,Sensitivity, etc. analysis
5. Amplifiers and Current mirrors using BJT/MOSFET
6. Op-Amp based Wein Bridge Oscillator and DAC using sub-circuit and Analog behaviouralmodelling
7. Digital Circuits – Logic switches / Multiplexer / Counter

HDL: (Logic Design and Simulation of Digital Circuits using VHDL / Verilog HDL /Both)

8. Study of VHDL and Verilog
9. Full Adder and Multiplexer using different Modelling / Descriptions and Concurrent and

SEQUENTIAL EXECUTION IN VHDL:

10. 8-bit Adder / Multiplier (min 4-bit) – Port Map, Generics, Technology Mapping in VHDL
11. 8-bit Counter – Bottom up approach design and Test vector generation in Verilog HDL
12. NAND / NOR / Transmission gates using Switch level modelling in Verilog HDL
13. Design of simple sequential and combinational circuits
14. Design of ALU
15. Design of FSM and Control Unit
16. FPGA real time programming and I/O Interfacing– Waveform generation / Traffic lightcontroller

OUTCOMES:

Upon completion of the course, students will be able to:

- Construct Analog and Digital circuits and study their characteristics using PSPICE.
- Implement digital circuits using HDL

TOOLS TO BE USED: LTSPICE, Mentor Graphics, Xilinx / Equivalent

BECF186T10 – CONTROL SYSTEMS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Circuit Theory

OBJECTIVES:

- To introduce the elements of control system and various representations.
- To provide knowledge on the time response and stability of systems
- To introduce the various frequencies response plots and analyzes the stability of systems.
- To introduce state variable representation of physical systems and study the effect of statefeedback.
- To design various types of compensators.

UNIT **I CONTROL SYSTEM MODELING & SYSTEM REPRESENTATION (9 Hrs)**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and Rotational mechanical systems – Transfer function – AC & DC Servomotor and Synchros -Block diagram reduction Techniques - Signal flow graph.

UNIT II TIME RESPONSE AND STABILITY ANALYSIS (9 Hrs)

Time response analysis - First Order Systems - Impulse and Step Response analysis of Second order systems - Steady state errors- Concepts of Stability-Routh-Hurwitz Criterion-Root Locus Technique-Application of Root Locus Diagram- Relative Stability.

UNIT III FREQUENCY RESPONSE AND STABILITY ANALYSIS (9 Hrs)

Frequency response – Frequency domain specifications - Correlation between frequency domain andtime domain specifications – Stability analysis - Bode plot – Polar plot - Nyquist Stability criterion

UNIT IV STATE VARIABLE ANALYSIS (9 Hrs)

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability

UNIT V COMPENSATOR DESIGN (9 Hrs)

Compensators - Effect of adding poles and zeros - Lag, lead and lag-lead compensators design using Bode Plot - Design of State feedback controller - P, PI, PD and PID Controller.

OUTCOMES: **Total: 45 Hrs**

At the end of the course, learners will be able to -

1. Represent a control system and thereby to obtain the mathematical model
2. Perform time domain analysis of control systems.
3. Perform frequency domain analysis of control systems.
4. Design compensators that can be used to design control systems with required specifications
5. Understand the state variable analysis of systems

TEXT BOOKS:

1. Nagarath I.J. and Gopal M., “Control Systems Engineering”, New Age International Publishers,2017
2. Norman S Nise, “Control Systems Engineering”, 7th Edition, Wiley, 2015
3. Benjamin C. Kuo, “Automatic Control systems”, Wiley, 2014

REFERENCES:

1. M. Gopal, “Control Systems, Principles and Design”, 4th Edition, Tata McGraw Hill, New Delhi,2012.
2. S.K.Bhattacharya, “Control System Engineering”, 3rd Edition, Pearson, 2013.
3. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Prentice Hall, 2012.
4. K. Ogata, “Modern Control Engineering”, 5th edition, PHI, 2012.
5. NPTEL Online Courses on “Control Engineering” and “Digital Control Systems”.

BECF186T20 – COMPUTER NETWORKS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:
Basic knowledge of Digital System Design, Signals & Systems and DigitalCommunication

OBJECTIVES:
The student should be made to -

- Understand the concepts of network architecture and transmission medium
- Perform and understand methods for error detection and correction of data
- Be exposed to various addressing schemes and routing protocols.
- Learn the flow control and congestion control algorithms
- Be familiar with real time applications of networks

UNIT I FUNDAMENTALS & SIGNAL TRANSMISSION (10 Hrs)

Fundamentals : Building a network – Requirements - Layering and protocols - OSI Model - Internet Architecture – Performance - Network Topology ; Physical Layer: Data and Signals - Digital Transmission - Analog Transmission - Multiplexing and Spread Spectrum - Transmission Media.

UNIT II MEDIA ACCESS & LOGICAL LINK CONTROL (9 Hrs)

Framing - Error Detection and Correction - Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging - Flow control.

UNIT III ROUTING & ADDRESSING SCHEMES (9 Hrs)

Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP) - Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV END TO END COMMUNICATION (9 Hrs)

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management – Flow control - Retransmission – Queueing Disciplines - TCP Congestion control - Congestion avoidance (DECbit, RED)

UNIT V APPLICATION LAYER PROTOCOLS (8 Hrs)

Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP - Multimediaapplications

OUTCOMES: **Total: 45 Hrs**

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

1. Choose the required functionality at each layer for given application
2. Detect and Correct the error in the frame
3. Apply the knowledge of addressing scheme and various routing protocols in datacommunication to select optimal path.
4. Trace the flow of information from one node to another node in the network
5. Develop real time applications of networks

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", FifthEdition, Morgan Kaufmann Publishers, 2011.
2. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition,McGrawHill, 2011.

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuringthe Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson/Prentice Hall Publishers,2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks – An Open SourceApproach, First Edition, McGraw Hill, 2011.

BECF186T30 – PRINCIPLES OF MANAGEMENT & PROFESSIONAL ETHICS

VI SEMESTER

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop knowledge on the principles of management essential for all kinds ofpeople in all kinds of organizations.
- To have a clear understanding of the managerial functions like planning, organizing, leading andcontrolling.
- To understand global business and diversity.
- To gain some basic knowledge on international aspect of management.
- To understand the concepts of computer ethics in work environment.

UNIT I INTRODUCTION TO MANAGEMENT (9 Hrs)

Definition of Management, process of Management, Planning, Organizing, leading, Controlling Classical Approach-Contribution and Limitation, Management Science Approach, Skills, Roles and Performance: Types of managers Managerial Skills,- Technical Skill, Analytical Skill Decision Making skill, Human Relation skill, Communication skill. Managerial Roles – Interpersonal Role, Informational Role, Decisional Role

UNIT II PLANNING FUNCTION (10 Hrs)

Elements of Planning-Objectives, Action, Resource, Implementation, Managerial Decision Making: Types of Decision, Process of Decision Making, Decision Making-Certainty Condition, Uncertainty Condition, Selecting Alternative. Managing Information System; Need for Decision Support System,MIS and DSS Strategic Planning – Organizational Strategy, Business Portfolio Matrix.

UNIT III ORGANIZING FUNCTION (9 Hrs)

Organizational Structure- Job Design, Departmentation, Span of Control, Delegation of Authority, Decentralized authority, Chain of Command and Authority, Line and Staff concept Matrix organizational Design

UNIT IV ENGINEERING ETHICS (9 Hrs)

Senses of 'engineering ethics' – variety of moral issues – types of inquiry – moral dilemmas – moralautonomy – kohlberg's theory – Gilligan's theory – consensus and controversy – professions and professionalism – professional ideas and virtues – theories about right action – self-interest – customsand religion – uses of ethical theories

UNIT V ENGINEER'S RESPONSIBILITY FOR SAFETY (8 Hrs)

Safety and risk – Assessment of safety and risk – Risk benefit analysis – Reducing risk – The Three Mile Island and Chernobyl- case studies **Total: 45 Hrs**

OUTCOMES: At the end of the course the student should be able to:

1. Examine situations and to internalize the need for applying ethics principles, values to tackle withvarious situations.
2. Develop a responsible attitude towards the use of computer as well as the technology.
3. Able to envision the societal impact on the products / projects they develop in their career.
4. Understanding the code of ethics and standards of computer professionals.
5. Analyze professional responsibility and empowering access to information in the work place.

TEXT BOOKS:

1. Mike Martin & Roland schinzinger "Ethics in engineering" McGraw Hill, 2009.
2. Govindarajan M, Natarajan. S.Senthilkumar V.S, "Engineering Ethics", PHI, 2004.
3. Dr. T. Ramaswamy, Principles of Management, Himalaya Publishing House, 2014.

REFERENCES:

1. Charles D.Fleddermamm, "Engineering Ethics", Pearson Hall, 2004.
2. Charles E.Haris, Michael S.Protchard & Michael J.Rabins, "Engineering Ethics- concepts andcases", Wadsworth Thompson Learning, 2009.
3. JhonR.Boartright, "Ethics and conduct of Business", Pearson Education, 2003.
4. Edmund G.See Bauer & Robert L.Bany, "Fundamental of Ethics for Scientists andEngineering", Oxford University, 2005.

BECF186T40 – EMBEDDED SYSTEMS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:
Basic knowledge of Microprocessors, Microcontrollers &Digital System Design

OBJECTIVES:
The student should be made to –

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts and overview of real time Operating system.
- Learn the system design techniques and networks for embedded systems to industrialapplications.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS (9 Hrs)

Complex systems and microprocessors– Embedded system design process – Overview on formalismsfor system design –Design example: Model train controller– Instruction sets preliminaries – ARM Processor – CPU: programming input and output– supervisor mode, exceptions and traps – Co– processors– Memory system mechanisms – CPU performance– CPU power consumption– Introduction to Embedded Industrial CPUs for rugged environment.

UNIT II EMBEDDED COMPUTING PLATFORM DESIGN (9 Hrs)

The CPU Bus–Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform–level performance analysis – Components for embedded programs– Models of programs– Assembly, linking and loading – compilation Programming techniques– Program level performance analysis – Software performance optimization –Program validation and testing.

UNIT III PROCESSES AND OPERATING SYSTEMS (9 Hrs)

Introduction – Kernel, Threads –Multiple tasks and multiple processes – Multirate systems– Pre- emptive real–time operating systems– Priority based scheduling– Interposes communication mechanisms – Evaluating operating system performance– power optimization strategies for processes GPOS versus RTOS- Classification of RTOS- Example Real time operating systems– POSIX– Windows CE.

UNIT IV SYSTEM DESIGN TECHNIQUES AND NETWORKS (9 Hrs)

Design methodologies– Design flows – Requirement Analysis – Specifications–System analysis and architecture design – Quality Assurance techniques– Distributed embedded systems – Multiprocessors–CPUs, accelerators, MPSoCs– Overview on Internet of (robotic) Things– Ubiquitousoptimization

UNIT V CASE STUDY (9 Hrs)

Data compressor – Alarm Clock – Audio player – Software modem–Digital still camera – Telephoneanswering machine–Engine control unit – Video accelerator–Challenges and trends in embedded systems in industrial applications

Total: 45 Hrs

OUTCOMES:

Upon completion of the course, students will be able to -

1. Describe the architecture and programming of ARM processor.
2. Outline the concepts of embedded systems.
3. Use the system design techniques to develop software for embedded systems.
4. Differentiate between the general purpose and real time operating system.
5. Model real-time consumer/industrial applications using embedded-system concepts.

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing SystemDesign", Third Edition "Morgan Kaufmann Publisher, 2012.

REFERENCES:

1. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", ThirdEdition, Cengage Learning, 2012.
2. David. E. Simon, "An Embedded Software Primer", 1st Edition, Addison WesleyProfessional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Designto Networking with C/C++", Prentice Hall, 1999.
4. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, McGraw Hill1997
5. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming",Dream Tech Press, 2005.
6. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", McGraw Hill,2004.

BECF186P70 – COMPUTER NETWORKS LABORATORY VI SEMESTER

L	T	P	C
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OBJECTIVES:

- To understand the function of various protocol
- To perform real time experiments using existing infrastructure
- To gain knowledge to construct LAN and WAN in real time environment

LIST OF EXPERIMENTS:

1. (a) Study of different types of Network cables and implement cross-wired cable and straightthrough cable using clamping tool b) Study of Network devices c) Study of Network IP
2. Configuration of Local Area Network (LAN) and VPN
3. Wireless LAN protocols
4. To create scenario and study the performance of network with CSMA / CA protocol andcompare with CSMA/CD protocols.
5. Implementation and study of stop and wait protocol
6. Implementation and study of Go back-N and selective repeat protocols
7. Implementation of client server using TCP protocol
8. Implementation of Remote Procedure Call
9. Implementation of distance vector routing algorithm
10. Configure a network using address resolution protocol (ARP) and routing information protocol(RIP) and analyze the performance of the network.
11. Configuration of internet protocol (IP)
12. Configuration of network using Ad hoc On demand distance vector (AODV) routing
13. Configuration of network using Dynamic Source Routing (DSR) routing

OUTCOMES:

- Ability to design MAC and routing protocols in Wired and Wireless Environment using NS2 /QUALNET / NS3 / OMNET / CISCO
- Acquire the technical competence to meet out the industry expectation on the state – of the artwired / wireless technologies.
- Acquire the ability to design WLAN/ LAN systems meeting out real time requirements

TOOLS TO BE USED: NS2/QUALNET/NS3/OMNET/CISCO PACKET TRACER

BECF186P80 – EMBEDDED SYSTEM DESIGN LABORATORY VI SEMESTER

L	T	P	C
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OBJECTIVES:

- To learn the working of ARM processor
- To understand the Building Blocks of Embedded Systems
- To learn the concept of memory map and memory interface
- To know the characteristics of Real Time Systems
- To write programs to interface memory, I/O's with processor
- To study the interrupt performance

LIST OF EXPERIMENTS:

1. Study of ARM evaluation system
2. Study of Keil C Compiler
3. Interfacing ADC and DAC
4. Interfacing LED and PWM
5. Interfacing real time clock and serial port
6. Interfacing keyboard and LCD
7. Interfacing EPROM and interrupt
8. Mailbox
9. Interrupt performance characteristics of ARM and FPGA
10. Flashing of LEDS
11. Interfacing stepper motor and temperature sensor
12. Implementing Zigbee protocol with ARM.

