Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

Curriculum and Syllabi

B.E. Electronics and Communication Engineering

Semesters I to VIII

REGULATIONS 2019

Department of Electronics and Communication Engineering

Vision

To strive for excellence in Electronics and Communication Engineering education, research and technological services imparting quality training to students, to make them competent and motivated engineers.

Mission

- Impart quality engineering education in Electronics and Communication Engineering through effective teaching learning process and updated curriculum.
- Equip the students with professionalism and technical expertise to provide appropriate solutions to societal and industrial needs.
- Provide stimulating environment for continuously updated facilities to pursue research through creative thinking and team work.

Programme: B.E. Electronics and Communication Engineering

Programme Educational Objectives (PEOs) – Regulations 2019

B.E. Electronics and Communication Engineering graduates will:

PEO1. Actively apply technical and professional skills in engineering practices towards the progress of the organization in competitive and dynamic environment

PEO2. Own their professional and personal development by continuous learning and apply the learning at work to create new knowledge

PEO3. Conduct themselves in a responsible, professional and ethical manner supporting sustainable economic development which enhances the quality of life

Programme Outcomes (POs) - Regulations 2019

On successful completion of B.E. Electronics and Communication Engineering programme, graduating students/graduates will be able to:

PO1.Engineering knowledge: Apply the knowledge of Mathematics, Science and engineering to solve problems in the field of Electronics and Communication Engineering

PO2.Problem analysis: Identify, formulate/model, analyze and solve complex problems in the field of Electronics and Communication Engineering

PO3.Design and development: Design an electronic system/component, or process to meet specific purpose with due consideration for economic, environmental, social, political, ethical, health and safety issues

PO4.Conduct investigations: Design and conduct experiment, analyze and interpret data to provide valid conclusions in the field of Electronics and Communication Engineering

PO5.Modern tool usage: Apply appropriate techniques and modern software tools for design and analysis of Electronic systems with specified constraints

OBE Coordinator Programme Coordinator Head of the Department

Head - OBE

PO6.Engineer and society: Apply contextual knowledge to provide engineering solutions with societal, professional and environmental responsibilities

PO7.Environment and sustainability: Provide sustainable solutions within societal and environmental contexts for problems related to Electronics and Communication Engineering

PO8.Ethics: Comply with code of conduct and professional ethics in engineering practices

PO9.Individual and team work: Perform effectively as a member/leader in multidisciplinary teams

PO10.Communication: Communicate effectively to engineering community and society with proper aids and documents

PO11.Project management & finance: Demonstrate knowledge and understanding of the engineering and management principles to manage projects in multidisciplinary environment

PO12.Lifelong learning: Recognize the need for, and have the ability to engage in independent and lifelong learning

Programme Specific Outcomes (PSOs) - Regulations 2019

On successful completion of B.E. Electronics and Communication Engineering programme, graduating students/graduates will be able to:

PSO1: Technology deployment: Apply technologies of electronics, embedded systems; signal processing, communication and networking in the field of Industrial Automotive, Consumer, Medical and Defense Electronics industries

PSO2: IC design: Apply the design flow of Very Large Scale Integrated circuits to design and test Integrated Circuits in semiconductor industries

OBE Coordinator　　Programme Coordinator　　Head of the Department

Head - OBE

Programme: B.E Electronics and Communication Engineering
2019 