OUTCOMES:

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

- Write programs in ARM for a specific Application
- Interface memory and Write programs related to memory operations
- Interface A/D and D/A convertors with ARM system
- Analyse the performance of interrupt
- Write programmes for interfacing keyboard, display, motor and sensor
- Formulate a mini project using embedded system

BECF186P90 – VLSI DESIGN LABORATORY VI SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

- To learn Hardware Descriptive Language (Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digitaland analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms.

LIST OF EXPERIMENTS:

(a) Study of IC design flow using EDA tools of different vendors

(b) Introduction to JTAG

FPGA Based Experiments:

1. HDL based design entry, Test bench creation and simulation of BCD counters PRBSgenerators, Comparators (min 4-bit) / Bothe multiplier / Carry select adder.
2. Synthesis, Placement and Routing (P&R) and post P&R simulation of the componentssimulated in (Expt. No. 2) above
3. Critical paths and static timing analysis results to be identified. Identify and verify possibleconditions under which the blocks will fail to work correctly.
4. Hardware fusing and testing of each of the blocks simulated in (Expt. 2). Use of either chipscope feature (Xilinx) or the signal tap feature (Altera) is a must.
5. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

IC Design Experiments:

6. Design and PSPICE simulation of

(a) Simple 5 transistor differential amplifier. Measure gain, BW, output impedance, ICMR, andCMRR.

(b) Ring Oscillator

7. Layout generation, DRC and LVS Checking, Parasitic Extraction and Resimulation of CMOSInverter.
8. Synthesis and Standard cell-based design of a circuit simulated in (Expt. 7-b) above - Synthesis principles, Logical Effort, Interpreting Scripts, Constraints and Library preparationand generation, Boolean Optimization, Optimization for Area, Power.
9. For Expt. 7-b above, Floor Planning, Placement and Routing (P&R), Power and Clock Routing, and post P&R simulation
10. Static Timing analyses procedures and constraints. Critical path considerations.
11. DFT - Scan chain insertion / Clock Tree Synthesis / Stick diagrams.

OUTCOMES:

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

- Write HDL code for basic as well as advanced digital integrated circuits.
- Import the logic modules into FPGA Boards and carry out a series of validations of thedesign.
- Synthesize, Place and Route the digital IPs.
- Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.

TOOLS TO BE USED:

Xilinx / Mentor Graphics / Cadence / Altera / MAGMA / Tanner /Microwind / LTSPICE / Equivalent

BECF187T50 – OPTICAL COMMUNICATION VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Analog and Digital Communication

OBJECTIVES:

- To learn the basic elements of optical fiber transmission link, fiber modes configurationsand structures.
- To understand the different kind of losses, signal distortion, SM fibers.
- To learn the various optical sources, materials and fiber splicing
- To learn the fiber optical receivers and noise performance in photo detector.
- To explore link budget, WDM, solitons and SONET/SDH network

UNIT I INTRODUCTION TO OPTICAL FIBERS (9 Hrs)

Evolution of fiber optic system- Element of an Optical Fiber Transmission link-- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS (9 Hrs)

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, SignalDistortion in Optical Waveguides-Information Capacity determination -Group Delay- Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength.

UNIT III FIBER OPTICAL SOURCES AND COUPLING (9 Hrs)

Direct and indirect Band gap Materials -LED structures -Light source materials -Quantum efficiencyand LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition – Rate equations-External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fiber -to- Fiber joints, Fiber splicing-Signal to Noise ratio , Detector response time.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS (9 Hrs)

Fundamental receiver operation, Pre-amplifiers, Error sources – Receiver Configuration– Probabilityof Error – Quantum limit, Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION (9 Hrs)

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solutions – Optical CDMA – Solitons in Optical Fiber -Ultra High Capacity Networks.

Total: 45 Hrs

OUTCOMES:

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

1. Demonstrate an understanding of optical fiber communication link, structure, propagation andtransmission properties of an optical fiber.
2. Estimate the losses and analyze the propagation characteristics of an optical signal in differenttypes of fibers.
3. Describe the principles of optical sources and power launching-coupling methods.
4. Compare the characteristics of fiber optic receivers.

5. Design a fiber optic link based on budgets To assess the different techniques to improve thecapacity of the system.

TEXT BOOKS:

1. Gerd Keiser, “Optical Fiber Communication & quot; Mc Graw-Hill International, 4th Edition.2010.
2. John M. Senior, “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.

REFERENCES:

1. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009.
2. J.Senior, & quot; Optical Communication, Principles and Practice & quot;, Prentice Hall ofIndia, 3rd Edition, 2008.
3. J.Gower, & quot; Optical Communication System & quot;, Prentice Hall of India, 2001.

BECF187P60 – OPTICAL COMMUNICATION LABORATORY VII SEMESTER

L	T	P	C
0	0	3	2

OBJECTIVES:

- To understand the working principle of optical sources, detector, fibersand optical components
- To develop understanding of simple optical communication link.
- To learn about the characteristics and measurements in optical fibre
- To understand the Various losses involved in OFC

LIST OF EXPERIMENTS:

1. DC Characteristics of Light Emitting Diode
2. DC Characteristics of PIN Photo diode
3. Mode Characteristics of Fibers
4. Measurement of connector and bending losses
5. Analysis of Fiber optic Analog - frequency response (analog)
6. Analysis of Fiber optic Digital Link - eye diagram (digital)
7. Numerical Aperture determination for Optical Glass Fibers
8. Numerical Aperture determination of Plastic Fiber
9. Attenuation Measurement in Fibers
10. Bit error rate Measurement
11. Design of basic Optical Communication system using computational tool
12. Study experiment – Optical Wavelength Multiple Access
13. Study of computational tools of Optical Communication

OUTCOMES:

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

- Understand the working principle of optical sources, detector, fibers and microwavecomponents
- Develop understanding of simple optical communication link
- Learn about the characteristics and measurements in optical fibre
- Analyse the losses in Optical Fibre Communication

LIST OF PROFESSIONAL ELECTIVE COURSES

BECF185EA0 – ANTENNAS AND PROPAGATION V SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Electromagnetic Fields and Wave guides

OBJECTIVES:

- To give insight of radiation phenomena.
- To give thorough understanding of the radiation characteristics of different types ofantenna
- To create awareness about different types of propagation of radio waves at differentFrequencies

UNIT I FUNDAMENTALS OF RADIATION (9 Hrs)

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance,Band width, Beam width, Input Impedance, Matching Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole

UNIT II ANTENNA ARRAYS (9 Hrs)

N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array, Yagi Arrays.

UNIT III APERTURE AND SLOT ANTENNAS (9 Hrs)

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas, Micro strip antennas – Radiation mechanism – Application, Numerical tool for antenna analysis

UNIT IV SPECIAL ANTENNAS (9 Hrs)

Principle of frequency, independent antennas –Spiral antenna, helical antenna, Log periodic, Modern antennas-Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR

UNIT V PROPAGATION OF RADIO WAVES (9 Hrs)

Modes of propagation , Structure of atmosphere , Ground wave propagation, Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation

OUTCOMES: **Total: 45 Hrs**

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

- Explain the various types of antennas and wave propagation
- Write about the radiation from a current element
- Analyse the antenna arrays, aperture antenna and special antenna

TEXT BOOK:

1. John D Kraus," Antennas for all Applications", 4th Edition, McGraw Hill, 2010.

REFERENCES:

1. Edward C. Jordan and Keith G. Balmain" Electromagnetic Waves and Radiating Systems"Prentice Hall of India, 2nd Edition 2011.
2. R.E. Collin," Antennas and Radio wave Propagation", McGraw Hill 1985.
3. Constantine.A. Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 4th Edition2016.
4. Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition New AgeInternational Publishers, 2006.
5. S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007
6. Robert S. Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
7. H. Sizun "Radio Wave Propagation for Telecommunication Applications", First IndianReprint, Springer Publications, 2007.

BECF185EB0 – INFORMATION THEORY AND CODING V SEMESTER

L	T	P	C
3	0	0	3

PRE - REQUISITE:

Basic Knowledge of Analog and Digital Communication

OBJECTIVES:

- To get exposed to concept of information and entropy
- To learn Shannon's theorem for coding, Calculation of channel capacity
- Ability to Apply coding techniques

UNIT I SOURCE CODING AND ENTROPY (9 Hrs)

Definition and Examples- Uniquely Decodable Codes-Instantaneous Codes-Constructing Instantaneous Codes-Kraft's Inequality - McMillan Inequality- Information and Entropy- properties of the Entropy function - Entropy and Average Word-Length- Shannon-Fano coding-Entropy of Extensions and products-Shannon's First Theorem.

UNIT II INFORMATION CHANNEL (9 Hrs)

Information Channel- Definitions- Binary Symmetric channel-System Entropies-system entropies forthe Binary Symmetric Channel-Extension to Shannon's First Theorem to information channels- Mutual Information-Mutual information for the Binary Symmetric channel-Channel Capacity

UNIT III CHANNELS AND OPTIMAL CODES (9 Hrs)

Decision rules- Improved Reliability- hamming Distance- Statement and proof of Shannon's Theorem- Converse of Shannon's Theorem- Optimality-Binary Huffman Codes-Average Word- length of Huffman codes-Optimally of Binary Huffman codes-r-ary Huffman codes-Extensions of sources-

UNIT IV CYCLIC CODES (10 Hrs)

Description of cyclic codes- Generator and parity check matrices of Cyclic codes- Encoding of cycliccodes- Cyclic hamming codes- Syndrome Computation and error Detection- Decoding of cyclic codes- Cyclic Hamming Codes-Error- Trapping Decoding- Improved error-Trapping Decoding- The(23,12) Golay code- shortened Cyclic codes-Cyclic Product codes- Quasi-Cyclic codes.

UNIT V CONVOLUTIONAL ARITHMETIC CODES (8 Hrs)

Encoding of Convolutional codes - Structural properties of Convolutional codes- Distance properties of Convolutional codes.

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to:

- Understand the concept of information and entropy
- Understand Shannon's theorem for coding
- Calculation of channel capacity
- Apply coding techniques

TEXT BOOKS:

1. N.Abramson, "Information and Coding", McGraw Hill, 1963.
2. M. Mansurpur, "Introduction to Information Theory", McGraw Hill, 1987.

REFERENCES:

1. R.B. Ash, "Information Theory", Prentice Hall, 1970.
2. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
3. G.A.Jones and J.Mary Jones, "Information and Coding Theory", Springer SUMS.

BECF185EC0 – INTRODUCTION TO MEMS V SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic Knowledge of Integrated Circuits, Measurement & Instrumentation

OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators

UNIT 1 INTRODUCTION (9 Hrs)

Introduction and Historical Background of MEMS development, intrinsic characteristics of MEMS, Overview of Microfabrication, Microelectronics Fabrication Process flow, Process selection and Design.

UNIT 2 SENSORS AND ACTUATORS (9 Hrs)

Introduction to electrostatic sensors and actuators – parallel plate capacitors and applications – Inertia sensor, pressure sensor, flow sensor, tactile sensor, parallel-plate actuators, Thermal Sensors and actuators.Piezoresistive sensors – piezo resistive sensor materials, stress analysis of mechanical elements and apllications.Piezoelectric sensing and actuators – Quartz, PZT, PVDF, ZnO

UNIT 3 LITHOGRAPHY (LIGA) AND ETCHING TECHNIQUE (9 Hrs)

Lithography's origin, Overview of photolithography, Lithography sensitivity and intrinsic resist sensitivity, resolution in photolithography and its enhancement technique, Dry Etching: Definitions and Jargon, Physical etching, plasma etching, Deep reactive Ion etching, Comparing Wet and Dry etching.

UNIT 4 SURFACE MICROMACHINING (9 Hrs)

Introduction, Mechanical properties of Thin films, Surface Micromachining processes, Poly-Si surface Micromachining modifications, comparison of bulk micromachining and surface micromachining. Top-Down and Bottom-Up micromachining technique.

UNIT 5 APPLICATIONS AND CASE-STUDIES (9 Hrs)

MEMS in Automotive market, MEMS in Medical and Biomedical Market, Environmental Monitoring, Industrial/Automation, IT/Peripheral, Telecommunication. CASE-STUDIES: Blood Pressure (BP) Sensor, Microphone, Acceleration sensor, Gyros.

OUTCOMES: Total: 45 Hrs

On successful completion of this course, the student should be able to:

- Interpret the basics of micro/nano electromechanical systems including their applications andadvantages
- Recognize the use of materials in micro fabrication and describe the fabrication processesincluding surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical transducers including sensors andactuators

TEXT BOOKS:

1. "Foundation of MEMS" Chang Liu, Second Edition, Parson, 2012.
2. "Fundamentals of Micro fabrication – The Science of Miniaturization" Marc J.Madou,Second Edition, CRC Press, 2011.

REFERENCES:

1. "Micro and Smart Systems" – Anantha suresh & Gopal Krishnan - Wiley India.
2. "Microsystem Design" - S.D.Senturia, Kluwer Academic Publishers.
3. "MEMS and Microsystems Design and Manufacture", Tai Ran Hsu,TataMcraw Hill, 2002.
4. "MEMS and NEMS: Systems, Devices, and Structures" Sergey Edward Lyshevski, CRC Press,2002.

BECF186ED0 - VLSI DESIGN VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Electronic Circuits and Digital System Design

OBJECTIVES:

- To understand the principles of CMOS-VLSI technology and the design issues involvedat circuit, logic, layout, system level and to learn programmable logics.

UNIT I INTRODUCTION TO VLSI AND MOS TRANSISTOR THEORY (10 Hrs)

Evolution of IC Technologies: SS1, MSI, LSI, VLSI, ULSI, and GLSI. The Moore's Law, MOS THEORY: The MOS as switch - nMOS and pMOS. CMOS logic and its features, The nMOS Enhancement Transistor - Working and Characteristics. Threshold voltage and Body effect of MOS. MOS device design equations (First order effects). MOS INVERTERS: The CMOS inverter Transfer characteristics, Noise margin. The nMOS and pseudo-nMOS inverter, Tile BiCMOS Inverter, Tile CMOS Transmission gate

UNIT II CMOS PROCESSING TECHNOLOGY AND LAYOUTS (9 Hrs)

Silicon Semiconductor fabrication technology, Fabrication forms and CMOS (Basic n-WELL process) LAYOUTS AND DESIGN RULES: Layout based rules, Simple CMOS Stick Layout diagrams - Inverter, NAND, NOR gates and Multiplexer. Scaling: Constant Field, and Constant voltage

UNIT III MOS CIRCUIT PERFORMANCE AND CMOS LOGIC CIRCUITS (9 Hrs)

Sheet Resistance definition, MOS device capacitances – model, Distributed RC effects, switching characteristics - Rise time, fall time and Delay time. Stage ratio, Simple examples of Combinational and Sequential circuits using CMOS: NANDI NOR gates, and Compound gates, Latches, and Registers.

UNIT IV SUB SYSTEM DESIGN AND TESTING (9 Hrs)

General System Design-Design of ALU subsystems, Adder and Multipliers Memories - Static RAM, Control Logic Implementation using PLA's. Testing of VLSI circuits - Need for Testing, Fault models, and ATPG. Design for Testability (DFT) - Scan Based and Self-test approaches.

UNIT V PROGRAMMABLE LOGICS (8 Hrs)

Basic ROM structures, PLAs, PALs, PLDs, Implementation of Traffic Light controller using PLD, FPGAs and CPLDs: XILINX and ALTERA series.

OUTCOMES: **Total: 45 Hrs**

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

- Learn the evolution of IC Technologies
- Learn and analyze front end and back end of CMOS Circuits
- Analyze circuit performance and logic circuits of CMOS
- Understand design and testability for VLSI circuits

TEXTBOOKS:

1. Neil Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design"-AddisonWesley,1998.
2. Charles H Roth, Jr."Digital Systems Design using VHDL"-Thomson Learning, 2001.

REFERENCES:

1. VLSI Design Principles- John P. Uyemura, John Wiley,2002
2. E. Fabricious, Introduction to VLSI design, McGraw-Hill1990
3. Wayne Wolf, Modern VLSI Design, Pearson Education, 2003

BECF186EE0 – MULTIMEDIA COMPRESSION TECHNIQUES VI SEMESTER

L	T	P	C
3	0	0	3

PRE- REQUISITE:

Basic knowledge of Coding Theory and CommunicationSystems

OBJECTIVES:

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of the secodes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

UNIT I MULTIMEDIA COMPONENTS (9 Hrs)

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

UNIT II AUDIO AND VIDEO COMPRESSION (9 Hrs)

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

UNIT III TEXT AND IMAGE COMPRESSION (9 Hrs)

Compression principles-source encoders and destination encoders-lossless and lossy compression- entropy encoding–source encoding-text compression–static Huffman coding dynamic coding–arithmetic coding– Lempel ziv-welsh Compression-image compression

UNIT IV VOIP TECHNOLOGY (9 Hrs)

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 (9 Hrs)

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.

OUTCOMES: Total: 45 Hrs

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

- Describe various multimedia components
- Describe compression and decompression techniques.
- Apply the compression concepts in multimedia communication.

TEXT BOOK:

1. Fred Halshall “Multimedia Communication-Applications, Networks, Protocols andStandards”, Pearson Education, 2007.

REFERENCES:

1. Tay Vaughan, “Multimedia: Making it work”, Seventh Edition, TMH, 2008.
2. Kurose and W.Ross“Computer Networking- a Top Down Approach”, Pearson Education,2005.
3. Marcus Goncalves “Voice over IP Networks”, McGraw Hill,1999.
4. KR. Rao,Z S Bojkovic, D A Milovanovic, “Multimedia Communication Systems:Techniques, Standards, and Networks”, Pearson Education, 2007.
5. R. Steimnetz, K. Nahrstedt, “Multimedia Computing, Communications and Applications”,Pearson Education, 1995.

BECF186EF0 – NANO ELECTRONICS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Material Science and Electronics

OBJECTIVES:

- To learn and understand basic concepts of Nano electronics.
- To know the techniques of fabrication and measurement.
- To gain knowledge about Nanostructure devices and logic devices.

UNIT I INTRODUCTION TO NANO TECHNOLOGY (8 Hrs)

Introduction to nano technology, meso structures, Basics of Quantum Mechanics: Schrodingerequation, Density of States. Particle in a box Concepts, Degeneracy, Band Theory of Solids, Kronig-Penny Model, Brillouin Zones

UNIT II CMOS SCALING AND ITS LIMITS (9 Hrs)

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), Nano Materials - Measurement and Fabrication of Nano materials.

UNIT III FUNDAMENTALS OF NANOELECTRONICS (9 Hrs)

Fundamentals of logic devices:- physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics
– quantum cellular automata – quantum computing – DNA computer; Ultimate computation: - power dissipation limit – dissipation in reversible computation.

UNIT IV NANO STRUCTURE DEVICES (9 Hrs)

Resonant Tunnelling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

UNIT V LOGIC DEVICES AND APPLICATIONS (10 Hrs)

Logic Devices-Silicon MOSFETs-Ferroelectric Field Effect Transistors-Quantum Transport Devices Based on Resonant Tunnelling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics-Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing- Molecular Electronics. MEMS/NEMS, Future applications and Trends

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to:

- Understand various aspects of Nano-technology and the processes involved in making nanocomponents and material.
- Leverage advantages of the Nano-materials and appropriate use in solving practical problems

TEXT/ REFERENCE BOOKS:

1. G.W. Hanson, Fundamentals of Nano electronics, Pearson, 2009.
2. W. Ranier, Nano electronics and Information Technology, Wiley-VCH, 2003.
3. K.E. Drexler, Nano systems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press,1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

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BECF187EG0 – DIGITAL IMAGE & VIDEO PROCESSING VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Signals & Systems, Digital Signal Processing andDigital System Design

OBJECTIVES:

- To learn digital image fundamentals.
- To be exposed to simple image processing techniques.
- To be familiar with image compression and segmentation techniques
- To represent image and video in form of features

UNIT I DIGITAL IMAGE FUNDAMENTALS (9 Hrs)

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models. – Neighborhood, adjacency, connectivity, distance measures.

UNIT II IMAGE ENHANCEMENT (9 Hrs)

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform–Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters. ColorImage Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; ColorSegmentation.

UNIT III IMAGE RESTORATION AND SEGMENTATION (9 Hrs)

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing-erosion and dilation.

UNIT IV WAVELETS AND IMAGE COMPRESSION (9 Hrs)

Wavelets and Multi-resolution image processing, wavelets and Sub band filter banks, wavelet packets, Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still imagecompression standards – JPEG and JPEG-2000

UNIT V VIDEO PROCESSING (9 Hrs)

Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search,fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of avideo encoder and decoder; Video coding standards – MPEG and H.26X. Video Segmentation- Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking

Total: 45 Hrs

OUTCOMES:

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

- Understand the image enhancement techniques
- Understand wavelets and image compression
- Understand the fundamentals of video processing

TEXT/REFERENCE BOOKS:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education,2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2nd edition,2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2011.

BECF187EH0 – WIRELESS SENSOR NETWORKS VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Data Communication Networks

OBJECTIVES:

- To understand the basics of Wireless sensor Networks
- To learn the Architecture of WSN
- To understand the concept of Networking and Networking in WSN

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS (9 Hrs)

Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints andchallenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks. **UNIT II ARCHITECTURES (9 Hrs)**

Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments- introduction to Tiny OS and nesC- Internet to WSN Communication

UNIT III NETWORKING SENSORS (10 Hrs)

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, RoutingProtocols Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT (8 Hrs)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS (9 Hrs)

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms,Node level Simulators, State-centric programming.

OUTCOMES: **Total: 45 Hrs**

Upon completion of the course, students will be able to:

- Understand challenges and technologies for wireless networks
- Understand architecture and sensors
- Establishing infrastructure and simulations

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless SensorNetworks", John Wiley, 2005.
2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks – An InformationProcessing Approach", Elsevier, 2007.
3. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks -Theory And Practice”, By John Wiley & Sons Publications, 2011

REFERENCES:

1. KazemSohraby, Daniel Minoli, & TaiebZnati, “Wireless Sensor Networks-Technology,Protocols, And Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

BECF187EI0 – ASIC DESIGN VII SEMESTER

L	T	P	C
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PRE-REQUISITE:

Basic knowledge of Digital System Design and VLSI

OBJECTIVES:

- To understand the programmable logic devices.
- To understand the logic of chip design.

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC & ASIC LIBRARY DESIGN(9 Hrs)

Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational LogicCell – Sequential logic cell - Data path logic cell - Transistors as Resistors – Transistor Parasitic Capacitance- Logical effort –Library cell design - Library architecture.

UNIT II PROGRAMMABLE ASICS, ASIC LOGIC CELLS AND ASIC I/O CELLS(9 Hrs)

Anti-fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT- Xilinx LCA –Altera FLEX-Altera MAX DC & AC inputs and outputs-Clock & Power inputs- Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC INTERCONNECT, ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGNENTRY (9 Hrs)

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 – Altera FLEX – Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation.

UNIT IV LOGIC SYNTHESIS, SIMULATION AND TESTING (9 Hrs)

Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation

UNIT V ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT & ROUTING (9 Hrs)

System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow– global routing-detailed routing-special routing-circuit extraction -DRC.

OUTCOMES: **Total: 45 Hrs**

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

- Understand the chip design
- Understand the concept of IC floor planning, Placement and routing.

TEXT BOOK:

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc.,1997.

REFERENCES:

1. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach,Prentice Hall PTR, 2003.
2. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
3. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech HousePublishers,2000.
4. F.Nekoogar. Timing Verification of Application-Specific Integrated Circuits(ASICs). Prentice Hall PTR,1999.
5. Malcolm R.Haskard, Can C.May," Analog VLSI Design – NMos and CMOS," Prentice Hall,1988

BECF187EJ0 – ADVANCED MICROCONTROLLERS VII SEMESTER

PRE-REQUISITE:

Basic knowledge of Microprocessors and Microcontrollers

L	T	P	C
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OBJECTIVES:

- To study the properties and evolution of RISC and CISC processors.
- To study the architecture addressing modes and instruction set of R8C microcontroller.
- To impart knowledge on embedded software development.

UNIT I RISC PROCESSORS (8 Hrs)

RISC Vs CISC, RISC properties and evolution, Advanced RISC microcontrollers, PIC 8-bit Microcontrollers

UNIT II R8C 16-BIT MICROCONTROLLER (9 Hrs)

The R8C Architecture, CPU Registers, Instruction Set, On-Chip Peripherals, R8C Tiny Development Tools, ADC, PWM, UART, Timer Interrupts, System design using R8C Microcontroller.

UNIT III MSP430 16 - BIT MICROCONTROLLER (9 Hrs)

The MSP430 Architecture, CPU Registers, Instruction Set, On-Chip Peripherals, MSP430 Development Tools, ADC, PWM, UART, Timer Interrupts, System design using MSP430 Microcontroller.

UNIT IV EMBEDDED SOFTWARE DEVELOPMENT (9 Hrs)

Cross development tools, Debugging techniques, Real-time Operating System, Memory Management, scheduling techniques.

UNIT V SYSTEM DEVELOPMENT (10 Hrs)

Microcontroller based System Design, Peripheral Interfacing, Inter-Integrated Circuit Protocol for RTC, EEPROM, ADC/DAC, CAN BUS interfacing, Application in Automobiles, Robotic and consumer Electronics.

OUTCOMES: **Total: 45 Hrs**

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

- Explain RISC and CISC properties
- Interfacing using CAN bus
- System design based on microcontroller

TEXT BOOK:

1. Julio Sanchez Maria P.Canton, Microcontroller Programming: Themicrochip PIC, CRCPress, Taylor & Francis Group,2007.

REFERENCES:

1. D. E. Simon, An Embedded Software Primer¦, Addison-Wesley, 1999.
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing SystemDesign, Morgan Kaufman Publishers, 2006.
3. John H.Davis, MSP 430 Micro controller basics¦ Elsevier, 2008.

BECF187EK0 – MOBILE COMMUNICATION AND NETWORKS VII SEMESTER

L	T	P	C
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PRE-REQUISITE:

Basic knowledge of Digital Communication and Antennas

OBJECTIVES:

- To understand the issues involved in mobile communication system design and analysis.
- To understand the concept of frequency reuse.
- To understand the characteristics of wireless channels.
- To know the fundamental limits on the capacity of wireless channels.

UNIT I CELLULAR CONCEPTS (8 Hrs)

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

UNIT II THE WIRELESS CHANNEL (10 Hrs)

Signal Propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels -Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models,power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat andfrequency selective fading, slow and fast fading, average fade duration and level crossing rate.

UNIT III ANTENNAS FOR MOBILE TERMINALS (9 Hrs)

Capacity of flat and frequency selective channels, Antennas- Antennas for mobile terminal monopoleantennas, PIFA, base station antennas and arrays

UNIT IV MULTI-ANTENNA COMMUNICATION (9 Hrs)

Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit Diversity-Altamonte scheme.

UNIT V MIMO AND MULTIPLEXING (9 Hrs)

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average SNR, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to -

- Understand the working principles of the mobile communication systems.
- Understand the relation between the user features and underlying technology.
- Analyze mobile communication systems for improved performance.

TEXT/REFERENCE BOOKS:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg&JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996

BECF187EL0 – CMOS IC DESIGN VII SEMESTER

L	T	P	C
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PRE-REQUISITE:

Basic knowledge of VLSI Design

OBJECTIVE:

- To understand MOS Devices and CMOS IC's, Design of a CMOS Amplifier, CMOSoscillator circuits and comparators.

UNIT I INTRODUCTION, DESIGN ISSUES AND MANUFACTURING PROCESS (9 Hrs)

A Historical Perspective, Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design, Introduction to Manufacturing Process, Manufacturing CMOS Integrated Circuits, IntegratedCircuit Layout: Design Rules, Parasitics.

UNIT II INTERCONNECT AND DELAY MODELS (9 Hrs)

Interconnect Modelling: Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconnect Techniques.

Delay Model & Robustness: Introduction, RC Delay model, Linear Delay model, logical path effortsof paths. Robustness: Variability- Reliability- Scaling-Variation Tolerant design.

UNIT III COMBINATIONAL CIRCUIT DESIGN (9 Hrs)

Review of Circuit Families, Circuit pitfalls and Fallacies- the CMOS Inverters and CMOS Logic Gates – Static View: Introduction to CMOS Inverter, The Static CMOS Inverter – An Intuitive Perspective, Evaluating the Robustness of the CMOS Inverter, Introduction to Static CMOS Design, Complementary CMOS, Ratioed Logic, Pass-Transistor Logic. CMOS Inverter: Dynamic View: Performance of CMOS Inverter: The Dynamic Behaviour, Power, Energy, and Energy-Delay, Perspective: Technology Scaling and its Impact on the Inverter Metrics

UNIT IV SEQUENTIAL CIRCUIT DESIGN (9 Hrs)

Static and Dynamic Sequential Circuits -Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles: Pulse Registers and Sense-Amplifier Based Registers, Pipelining: An Approach to Optimize Sequential Circuits – Latch Vs Register-Based Pipelines – A Logic Style for Pipelined Structures, Non bistable Sequential Circuits

UNIT V DESIGN OF ABB AND MEMORY STRUCTURES (9 Hrs)

Arithmetic Building Blocks: Introduction, Data paths in Digital Processor Architecture, The Adder,The Multiplier, The Shifter, Other Arithmetic Operators, Power and Speed Trade-off's in Data path Structures, Perspective: Design as a Trade-off

Memory and Array Structures: Introduction, The Memory Core, Memory Peripheral Circuitry, Memory Reliability and Yield, Power Dissipation in Memories, Case Studies in Memory Design: ThePLA, A 4-Mbit SRAM and A 1-Gbit NAND Flash memory, Perspective: Semiconductor Memory Trends and Evolution

OUTCOMES: **Total: 45 Hrs**

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

- Design different CMOS circuits using various logic families along with their circuit layout.
- Understand the concepts of MOS Design.
- Design and analysis of Combinational and Sequential MOS Circuits.
- Extend the Digital IC Design to Different Applications.
- Understand the Concepts of Semiconductor Memories, Flash Memory, RAM array organization.

TEXTBOOKS:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits – ADesign Perspective, 2nd edn., Pearson Education, 2003.
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan,Borivoje Nikolic, 2nd Ed., PHI.
3. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

REFERENCE BOOKS:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, 2011.
2. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

BECF187EM0 – SPEECH AND AUDIO PROCESSING VII SEMESTER

L	T	P	C
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PRE-REQUISITE:

Basic knowledge Signal & Systems and Digital Signal Processing

OBJECTIVES:

- To introduce speech production and related parameters of speech.
- To learn the computation and use of techniques in the analysis of speech.
- To understand different speech modelling procedures and their implementation issues.

UNIT I INTRODUCTION TO SPEECH PRODUCTION AND MODELING (9 Hrs)

Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT II LINEAR PREDICTION OF SPEECH (9 Hrs)

Basic concepts of linear prediction; Linear Prediction Analysis of nonstationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

UNIT III SPEECH QUANTIZATION (8 Hrs)

Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer,differential quantizers; Vector quantization – distortion measures, codebook design, codebook types

UNIT IV SCALAR QUANTIZATION OF LPC (9 Hrs)

Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

UNIT V CODE EXCITED LINEAR PREDICTION (10 Hrs)

CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders;Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729 standards

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to:

- Mathematically model the speech signal
- Analyze the quality and properties of speech signal.
- Modify and enhance the speech and audio signals.

TEXT BOOKS:

1. "Digital Speech" by A.M.Kondoz, Second Edition, Wiley, 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu,Wiley Inter science, 2003.

REFERENCE BOOKS:

1. Ben Gold And Nelson Morgan, "Speech And Audio Signal Processing, Processing AndPerception Of Speech And Music", Wiley- India Edition, 2006.

BECF187EN0 – HIGH SPEED ELECTRONICS VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISTIE:

Basic Knowledge in Electronic Circuits and Transmission Lines

OBJECTIVES:

- To understand the importance of high-speed electronics circuits in various applications.
- To learn the characteristics of various components used in high speed electronics
- To implement the design of High-speed electronic system using those components.

UNIT I TRANSMISSION LINE THEORY CROSSTALK AND NONIDEAL EFFECTS (9 Hrs)

Signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise;

UNIT II DEVICES (8 Hrs)

Passive and active, Lumped passive devices (models), Active (models, low vs. high frequency)

UNIT III RF AMPLIFIER (10 Hrs)

Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers,Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF poweroutput stages Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators

UNIT IV PRINCIPLES (9 Hrs)

PLL Transceiver architectures Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges

UNIT V NOISE ANALYSIS (9 Hrs)

Sources, Noise Figure, Gain compression, Harmonic distortion, Inter-modulation, Cross-modulation, Dynamic range.

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to:

- Understand significance and the areas of application of high-speed electronics circuits.
- Understand the properties of various components used in high speed electronics
- Design High-speed electronic system using appropriate components.

TEXT/REFERENCE BOOKS:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: AHandbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press.
2. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004,
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5. Kai Chang, "RF and Microwave Wireless systems", Wiley, 2000.
6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

BECF187EO0 – BIO-MEDICAL ELECTRONICS VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISTIE:

Basic Knowledge in Electronic Devices and Circuits

OBJECTIVES:

- To learn the electrical and non-electrical physiological measurements
- To understand the function of bio amplifiers.
- To know the configuration of various electrodes

UNIT I BIO POTENTIAL ELECTRODES (9 Hrs)

Origin of bio potential and its propagation, Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – non polarizable electrodes. Types ofelectrodes - surface, needle and micro electrodes and their equivalent circuits, Recording problems - measurement with two electrodes

UNIT II ELECTRODE CONFIGURATIONS (9 Hrs)

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode, EMG– unipolar andbipolar mode

UNIT III BIO AMPLIFIER (9 Hrs)

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECGamplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier, Power line interference

UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS (9 Hrs)

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers
- systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT (9 Hrs)

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

OUTCOMES: **Total: 45 Hrs**

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

- Perform electrical and non-electrical physiological measurements
- Explain the function of bio amplifiers.

TEXT BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons,2004.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, 2003.

REFERENCES:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", PHI, 2007.
2. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", McGrawHill,2003.
3. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

BECF187EP0 – MIXED SIGNAL DESIGN VII SEMESTER

PRE-REQUISTIE:

Basic Knowledge in Signals & Systems and Analog Electronics

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OBJECTIVES:

- To understand the analysis of mixed signals for various applications.
- To learn the inter-conversions between signals.
- To design systems involving mixed signals.

UNIT I ANALOG AND DISCRETE-TIME SIGNAL PROCESSING (9 Hrs)

Introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics ofanalog discrete-time filters and Z-transform.

UNIT II SWITCHED CAPACITOR FILTERS (9 Hrs)

Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitorfilter applications

UNIT III BASICS OF DATA CONVERTERS (10 Hrs)

Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADCstructures, High-resolution ADCs, DACs.

UNIT IV MIXED SIGNAL LAYOUT (9 Hrs)

Interconnects and data transmission; Voltage-mode signalling and data transmission; Current-modesignalling and data transmission.

UNIT V INTRODUCTION TO FREQUENCY SYNTHESIZERS & SYNCHRONIZATION (8 Hrs)
Basics of PLL, Analog PLLs; Digital PLLs, DLLs

OUTCOMES: **Total: 45 Hrs**

At the end of the course, students will demonstrate the ability to:

- Understand the practical situations where mixed signal analysis is required.
- Analyze and handle the inter-conversions between signals.
- Design systems involving mixed signals

TEXT BOOKS:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, revised second edition, IEEEpress, 2008.
4. Rudy V. de Plassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.

REFERENCE BOOKS:

1. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
2. R. Schauman, Design of analog filters, Prentice-Hall 1990.
3. M. Burns et al., An introduction to mixed-signal IC test and measurement, Oxford universitypress, first Indian edition, 2008.

BECF187EQ0 – ADAPTIVE SIGNAL PROCESSING VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISTIE:

Basic Knowledge in Signals & Systems and Digital Signal Processing

OBJECTIVES:

- To learn the significance of real time changing control parameters.
- To understand the representation of 'adaptability requirement'.
- To understand the mathematical modelling of various signal
- processing systems.

UNIT I INTRODUCTION TO ASP (9 Hrs)

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

UNIT II LMS AND FILTERS (9 Hrs)

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean squareerror and MIS-adjustment

UNIT III LMS ALGORITHM (9 Hrs)

Variants of the LMS algorithm the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

UNIT IV RANDOM VARIABLES (9 Hrs)

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modelling, joint process estimator, gradient adaptive lattice.

UNIT V INTRODUCTION TO RECURSIVE LEAST SQUARES (9 Hrs)

Vector space formulation of RLS estimation, pseudo inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affineprojection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Total: 45 Hrs

OUTCOMES:

At the end of the course, students will demonstrate the ability to:

- Understand the non-linear control and the need and significance of changing the controlparameters w.r.t. real-time situation.
- Mathematically represent the 'adaptability requirement'.
- Understand the mathematical treatment for the modelling and design of the signal processingsystems.

TEXT BOOKS:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

REFERENCES:

1. Adaptive Signal Processing, Bernie Widrow and Stearns, Prentice Hall,
2. Fundamentals of Adaptive Filtering, Ali Sayed, Wiley, 2003
3. Kernel Adaptive Filtering, Liu, Principe and Haykin, Wiley, 2010

BECF187ER0 – RF DESIGN VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Electronic Circuits and Microwave Engineering

OBJECTIVE:

- To understand the characteristics of active/passive RF devices and components.
- To learn the characteristics of RF filters.
- To learn the design of RF amplifiers and Oscillators.

UNIT I RF ISSUES (9 Hrs)

Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications

UNIT II RF FILTER DESIGN (8 Hrs)

Overview, Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

UNIT III ACTIVE RF COMPONENTS & APPLICATIONS (10 Hrs)

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Micro-strip line matching networks, Amplifier classes of operation and biasing networks

UNIT IV RF AMPLIFIER DESIGNS (9 Hrs)

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband, high power and multistage amplifiers.

UNIT V OSCILLATORS, MIXERS & APPLICATIONS (9 Hrs)

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers; Phase Locked Loops; RF directional couplers and hybrid couplers; Detector and demodulator circuits

OUTCOMES: **Total: 45 Hrs**

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

- Use the active/ passive RF devices and components for various applications.
- Analyze the RF filter and Oscillator design.

TEXT BOOKS:

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications,Pearson Education Asia, First Edition, 2001.
2. Pozar, Microwave Engineering, John Wiley, Third Edition, 2004.

REFERENCES:

1. Joseph. J. Carr, Secrets of RF Circuit Design, McGrawHill, Third Edition, 2000.
2. Mathew M . Radmanesh, Radio Frequency & Microwave Electronics, Pearson, 2001

BECF188ES0 – NEURAL NETWORKS & FUZZY LOGIC VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Mathematics, Data Communication and Networks

OBJECTIVES:

- To learn the various architectures of building an ANN and its applications
- To learn advanced methods of representing information in ANN like self-organizingnetworks, associative and competitive learning
- To learn the fundamentals of Crisp sets, Fuzzy sets and Fuzzy Relations

UNIT I INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (9 Hrs)

Neuro-physiology - General Processing Element - ADALINE - LMS learning rule – MADALINE – XOR Problem – MLP - Back Propagation Network - updation of output andhidden layer weights - application of BPN.

UNIT II ASSOCIATIVE MEMORY & CPN (9 Hrs)

Associative memory - Bi-directional Associative Memory – Hopfield memory - travelling sales man problem Annealing, Boltzmann machine-learning–application-Counter Propagation network–architecture–training Applications

UNIT III SELF ORGANIZING MAP & ART (9 Hrs)

Self-organizing map - learning algorithm - feature map classifier – applications - architecture of Adaptive Resonance Theory - pattern matching in ART network

UNIT IV CRISP SETS AND FUZZY SETS (9 Hrs)

Introduction – crisp sets an overview – the notion of fuzzy sets –Basic concepts of fuzzy sets – classical logic and overview – Fuzzy logic- Operations on fuzzy sets - fuzzy complement – fuzzy union – fuzzy intersection combinations of operations – general aggregation operations

UNIT V FUZZY RELATIONS (9 Hrs)

Crisp and fuzzy relations – binary relations – binary relations on a single set– equivalence and similarity relations – Compatibility or tolerance relations– orderings – morphisms-fuzzy relation equations.

OUTCOMES: Total: 45 Hrs

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

- Learn the various architectures of building an ANN and its applications
- Learn the Fundamentals of Crisp sets, Fuzzy sets and Fuzzy Relations

TEXT BOOKS:

1. Freeman J.A. and Skapura B.M., "Neural Networks, Algorithms Applications andProgramming Techniques", Addison-Wesley, 1990.
2. George J Klir and Tina A Folger," Fuzzy sets, uncertainty and information", PHI, 1988.

REFERENCES:

1. Laurene Fausett, "Fundamentals of Neural Networks: Architecture, Algorithms andApplications", Pearson Education, 1994.
2. H.J. Zimmerman, "Fuzzy set theory and its Applications", Allied Publishers Ltd, 1996

BECF188ET0 – 4G LTE CELLULAR SYSTEMS VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISTIE:

Basic knowledge of Cellular Mobile Communication

OBJECTIVES:

- To categorize the current wireless cellular standards of LTE and LTE advanced.
- To analyze the effective utilization of spectrum and RF requirements for LTE.
- To discriminate the LTE Air Interface, OFDMA, MIMO, SDR and CoMP technology.
- To describe the relay deployment and overview of WiMAX.

UNIT I STANDARDIZATION OF LTE (10 Hrs)

3rd Generation Partnership Project (3GPP); The 3G Evolution to 4G; Long Term Evolution (LTE) and System Architecture Evolution (SAE), LTE and LTE-Advanced; LTE-Advanced E- UTRAN architecture; Protocol stack: NAS (Non- Access Stratum), RRC (Radio Resource Control), PDCP (Packet Data Convergence Protocol), RLC (Radio Link Control), MAC (Medium Access Control); Evolved Packet Stratum: Mobility Management Entity (MME), Serving Gateway (S- GW), Packet Data Network Gateway (PDN-GW).

UNIT II SPECTRUM AND RF CHARACTERISTICS (9 Hrs)

Carrier aggregation: LTE and LTE-Advanced carrier aggregation scenario; Control channels; Multiple access scheme; Transceiver architecture; Spectrum sharing; Research challenges: Transceiver design; Increased FFT size, Resource management; Retransmission control; Overview of RF Requirements for LTE

UNIT III KEY 4G TECHNOLOGIES (9 Hrs)

OFDMA; SOFTWARE DEFINED RADIO, Enhanced MIMO, HANDOVER AND MOBILITY,
Enhanced MIMO: Single-User MIMO (SU- MIMO): MIMO adaptive switching scheme. LTE- Advanced main MIMO modes; Multi-User MIMO (MU-MIMO); Cooperative MIMO; Single- site MIMO: Advanced precoding concept. Downlink MIMO transmission; Uplink MIMO transmission

UNIT IV COMP TRANSMISSION & RECEPTION (9 Hrs)

CoMP architecture: Centralized architecture, Distributed architecture, Mixed architectures: The CoMP schemes: Downlink, Uplink, Relays: Relay basic scheme, Relay deployment scenarios; Types; Duplexing schemes: Integration into RAN, Add-ons; BACKHAUL DESIGN FOR INBAND RELAYING.

UNIT V LTE VS WIMAX (8 Hrs)

WiMAX Overview: WiMAX Standards Evolution, WiMAX Deployment; Technology Comparison between LTE and WiMAX.

OUTCOMES: **Total: 45 Hrs**

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

- Describe the different standards of LTE and LTE –advanced such as SAE, EPC
- Discriminate 4G Technology.
- Differentiate relay schemes and compare LTE with WiMAX.

TEXT BOOKS:

1. Erik Dahlman, Stefan Parkvall, John Skold, "4G: LTE Advanced for Mobile Broadband,Second Edition, 2011.
2. Erik Dahlman, Stefan Parkvall, John Skold, "4G, L T E Advanced Pro and The Road to5G", 3rd Edition.

REFERENCE:

1. Christopher Cox, Wiley, "An introduction to LTE: LTE Advanced, SAE and 4G MobileCommunication, 2012

BECF188EU0 – ERROR CORRECTING CODES VIII SEMESTER

PRE-REQUISITE:

Basic Knowledge of Analog and Digital Communication

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand about the concepts of various types of error sources
- To learn the error control coding techniques applied in the field of Digital Communication.

UNIT I LINEAR BLOCK CODES (9 Hrs)

Introduction- Mathematics of Binary Codes- Parity Checks- Systematic codes- Minimum HammingDistance of a linear block code- How to Encode - Generator Matrix-Encoding with parity check matrix- Decoding with parity check matrix- Decoding by Standard Array- Codec Design for linear Block Codes- Modifications to Block Codes- Dorsch Algorithm Decoding, Syndrome decoding on symmetric channels- Hamming codes- Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings- factorization of (X^n-1) over a finite field.

UNIT II CYCLIC CODES (9 Hrs)

Introduction- Definition of a cyclic code- Example of a cyclic code- Polynomial Representation- Encoding by convolution- Establishing the cyclic property -Deducing the properties of a cyclic code-Primitive Polynomials- Systematic Encoding of cyclic codes- Syndrome of a cyclic code- Implementation of Encoding- Decoding-Decoder operation - Multiple Error Correction-Example of Multiple Error Correction- Shortened Cyclic codes- Expurgated Cyclic codes-Cyclic codes for Burst -Error correction- Spectral properties of cyclic codes.

UNIT III BCH CODES (9 Hrs)

Introduction- Specifying Cyclic codes by roots-Definition of BCH codes-Construction of BCH codes-roots and parity check matrices- Algebraic Decoding- BCH Decoding and the BCH Bound- Decodingin the frequency domain- Decoding examples for binary BCH codes- Polynomial form of the key equation- Euclid's method-Berlekamp-Massey Algorithm- Massey's minimum shift register synthesistechnique and its relation to Berlekamp's algorithm- A fast Berlekamp - Massey algorithm.

UNIT IV REED SOLOMON CODES (9 Hrs)

Introduction- Generator Polynomial for a Reed Solomon Code-Time domain encoding for Reed Solomon Code- Decoding Reed Solomon Codes- Reed Solomon Code Decoding Example-Frequency Domain Encoded Reed Solomon Code-Erasure Decoding- Generalized Minimum Distance Decoding-Welch-Berlekamp Algorithm- Singly Extended Reed Solomon Codes-Doubly Extended Reed Solomon Codes- Justeen codes, MDS codes, Alterant, Goppa codes

UNIT V CONVOLUTION CODES (9 Hrs)

Introduction- General properties of Convolutional codes- Generator Polynomials – Terminology- Encoder State Diagram- Distance Structure of Convolutional codes-Evaluating Distance and weight Structures- Maximum Likelihood Decoding- Viterbi Algorithm- General properties –Example of viterbi decoding- issues arising- Practical implementations of viterbi decoding-Performance of Convolutional codes- Good Convolutional codes- punctured Convolutional codes- Applications of Convolutional codes- codes for multilevel modulations- Wozencraft's sequential decoding algorithm,Fann's algorithm.

Total: 45 Hrs

OUTCOMES:

At the end of the course, students will demonstrate the ability to:

- Understand the error sources
- Understand error control coding applied in Digital Communication

TEXT BOOKS:

1. F.J. McWilliams and N.J.A. Slone, "The theory of error correcting codes", 1977.
2. R.E. Balahut, "Theory and practice of error control codes", Addison Wesley, 1983.

REFERENCES:

1. Peter Sweeney, "Error Control Coding from theory to practice", John Wiley & Sons ltd, 2002.
2. Shu Lin and D.J. Costello Jr., "Error Control Coding", Prentice Hall, 1983.

BECF188EV0 – VLSI TESTING — VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Digital Circuits

OBJECTIVES:

- To understand the basics of testing and the testing equipments in VLSI
- To understand the different testing methods in VLSI

UNIT I INTRODUCTION **(8 Hrs)**

Test process and automatic test equipment, test economics and product quality, fault modelling

UNIT II DIGITAL TESTING **(9 Hrs)**

Logic and fault simulation, testability measures, combinational and sequential circuit test generation.

UNIT III ANALOG TESTING **(9 Hrs)**

Memory Test, DSP Based Analog and Mixed Signal Test, Model based analog and mixed signal test, delay test, IIDQ test.

UNIT IV DESIGN FOR TESTABILITY **(10 Hrs)**

Built-in self-test, Scan chain design, Random Logic BIST, Memory BIST, Boundary scan test standard, Analog test bus, Functional Microprocessor Test, Fault Dictionary, Diagnostic Tree, Testable System Design, Core Based Design and Test Wrapper Design, Test design for SOCs.

UNIT V LOADED BOARD TESTING **(9 Hrs)**

Unpowered short circuit tests, unpowered analog tests, Powered in-circuit analog, digital and mixed signal tests, optical and X-ray inspection procedures, functional block level design of in-circuit test equipment

OUTCOMES: **Total: 45 Hrs**

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

- Explain different testing equipments.
- Design the different testing schemes for a circuit.
- Discuss the need for test process

TEXT BOOK:

1. Michael L. Bushnell and Vishwani D. Agarwal, “Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits”, Springer, 2006.

REFERENCE:

1. Dimitris Gizopouilos, “Advances in Electronic Testing”, Springer, 2006

BECF188EW0 – SATELLITE COMMUNICATION VIII SEMESTER

PRE-REQUISITE:

Basic knowledge of Antennas and Digital Communication

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of satellite orbits.
- To understand the satellite segment and earth segment.
- To analyze the various methods of satellite access.
- To understand the applications of satellites.

UNIT I SATELLITE ORBITS (9 Hrs)

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse- Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT AND SATELLITE LINK DESIGN (9 Hrs)

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, Communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite Uplink and Downlink Analysis and Design, Link Power Budget, C/N calculation, G/T ratio-Performance Impairments-System noise, Inter-modulation Noise, Noise Temperature, Propagation Factors, Rain and Ice effects, Polarization.

UNIT III EARTH SEGMENT (9 Hrs)

Introduction – Receive – Only home TV systems (TVRO) – Outdoor UNIT – Indoor UNIT for analog(FM) TV – Master antenna TV system (MATV) – Community Antenna TV system (CATV) – Transmit – Receive earth stations, Antennas, Terrestrial Interface, Equipment Measurements on G/T, C/N, EIRP, Antenna Gain.

UNIT IV SATELLITE ACCESS (9 Hrs)

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption.

UNIT V SATELLITE APPLICATIONS (9 Hrs)

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV (BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

OUTCOMES: **Total: 45 Hrs**

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

- Analyze the satellite orbits.
- Analyze the earth segment and space segment.
- Design various satellite applications

TEXT BOOK:

1. Dennis Roddy, "Satellite Communication", Fourth Edition, McGraw Hill, 2006.

REFERENCES:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite CommunicationSystems Engineering", Prentice Hall, 2007.
2. N. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "Satellite Communication Applications", Hand Book, Artech House BostanLondon, 1997.
4. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill, 1984.
5. Robert G. Winch, "Telecommunication Transmission Systems", McGraw-Hill, 1983.
6. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan, 2003.

BECF188EX0 - RADAR AND NAVIGATIONAL AIDS VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Antenna Propagation and Digital communication

OBJECTIVES:

- To understand Doppler principle for target detection in Radars
- To understand Principles of antennas and propagation related to radars along with studyof transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids relatedto navigation

UNIT I INTRODUCTION TO RADAR EQUATION (9 Hrs)

Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses – Other Radar Equation Considerations.

UNIT II MTI AND PULSE DOPPLER RADAR (9 Hrs)

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

UNIT III DETECTION OF SIGNALS IN NOISE (9 Hrs)

Matched –Filter Receiver –Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters- Frequency-Scan Arrays Radar Transmitters and Receivers - Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers -Other RF Power Sources – Other aspects of Radar Transmitter.- The Radar Receiver - Receivernoise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV RADIO DIRECTION AND RANGES (9 Hrs)

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range (VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments. Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System -Decca Receivers - Range and Accuracy of Decca - The Omega System

UNIT V SATELLITE NAVIGATION SYSTEM (9 Hrs)

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment – Instrument Landing System - Ground Controlled Approach System - Microwave Landing System (MLS) The Doppler Effect - Beam Configurations -Doppler Frequency Equations – Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped- Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navistar Global Positioning System (GPS).

OUTCOMES: Total: 45 Hrs

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

- Explain the principles of navigation
- Derive and discuss the range equation and nature of detection

TEXTBOOKS:

1. Merrill I. Skolnik," Introduction to Radar Systems", 3rd Edition, McGraw-Hill, 2003.
2. N.S. Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.

REFERENCES:

1. Peyton Z. Peebles: "Radar Principles", John Wiley, 2002.
2. J.C Toomay, "Principles of Radar", 2nd Edition, PHI, 2004

BECF188EY0 – WAVELET AND ITS APPLICATIONS VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Signals & Systems and Digital Signal Processing

OBJECTIVES:

- To understand the fundamentals of Wavelet Transform
- To learn the multi-resolution analysis technique with respect to WT
- To know the characteristics of types of wavelet transforms and their applications

UNIT I FUNDAMENTALS OF WAVELET TRANSFORMS (9 Hrs)

Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.

UNIT II MULTI RESOLUTION ANALYSIS (9 Hrs)

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General OrthonormalMRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS (9 Hrs)

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency –Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal) – Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM (9 Hrs)

Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by FilterBanks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT – Multi Band Wavelet Transforms Lifting Scheme- Wavelet Transform Using Polyphase Matrix Factorization – GeometricalFoundations of Lifting Scheme – Lifting Scheme in Z –Domain.

UNIT V APPLICATIONS (9 Hrs)

Wavelet methods for signal processing- Image Compression Techniques: EZW–SPHIT Coding – Image Denoising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions – Edge Detection and Object Isolation, Image Fusion, and Object Detection.

OUTCOMES: **Total: 45 Hrs**

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

- Understand the fundamentals of Wavelet Transform
- Implement the multiresolution analysis technique with respect to WT
- Understand the characteristics of Wavelet Transforms and their applications

TEXTBOOKS:

1. R. Rao R M and A S Bopardikar, “Wavelet Transforms Introduction to theory andApplications”, Pearson Education, Asia, 2000.
2. L.Prasad & S.S.Iyengar, “Wavelet Analysis with Applications to Image Processing”, CRCPress, 1997.

REFERENCES:

1. J. C. Goswami and A. K. Chan, “Fundamentals of wavelets: Theory, Algorithms andApplications" John Wiley, 1999.
2. M. Vetterli, J. Kovacevic, “Wavelets and sub band coding" Prentice Hall Inc, 1995.
3. Stephen G. Mallat, “A wavelet tour of signal processing" 2 nd Edition Academic Press, 2000.
4. Soman K P and Ramachandran K I, “Insight into Wavelets from Theory to practice” PrenticeHall, 2004

LIST OF OPEN ELECTIVE

COURSES (OEC)

BECF185OEA – DISASTER MANAGEMENT V SEMESTER

L	T	P	C
3	0	0	3

PRE - REQUISITE:

Basic Knowledge of Environmental Science

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters,disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To develop rudimentary ability to respond to their surroundings with potential disasterresponse in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS (9 Hrs)

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) (9 Hrs)

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- non structural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT (9 Hrs)

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA (9 Hrs)

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response andPreparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELDWORKS (9 Hrs)

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Madedisasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field worksrelated to disaster management.

Total: 45 Hrs

OUTCOMES:

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

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disasterdamage assessment and management

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India EducationPvt. Ltd., 2012.
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management,NIDM,
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers,New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

BECF185OEB – CRYPTOGRAPHY & NETWORK SECURITY V SEMESTER

PRE- REQUISITE:

Basic knowledge of Digital Communication

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand OSI security architecture and classical encryption techniques.
- To acquire fundamental knowledge on the concepts of finite fields and number theory.
- To understand various block cipher and stream cipher models.
- To describe the principles of public key cryptosystems, hash functions and digital signature.

UNIT I INTRODUCTION & NUMBER THEORY (9 Hrs)

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography). FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem- Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY (9 Hrs)

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography:Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES (9 Hrs)

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr

UNIT IV SECURITY PRACTICE & SYSTEM SECURITY (9 Hrs)

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practicalimplementation of cryptography and security.

UNIT V E-MAIL, IP & WEB SECURITY (9 Hrs)

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation - Pretty Good Privacy- S/MIME. IP Security: Overview of IP sec-IP and IP v6 -Authentication Header-Encapsulation Security Payload (ESP)- Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol computing the keys-client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Total: 45 Hrs

OUTCOMES:

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

- Design firewalls and intrusion detection system
- Design security services for E-mail

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education,March 2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner," Network Security", Prentice Hall ofIndia, 2002.

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols",Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysses Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition,Private Communication in Public World", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, WileyDreamtech India Pvt Ltd, 2003.
7. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995

OEC1 **NANO SCIENCE** **V SEMESTER**

PRE-REQUISITE:

Basic knowledge of Material Science & Electronics

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Understand carbon nano structures
- To Understand carbon nano tubes for data processing
- To Understand mass storage device
- To Understand data transmission interfaces and displays

UNIT I TECHNOLOGY AND ANALYSIS **(10 Hrs)**

Film Deposition Methods, Lithography, Material Removing Technologies, Etching and Chemical, Mechanical Processing, Scanning Probe Techniques, Carbon Nano Structures: Carbon Clusters, Carbon Nano tubes, Fabrication, Electrical, Mechanical and Vibrational Properties, Applications of Carbon Nano Tubes.

UNIT II LOGIC DEVICES **(9 Hrs)**

Silicon MOSFETS, Novel Materials and Alternative Concepts, Ferro Electric Filed Effect Transistors, Super Conductor Digital Electronics, Carbon Nano Tubes for Data Processing.

UNIT III RANDOM ACCESS MEMORIES **(8 Hrs)**

High Permittivity Materials for DRAMs, Ferro Electric Random Access Memories, Magneto- Resistive RAM.

UNIT IV MASS STORAGE DEVICES **(9 Hrs)**

Hard Disk Drives, Magneto Optical Disks, Rewriteable DVDs based on Phase Change Materials,Holographic Data Storage.

UNIT V DATA TRANSIMISSION, INTERFACES AND DISPLAYS **(9 Hrs)**

Photonic Networks, Microwave Communication Systems, Liquid Crystal Displays, Organic LightEmitting Diodes.

OUTCOMES: **Total: 45 Hrs**

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

- Understand the basic structure and functioning of carbon nano tube
- Super conductors in digital electronics
- Materials and material processing for DRAMs,
- Technique for mass storage devices
- Data transmission interfaces and displays

TEXTBOOKS:

1. Rainer Waser, “Nano Electronics and Information Technology”, Wiley VCH, April 2003.
2. Charles Poole, “Introduction to Nano Technology”, Wiley Interscience, May 2003.

BECF185OEC – PLC AND DATA ACQUISITION SYSTEMS V SEMESTER

PRE-REQUISITE:

Analog and Digital Electronics

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable the students to

- To understand the need of computer control in automation.
- To study the data acquisition systems.
- To study the evolution and advantages of PLC.
- To understand the various PLC instructions.
- To study the use of PLC for some specific applications.

UNIT I COMPUTER CONTROL-INTRODUCTION (8 Hrs)

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers-Supervisory computer control- Direct digital control-Digital control interfacing-SCADA.

UNIT II DATA ACQUISITION SYSTEMS (9 Hrs)

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation – Microprocessor/PC based acquisition systems.

UNIT III BASICS OF PLC (10 Hrs)

Definition and History of PLC-PLC advantage and disadvantages- Over all PLC systems-CPU and Programmer/Monitors-PLC input and output models – Architecture- PLC Programming language – Relay logic – Ladder logic – Programming of Gates – Flow charting as a programming method – connecting PLC to computer - PLC Troubleshooting and Maintenance.

UNIT IV PLC PROGRAMMING (9 Hrs)

Programming of Timers – Introduction - ON delay, OFF delay, Retentive Timers – PLC Timer functions – Examples of timer function Industrial application, Programming Counters – up/down counter – Combining counter - Examples of counter function Industrial application. PLC Arithmetic Functions – PLC number Comparison function.

UNIT V PLC DATA HANDALING FUNCTIONS (9 Hrs)

PLC Program Control Instructions: Master Control Reset - Skip – Jump and Move Instruction. Sequencer instructions - Types of PLC Analog modules and systems, PLC analog signal processing –BCD or multi bit data processing – Case study of Tank level control system, bottle filling system andSequential switching of motors.

Total: 45 Hrs

OUTCOMES:

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

- Able to understand the need of computer in Automation.
- Understand the basics of data conversion and data acquisition.
- Understand the fundamental of PLC.
- Program a PLC with different logical languages.
- Various industrial Applications of PLCs are studied.

TEXT BOOKS:

1. Petrezeulla, "Programmable Logic Controllers", McGraw Hill, 1989.
2. Curtis D. Johnson," Process Control Instrumentation Technology", 8th edition PHI, 2005

REFERENCES:

1. Hughes .T, "Programmable Logic Controllers", ISA Press, 1989.
2. G.B.Clayton," Data Converters", The Mac Millian Press Ltd., 1982.
3. John w.Webb & Ronald A.Reis., "Programmable logic controllers- principles andapplications", 5th Edition, PHI, 2010.

OEC1 AUTOTRONICS V SEMESTER

PRE-REQUISITE:

Automobile Engineering

L	T	P	C
3	0	0	3

OBJECTIVES:

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

- To understand the basics of ignition, injection and engine control systems
- To learn the various chassis and safety system operation and applications
- To learn about various methods of sensors and actuators for engine control parameters

OUTCOMES:

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

- Develop through basic knowledge about various ignition and injection systems.
- Acquire knowledge on the safety systems of the automobile.
- Learn about various methods of sensors for engine controls.

UNIT I INTRODUCTION (9 Hrs)

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards, Charging systems: Working and design ofcharging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits

UNIT II IGNITION AND INJECTION SYSTEMS (9 Hrs)

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuelinjection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS (9 Hrs)

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect,Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS (9 Hrs)

Control modes for fuel control-engine control subsystems – ignition control methodologies – differentECU‟s used in the engine management – block diagram of the engine management system. In vehiclenetworks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS (9 Hrs)

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TEXT BOOKS: **Total: 45 Hrs**

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint,2013

REFERENCES:

1. Tom Denton, “Automobile Electrical and Electronics Systems”, Edward Arnold Publishers,2000.
2. Barry Hollembeak, “Automotive Electricity, Electronics & Computer Controls”, DelmarPublishers, 2001.
3. Richard K. Dupuy “Fuel System and Emission controls”, Check Chart Publication, 2000.
4. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.

BECF186OEF – REMOTE SENSING & GIS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic Knowledge of Science & Engineering

OBJECTIVES:

- To provide students an exposure to Remote sensing
- To ensure that students begin to understand the geographic information system

UNIT I REMOTE SENSING (9 Hrs)

Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR , Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS (9 Hrs)

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface

UNIT III OPTICAL AND MICROWAVE REMOTE SENSING (9 Hrs)

Satellites - Classification – Based on Orbits – Sun Synchronous and Geo Synchronous – Based on Purpose – Earth Resources Satellites, Communication Satellites, Weather Satellites, Spy Satellites – Satellite Sensors - Resolution – Spectral, Spatial, Radiometric and Temporal Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle – Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics

UNIT IV GEOGRAPHIC INFORMATION SYSTEM (9 Hrs)

GIS – Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering
– Data Output – Printers and Plotters 43

UNIT V MISCELLANEOUS TOPICS (9 Hrs)

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems.

Total: 45 Hrs

OUT COMES:

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

- Understand the concept of remote sensing
- Understand the different application of GIS

TEXT BOOKS:

1. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001.
2. M.G. Srinivas, Remote Sensing Applications, Narosa Publishing House, 2001.

REFERENCES:

1. Lillesand T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley andSons, Inc, New York.
2. Janza.F.J., Blue, H.M., and Johnston, J.E., "Manual of Remote Sensing Vol.I, AmericanSociety of Photogrammetry, Virginia, U.S.A, 1975

BECF186OEG – BIG DATA ANALYTICS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic Knowledge on Data bases, Data mining and Data Structures.

OBJECTIVES:

- To understand Big Data models and structure
- Introduction to Analytic Tool –R
- Mining Data streams for Analytics
- Understanding Map Reduce Framework
- Advanced Analytic Tools and Techniques

UNIT I INTRODUCTION TO ANALYTIC TOOL (9 Hrs)

R Using R for Initial Analysis of the Data -Introduction to R programming, initial exploration - analysis of the data using R - basic visualization using R –Basic Scripting-Data Set Analysis.

UNIT II OVERVIEW OF DATA ANALYTICS (9 Hrs)

Introduction to Big Data Analytics -definition -overview of big data - Characteristics– Importance ofBig Data - data preparation -model planning,-Use cases-critical activities in each Phase of the lifecycle.

UNIT III MINING DATA STREAMS (9 Hrs)

The Stream Data Model .-Sampling Data in a Stream -Filtering Streams - Counting Distinct Elementsin a Stream - Estimating Moments .- Counting Ones in a Window Link Analysis : Page Rank -Topic-Sensitive Page Rank -Link Spam -Hubs and Authorities.

UNIT IV MAPREDUCE AND THE NEW SOFTWARE STACK (9 Hrs)

Distributed File Systems-Map Reduce Algorithms Using Map Reduce-Extensions to MapReduce the Communication Cost Model-Complexity Theory for Map Reduce.

UNIT V BIG DATA FROM THE TECHNOLOGY PERSPECTIVE (9 Hrs)

Introduction to Hadoop –Components of Hadoop –Application Development in Hadoop –Pig Hive- Jaql, Getting Data in Hadoop-copy Data-Flume, Other Hadoop Components-Zoo Keeper HBase- Oozie.

OUTCOMES: **Total: 45 Hrs**

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

- Have Strong Foundations on Data Analytics Models and structure
- Understand the Role of Big Data and its importance
- Data modeling and Link stream Analysis
- Able to setup Analytical Environment using R-Studio
- Able to perform simple analysis application and programs using R –Scripts.

TEXT BOOKS:

1. Jure Leskovec ,Anand Rajaraman, Jeffrey D.Ullman, “Mining of Massive Datasets” ,SecondEdition, Cambridge University Press, 2014.
2. Paul Zikopoulos, “Understanding Big Data”, First Edition, McGraw Hill Corporations-2012.

REFERENCES:

1. Garrett Grolemund, “Introduction to Data Science with R”, O’Reilly media, 2014.
2. Garrett Grolemund, “Hands-On Programming with R: Write Your Own Functions and Simulations Paperback”, O'Reilly media, 2014.

BECF186OEH - COMPUTER INTEGRATED MANUFACTURING VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic Knowledge of CAD & CAM

OBJECTIVES:

- To know about the CIM.
- To know about the Group technology and process planning.

UNIT I **(9 Hrs)**

Introduction to Automation -Production system Facilities, Manufacturing Support Systems, Automation in Production Systems, Automated Manufacturing Systems, Types of Automation, Computerized manufacturing Support System, Reasons for Automating, Manufacturing Industries and Products, Manufacturing operations, Product / Production Relationships, Production Concepts and Mathematical Models. Basic elements of an Automated System, Advanced Automation Functions, Levels of Automation, Industrial Control Systems-Process Industries versus Discrete Manufacturing Industries, Continuous versus Discrete Control, Computer Process Control, Forms of Computer Process Control

UNIT II **(9 Hrs)**

Fundamentals of CAD, CAM and CAE, CIM Definition, CIM Wheel, CIM components, Evolution of CIM - Development of computers - Needs of CIM, Benefits of CIM. CIM Hardware & Software, CIM Models, DBMS and Network system - Data base and DBMS- requirement, features and architecture of DBMS, CIM Communications (Network) System, Communication Matrix, Network Architectures, Tools and Techniques

UNIT III **(9 Hrs)**

Group Technology – Introduction - coding and classification system, Production Flow Analysis, Coding System - OPTIZ, MICLASS, Benefits of Group Technology, Machine cell design. Process Planning- Structure of a Process Planning, Process Planning function, CAPP - Types of CAPP, Retrieval and Generative type CAPP, Concurrent engineering, Design for Manufacturing and Assembly, Advanced Manufacturing Planning.

UNIT IV **(9 Hrs)**

Fundamentals of NC Technology – Basic components of an NC System, NC Coordinate and Motion Control systems, Computer Numerical Control, Features of CNC, Machine Control Unit for CNC, CNC Software, DNC Machines, Application of NC machine tools Applications, Structure of CNC Machines,CNC Controllers, NC Part Programming, Computer-Assisted Part Programming. Features and Applications of CNC Turning Centre, CNC Milling Machine, CNC Turn-Mill Centre, CNC machining Centre, CNC Tooling system and Automatic Tool Changing System, Computer Aided Quality Control- contact, non-contact inspection methods, Coordinate Measuring Machine CMM - Integration of CAQC with CAD / CAM.

UNIT V **(9 Hrs)**

FMS -Components of FMS, Computer control and function, FMS planning, scheduling and control, Knowledge Based Scheduling, FMS operation control, Hierarchy of computer control, supervisory control, types of software used in FMS, Applications and Benefits. Production Support Machines andSystems -Industrial Robots, Automated Material Handling, Automatic Guided Vehicles, Automated Storage and Retrieval system. Developments in Manufacturing Technologies- AI and Expert System, Agile manufacturing, Lean Manufacturing, Virtual Manufacturing, Simulation in Manufacturing – Factories of Future.

Total: 45 Hrs

OUTCOMES:

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

- Develop through basic knowledge about CIM.
- Acquire knowledge on the applications of CIM.
- Learn the usage of group technology and process planning.

TEXT BOOKS:

1. Kant Vajpayee.S, "Principles of Computer- Integrated Manufacturing"; 1st ed. PHI 2006.
2. Mikell p. Groover, "Automation, Production Systems & CIM", 2nd ed. PHI 2001.
3. James A.Rehg, Henry W.Kraebber, "Computer- Integrated Manufacturing", second Edition,Pearson Education.
4. P.N. Rao, "CAD/CAM Principles and Applications", Second Edition, TMH 2006.

REFERENCES:

1. Radhakrishnan.P, Subramanyan. S, Raju.V, "CAD/CAM/CIM", Second Edition, New AgeInternational publishers, 2000
2. Daniel Hunt.V., "Computer Integrated Manufacturing Hand Book", Chapman & Hall, 1989
3. Groover M.P, "Computer Aided Design and Manufacturing", Prentice Hall of India, 1987
4. Yorem Koren, "Computer Control of Manufacturing System", McGraw Hill, 1986
5. Ranky Paul. G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
6. Roger Mannam, "Computer Integrated Manufacturing from Concepts of Realization" 1st ed.Addison Wiley, 1997.
7. P. N. Rao, "Computer Aided Manufacturing", TMH, 2007, 12th Edition.

BECF186OEI – OPERATIONAL RESEARCH VI SEMESTER

PRE-REQUISITE:

Basic knowledge of Mathematics

L	T	P	C
3	0	0	3

OBJECTIVE:

- To improve a quantitative decision making procedure.

UNIT I LINEAR PROGRAMMING AND SIMPLEX METHOD (9 Hrs)

Mathematical formulation of the problem - Graphical solution method - Exceptional cases – General linear programming problem - Canonical and standard forms of linear programming problem - The simplex method - Computational procedure : The simplex algorithm - Artificial variable techniques :Big M method, Two phase method - problem of degeneracy.

UNIT II TRANSPORTATION, ASSIGNMENT AND ROUTING PROBLEMS (9 Hrs)

Mathematical formulation of the transportation problem - Triangular basis - Loops in a transportationtable - Finding initial basic feasible solution (NWC, IBM and VAM methods) - Moving towards optimality- Degeneracy in transportation problems- Transportation algorithm (MODI method) – Unbalanced transportation problems - Mathematical formulation of the assignment problem - Assignment algorithm Hungarian assignment method – Routing problems : Travelling salesman problem.

UNIT III GAME THEORY AND SEQUENCING PROBLEMS (9 Hrs)

Two person zero sum games - Maxmin Minmax principle - Games without saddle points (Mixed strategies) - Solution of 2 X 2 rectangular games - Graphical method - Dominance property - Algebraic method for m x n games - Matrix oddments method for m x n games - Problem of sequencing - Problems with n jobs and 2 machines - Problems with n jobs and k machines - Problemswith 2 jobs and k machines.

UNIT IV INTEGER PROGRAMMING AND INVENTORY CONTROL (9 Hrs)

Gomory's All I.P.P method - Gomory's mixed integer method - Branch and bound method - Reasons for carrying inventory - Types of inventory - Inventory decisions - Economic order quantity - Deterministic inventory problem – EOQ problem with price breaks - Multi item deterministic problem.

UNIT V REPLACEMENT PROBLEMS AND PERT/CPM (9 Hrs)

Replacement of equipment or asset that deteriorates gradually - Replacement of equipment that fails suddenly - Recruitment and promotion problem - Network and basic components - Rules of network construction - Time calculations in networks - Critical path method (CPM) - PERT - PERT calculations - Negative float and negative Slack - Advantages of network (PERT/CPM).

OUTCOMES: **Total: 45 Hrs**

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

- ❖ Understand the Concept of Routing Problems
- ❖ Understand the Integer Programming and Replacement Problems

TEXT BOOKS:

1. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Eighth Edition, SultanChand & Sons, New Delhi, 1999.

REFERENCES:

1. H.A.Taha, Operations Research, Sixth Edition, MacMillen.
2. Richard Bronson, Operations Research, Schaum's Outline Series, McGraw Hill, 1982. J.K.Sharma, Operation Research (Theory and Applications), MacMillen, 1997

BECF186OEJ - 3D PRINTERS & APPLICATIONS VI SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE: Basic knowledge of Control & Instrumentation

OBJECTIVES:

- To develop CAD models for 3D printing
- To import and export CAD data and generate. STL file
- To select 3D printing process for an application.ect a specific material for the given application
- To produce a product using 3D printing or Additive Manufacturing (AM)

UNIT I 3D PRINITING (ADDITIVE MANUFACTURING) (9 Hrs)
Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.

UNIT II CAD FOR ADDITIVE MANUFACTURING (9 Hrs)
CAD Data formats, Data translation, Data loss, STL format.

UNIT III ADDITIVE MANUFACTURING TECHNIQUES (9 Hrs)
Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, HealthCare, Defence, Automotive, Construction, Food Processing, Machine Tools.

UNIT IV MATERIALS (9 Hrs)
Polymers, Metals, Non-Metals, Ceramics - Various forms of raw material – Liquid, Solid, Wire, Powder, Powder Preparation and their desired properties, Polymers and their properties. Support Materials.

UNIT V ADDITIVE MANUFACTURING EQUIPMENT AND POST PROCESSING (9 Hrs)
Process equipment- design and process parameters -Governing bonding mechanism -Common faults and troubleshooting- Process design- Post processing: requirement and techniques Product quality - Inspection and testing- Defects and their causes

Total: 45 Hrs

OUTCOMES:
Upon completion of this course, Students should be able to -

- Develop CAD models for 3D printing.
- Import and Export CAD data and generate STL file.
- Select a specific material for the given application.
- Select a 3D printing process for an application.
- Produce a product using 3D Printing or Additive Manufacturing (AM).

TEXT BOOKS:

1. Andreas Gebhardt and Jan-Steffen Hötter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.
2. Ian Gibson, David W. Rosen and Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", 2nd edition, Springer., United States, 2015, ISBN- 13: 978-1493921126.

REFERENCES:

1. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.
2. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications",World Scientific, 2017.
3. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series inMaterial Science, 2013.
4. L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping",Kulwer Academic Press, 2001.
5. Zhiqiang Fan And Frank Liou, "Numerical Modeling of the Additive Manufacturing (AM)Processes of Titanium Alloy", InTech, 2012.

BECF187OEK – SENSORS & ACTUATORS VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Basic Electronics

OBJECTIVES:

- To acquire knowledge about the principles and analysis of sensors.
- To emphasis on characteristics and response of micro sensors.
- To acquire adequate knowledge of different transducers and Actuators.
- To learn about the Micro sensors and Micro actuators.
- To select sensor materials for fabrication for different applications

UNIT I SENSORS (9 Hrs)

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

.UNIT II INDUCTIVE AND CAPACITIVE TRANSDUCERS (9 Hrs)

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. **Capacitive transducers:** - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT III ACTUATORS (9 Hrs)

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators,Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

UNIT IV MICRO SENSORS AND MICRO ACTUATORS (9 Hrs)

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

UNIT V SENSOR MATERIALS AND PROCESSING TECHNIQUES (9 Hrs)

Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials. Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining: Bulk silicon micromachining, Surface silicon micromachining, LIGA process.

Total: 45 Hrs

OUTCOMES:

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

- Analyze the basics and design the resistive sensors.
- Identify the materials and designing of inductive and capacitive sensors.
- Analyze various types of Actuators.
- Design Micro sensors and Micro actuators for various applications.
- Implement fabrication process and technologies and compare various Micro-machiningprocesses

TEXT BOOKS:

1. Patranabis.D, Sensors and Transducers, Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, Microsystem Technology and Microbotics First edition,Springer – Verlag Newyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourthedition, Springer, 2010.

REFERENCES:

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBHpublishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, Micro actuators Electrical, Magnetic, thermal, optical, mechanical,chemical and smart structures, First edition, Kluwer academic publishers, Springer, 1997.
4. Manfred Kohl, Shape Memory Actuators, first edition, Springer.

BECF187OEL – ADHOC NETWORKS VII SEMESTER

PRE-REQUISITE:

Basic knowledge of Data Communication Networks

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the wireless networks
- To understand the concept of wireless protocols

UNIT I INTRODUCTION TO WIRELESS NETWORKS (9 Hrs)

Characteristics of wireless channels, Fundamentals of WLANs, IEEE 802.11 standard, HIPERLAN Standard, First-, Second, third and beyond 3G - generation cellular systems, WLL, Wireless ATM, IEEE 802.16 standard, HIPERACCESS, AdHoc Wireless Internet.

UNIT II MAC, ROUTING AND MULTICAST ROUTING PROTOCOLS (9 Hrs)

MAC Protocols: Design issues, goals and classification, Contention –based protocols with reservationand scheduling mechanisms, Protocols using directional antennas. Routing protocols: Design issues and classification, Table-driven, On-demand and Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical and power-aware routing protocols. Multicast Routing Protocols: Design issues and operation, Architecture reference model, classification, Tree based and Mesh-based protocols, Energy-efficient multicasting.

UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS (9 Hrs)

Transport layer Protocol: Design issues, goals and classification, TCP over AdHoc wireless Networks, Security, Security requirements, Issues and challenges in security provisioning, Network security attacks, Security routing. Quality of Service: Issues and challenges in providing QoS, Classification ofQoS solutions, MAC layer solutions, Network layer solutions, QoS frameworks.

UNIT IV WIRELESS SENSOR NETWORKS (9 Hrs)

Architecture, Data dissemination, Date gathering, MAC protocols, location discovery, Quality of a sensor network.

UNIT V ENERGY MANAGEMENT (9 Hrs)

Classification of battery management schemes, Transmission power management schemes, System power management schemes. Performance Analysis -ABR beaconing, Performance parameters,Route-discovery time, End-to-end delay performance, Communication throughput performance, Packet loss performance, Route reconfiguration repair time, TCP/IP based applications.

OUTCOMES: **Total: 45 Hrs**

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

- Understand the fundamentals of sensor networks
- Understand the various wireless sensor protocols

TEXTBOOKS:

1. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures andprotocols, Prentice Hall PTR, 2004.
2. C.K.Toh, AdHoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR,2001

REFERENCES:

1. Mohammad Ilyas, The Handbook of AdHoc Wireless Networks, CRC press, 2002.
2. Charles E. Perkins, AdHoc Networking, Addison – Wesley, 2000.
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, Mobile AdHocNetworking, Wiley – IEEE press, 2004.

BECF187OEM – ARTIFICIAL INTELLIGENCE VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Computer Architecture

OBJECTIVES:

- The course aims to provide some fundamentals of AI and algorithms required to produce AI systems able to exhibit limited human-like abilities, particularly in the form of problem solving by search, representing and reasoning with knowledge and panning.

UNIT I **(9 Hrs)**

Introduction – Foundations of AI, the History of AI –Intelligent Agent – Agent and Environment, Good Behaviour: The Concept of Rationality, Nature of Environments, Structure of Agents- ProblemSolving Agents -Example Problems.

UNIT II **(9 Hrs)**

Uninformed Searching strategies-Breadth First Search, Depth First search, Depth limited search, Iterative deepening search, Bidirectional Search - Avoiding repeated States - Searching with Partial information – Informed search strategies – Greedy Best First Search-A* Search-Heuristic Functions- Local Search Algorithms for Optimization Problems-Local search in Continuous Spaces.

UNIT III **(9 Hrs)**

Online Search Agents and Unknown Environments-Online Search Problems, Online Search Agents- Online Local search, learning in Online Search – Constraint Satisfaction Problems- Backtracking CSP, The Structure of Problems-Adversarial Search-Games, Optimal Decisions in Games, Alpha- Beta Pruning.

UNIT IV **(9 Hrs)**

Logical agents – Knowledge Based Agents, The Wumpus World, Propositional Logic-A very simpleLogic –First Order logic– inferences in first order logic – forward chaining – backward chaining – Unification – Resolution.

UNIT V **(9 Hrs)**

Planning with state space search – Partial-order planning – Planning graphs – Planning and acting in the real world.

OUTCOMES: **Total: 45 Hrs**

At the end of the course students should able to:

- Understand the fact that the computational complexity of most AI problems requires usregularly to deal with approximate techniques;
- Appreciate different perspectives on what the problems of artificial intelligence are and howdifferent approaches are justified.
- Design basic problem solving methods based on AI-based search, knowledge representation,reasoning with knowledge and panning.

TEXT BOOK:

1. S. Russel and P. Norvig, “Artificial Intelligence –A Modern Approach”, Second Edition,Pearson Education 2003.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, “Computational Intelligence: a LogicalApproach”, Oxford University Press, 2004.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for Complex Problem Solving”,Fourth Edition, Pearson Education, 2002.

BECF187OEN – TOTAL QUALITY MANAGEMENT VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Principles of Management and Professional Ethics

OBJECTIVES:

- To introduce the basic functions of Total Quality Management
- To learn the principles of TQM
- To impart knowledge on statistical process control techniques
- To study the usage of tools for problem solving
- To familiarize various system standards

UNIT I INTRODUCTION (9 Hrs)

Definition of quality, dimensions of quality, quality planning, quality costs - analysis Techniques forquality Costs, basic concepts of total quality management, historical review, principles of TQM, leadership – concepts, Role of senior management, quality council, quality statements, Strategic planning, deming philosophy, Barriers to TQM implementation.

UNIT II TOTAL QUALITY MANAGEMENT PRINCIPLES (9 Hrs)

Customer satisfaction – customer perception of quality, customer complaints, service quality, customer retention, employee involvement – motivation, empowerment, teams, recognition and reward, performance appraisal, benefits, continuous process improvement – Juran trilogy, pdsa cycle, 5s, kaizen, supplier partnership – partnering, sourcing, supplier selection, supplier rating, relationshipdevelopment, performance measures – basic concepts, strategy, performance measure.

UNIT III TOTAL QUALITY MANAGEMENT TOOLS (9 Hrs)

Bench marking – reasons to benchmark, benchmarking process, quality function deployment (QFD) –house of quality, QFD process, benefits, taguchi quality loss function, total productive maintenance (TPM) – concept, improvement needs, FMEA – stages of FMEA.

UNIT IV QUALITY SYSTEMS (9 Hrs)

Quality Auditing - Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

UNIT V STATISTICAL PROCESS CONTROL (SPC) (9 Hrs)

The seven tools of quality, statistical fundamentals – measures of central tendency and dispersion, population and sample, normal curve, control charts for variables and attributes, process capability, concept of six sigma, new seven management tools.

Total: 45 Hrs

OUTCOMES:

Upon completion of this course, Students should be able to

- Understand the basics of TQM
- Explain the principles of TQM
- Solve problems on statistical process control
- Use the tools for finding solutions
- Gain knowledge on system standards

TEXT BOOK:

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003.(Indian reprint 2004).

REFERENCES:

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5thEdition), South-Western (Thomson Learning), 2002.
2. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. And Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New AgeInternational 1996.

BECF187OEO - GLOBAL POSITIONING SYSTEMS VII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Communication Systems

OBJECTIVES:

- To understand the basics of GPS
- To understand the geographical co-ordinate system.

UNIT I **(9 Hrs)**

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems –GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reportingAnti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II **(9 Hrs)**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System –Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link toEarth Rotation – Time and Earth Motion Services.

UNIT III **(9 Hrs)**

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced andDifferenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV **(9 Hrs)**

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Observables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V **(9 Hrs)**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation– Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS –Metrological and Climate Research using GPS.

OUTCOMES: **Total: 45 Hrs**

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

- Learn the GPS systems
- Understand the geographic systems and their applications.

TEXT BOOKS:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4threvised edition, Springer, Wein, New york, 1997
2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons, NewYork, 1995.

REFERENCES:

1. B.Parkinson, J.Spilker, Jr. (Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA,Enfant Promenade SW, Washington, DC 20024, 1996.

A.Kleusberg and P.Teunisen (Eds), “GPS for Geodesy”, Springer-Verlag, Berlin, 1996

4. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

BECF188OEP – ROBOTICS AND AUTOMATION VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Sensors and Transducers

OBJECTIVES:

The course will enable the students to:

- To familiarize the student with the anatomy of robots and their applications.
- To specify and provide the knowledge of techniques involved in robot vision system.
- To provide knowledge about various kinds of end effectors.
- Understand the various kinematics and inverse kinematics of robots.
- To equip students with latest robot languages implemented in industrial manipulators.

UNIT I INTRODUCTION TO ROBOTICS (9 Hrs)

Need for Robots, Asimov's laws of robotics, Basic components-Classification, Characteristics-Work volume, spatial resolution and repeatability, Precision and accuracy. Coordinate system- Drives & Control systems, Actuators, Applications of Robots.

UNIT II SENSORS IN ROBOTICS (9 Hrs)

Position sensors (Piezo Electric sensor, LVDT, Optical Encoders)-Proximity (Inductive, Capacitive, Hall Effect & Ultrasonic), Range sensors (Laser Meters, Lighting Approach & Time of Flight Range Finder)-Image Processing & Analysis:-Image Data reduction-Feature extraction-Object Recognition

UNIT III END EFFECTORS (9 Hrs)

Wrist configuration, Pitch, Yaw, Roll – Types of Grippers -Mechanical Grippers- Pneumatic and Hydraulic Grippers-Vacuum Cups-Magnetic Grippers –Two Fingered and Three fingered Grippers- Robot/End effectors Interface-Selection and Design Considerations.

UNIT IV ROBOT KINEMATICS (9 Hrs)

Forward Kinematics, Inverse Kinematics and the difference, Forward Kinematics and Inverse Kinematics of manipulators with two, three degrees or freedom (in two dimensional), four degrees offreedom (in three dimensional) – derivations. Homogenous transformation matrix, translational and rotational matrix, Denavit & Hartenberg representation

UNIT V ROBOT PROGRAMMING (9 Hrs)

Teach pendant programming, Lead through programming, Robot languages: VAL Programming, Motion command, Sensor command, End Effectors command. RGV, AGV, Implementation of robotsin industries, various steps, Safety considerations for robot operations. Economic analysis of robots: Pay back methods, EUAC method and Rate of return method.

Total: 45 Hrs

OUTCOMES:

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

- Able to demonstrate the mechanical structures of industrial robots.
- Able to understand the importance of robot vision.
- Able to apply knowledge and choose the best end effectors for specific applications.
- Forward and inverse kinematics of Robotics is learned.
- Able to program and industrial robot through different methods and languages.

TEXT BOOKS:

1. Ganesh. S. Hedge, "A Textbook of Industrial Robotics", Lakshmi Publications, 2008.
2. Mikell.P.Groover," Industrial Robotics-Technology, Programming and Applications",McGraw Hill, second edition 2012.

REFERENCES:

1. Oran Koren, "Robotics for Engineers", McGraw Hill, 1985.
2. Fu K.S.Gonalz R.C. and ice C.S.G."Robotics, Control, Sensing, Vision and Intelligence"McGraw Hill Ltd., 2007.
3. Deb.S.R."Robotics Technology and Flexible Automation", Tata McGraw Hill, 2010.

BECF188OEQ – HUMAN RESOURCES AND MANAGEMENT VIII SEMESTER

PRE-REQUISITE:

L	T	P	C
3	0	0	3

Principles of Management and Professional Ethics

OBJECTIVES:

The course should enable the students to:

- Introduction to Human Resources Management
- Provides the concept of best fit employee
- Given the idea of training and executive development
- Providing the knowledge of sustaining employee interest
- Understanding the method of performance evaluation and control process

UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT (9 Hrs)

Evolution of human resource management – The importance of the human factor – Challenges – Inclusive growth and affirmative action -Role of human resource manager – Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

UNIT II THE CONCEPT OF BEST FIT EMPLOYEE (9 Hrs)

Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources. Recruitment - Selection – induction – Socialization benefits

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT (9 Hrs)

Types of training methods –purpose- benefits- resistance. Executive development programmes – Common practices - Benefits – Self-development – Knowledge management.

UNIT IV SUSTAINING EMPLOYEE INTEREST (9 Hrs)

Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Development of mentor – Protégé relationships

UNIT V PERFORMANCE EVALUATION AND CONTROL PROCESS (9 Hrs)

Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change, The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

OUTCOMES: **Total: 45 Hrs**

The Students should be able to:

- Understands the perspectives of Human resources management
- Best fit employee concept provided with demand and requirement.
- Acquired the knowledge of training and executive development
- Explained the concept of sustaining the employee with compensation plans
- Acquired the method of performance evaluation and control process

TEXTBOOKS

1. Dessler Human Resource Management, Pearson Education Limited, 2007
2. Decenzo and Robbins, Human Resource Management, Wiley, 8th Edition, 2007.

REFERENCES

1. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource PHILearning. 2012
2. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
3. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
4. Ivancevich, Human Resource Management, McGraw Hill 2012.
5. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

BECF188OER – COMPUTER CONTROL OF PROCESS VIII SEMESTER

PRE REQUISITE:

Basic knowledge of Control systems

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the analysis of discrete data system
- To learn about the various digital control algorithm.
- To study the techniques of DAS, DDC, AI and SCADA.
- To learn about PLC and programming some basic applications.

UNIT I ANALYSIS OF DISCRETE DATA SYSTEM (9 Hrs)

State-space representation of discrete data systems – Selection of sampling process – Selection of sampling period – Review of z-transform – Pulse transfer function – Modified z-transform - Stabilityof discrete data system – Jury's stability test

UNIT II DESIGN OF DIGITAL CONTROLLER (9 Hrs)

Digital PID – Position and velocity form – Deadbeat's algorithm – Dahlin's algorithm – kalman's algorithm – Pole placement controller – Predictive controller.

UNIT III COMPUTER AS A CONTROLLER (9 Hrs)

Basic building blocks of computer control system – Data acquisition systems – SCADA – Direct digital control – Introduction to AI and expert control system – Case study - Design of computerizedmulti loop controller.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER (9 Hrs)

Evolution of PLC's – Components of PLC – Advantages over relay logic - PLC programming languages – Ladder diagram – Programming timers and counters – Design of PLC.

UNIT V APPLICATIONS OF PLC (9 Hrs)

Instructions in PLC – Program control instructions, math instructions, sequencer instructions – Use ofPC as PLC – Application of PLC – Case study of bottle filling system

OUTCOMES: **Total: 45 Hrs**

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

- Understand the analysis of discrete data system
- Understand about the various digital control algorithm.
- Learn the techniques of DAS, DDC, AI and SCADA.
- Understand about programming of PLC.

TEXT BOOKS;

1. P.B. Deshpande, and R.H.Ash, 'Computer Process Control', ISA Publication, USA, 1995.
2. Petruzella, 'Programmable Controllers', McGraw Hill, 1989.

REFERENCES:

1. C.M.Houpis, G.B.Lamount, 'Digital Control Systems Theory, Hardware and Software',International Student Edition, McGraw Hill Book Co., 1985.
2. G. Stephanoupoulis, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.
3. T.Hughes, 'Programmable Logic Controllers, 3rd Edition, ISA press.
4. Singh, 'Computer Aided Process Control', Prentice Hall of India, 2004.

BECF188OES – CLOUD COMPUTING VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Computer Networks

OBJECTIVES:

- To understand the concept of cloud computing
- To Understand the cloud services

UNIT I CLOUD COMPUTING PRIMER (9 Hrs)

Cloud computing characteristics, cloud definition -cloud deployment models – private, public, hybridand Community cloud, cloud services – SaaS, PaaS, and IaaS, Drivers for cloud computing, building cloud infrastructure – a phased approach- virtualization and its benefits- cloud economics and challenges.

UNIT II CLASSIC DATA CENTER (CDC) (9 Hrs)

Key elements of data center - application, DBMS, compute, storage and network, server clustering, RAID technology, intelligent storage system, DAS, FC-SAN – components, port type, addressing, and zoning, IP-SAN – iSCSI and FCIP, converged network - FCoE, NAS, object based and unified storage, business continuity terminologies, backup-recovery and duplication, local and remote replication, CDC monitoring and management, Information lifecycle strategy.

UNIT III VIRTUALIZED DATA CENTER (VDC) (9 Hrs)

Compute: Compute virtualization benefits, hypervisor types, virtual machine (VM) -resources, V M resource management, physical to virtual conversion – process, benefits. Storage: Storage virtualization benefits, storage for VMs, block and file level storage virtualization, virtual Provisioning – benefits and best practices, storage tiering. Networking: Network virtualization benefits, VDC network infrastructure components, VLANs, and Network traffic management techniques.

UNIT IV VIRTUALIZED DATA CENTER – DESKTOP AND APPLICATION (9 Hrs)

Desktop, application, and user state virtualization – benefits, tools, and deployment methods, Business Continuity in VDC:-Eliminating single points of failure, clustering, fault tolerance, and NIC teaming,backup and replication in VDC, VM templates and VM migration. Cloud Security:-Basic information security concepts, cloud security concerns and threats, security mechanisms in cloud at compute, storage, and network layer, Governance, Risk and compliance in Cloud.

UNIT V CLOUD INFRASTRUCTURE AND MANAGEMENT (9 Hrs)

Cloud infrastructure framework -components, infrastructure management and service creation tools-processes – asset - configuration management, service catalog management, financial management, capacity, performance availability management, incident, problem and compliance management. Cloud Migration Considerations:- Considerations for choosing right application and cloud model, service provider specific considerations, cloud adoption phases, Financial and technical feasibility assessment, migration and optimization considerations.

Total: 45 Hrs

OUTCOMES:

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

- Understand the pros and cons of cloud computing
- Understand cloud service development tools

TEXT BOOKS:

1. Cloud Infrastructure and Services Student Guide - EMC Education Services- 2011.

REFERENCES:

1. EMC IT's Journey to the Private Cloud: A Practitioner's Guide -2011
2. EMC IT'S "ON-RAMP" TO THE JOURNEY TO THE PRIVATE CLOUD Replat form to an
3. Open, Scalable Infrastructure-2011
4. EMC IT's Journey to the Private Cloud: Applications & Cloud Experience.
5. EMC IT's Journey to the Private Cloud: Server virtualization.
6. EMC IT's Journey to the Private Cloud: Backup & Recovery Systems.
7. EMC IT's Journey to the Private Cloud: Virtual Desktop-2011. (Incl.Ref.no: 3, 4, 5, 6)

BECF188OET – IOT ARCHITECTURE & PROTOCOLS VIII SEMESTER

L	T	P	C
3	0	0	3

PRE-REQUISITE:

Basic knowledge of Data Communication

OBJECTIVES:

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)

UNIT I OVERVIEW (9 Hrs)

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Businessprocesses in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

UNIT II REFERENCE ARCHITECTURE (9 Hrs)

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS (9 Hrs)

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT IV TRANSPORT & SESSION LAYER PROTOCOLS (9 Hrs)

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

UNIT V SERVICE LAYER PROTOCOLS & SECURITY (9 Hrs)

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer.

OUTCOMES: Total: 45 Hrs

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

- Understand the Architectural Overview of IoT
- Understand the IoT Reference Architecture and Real World Design Constraints
- Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)

TEXT BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Aves and, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

REFERENCES:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5, Springer.
3. 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.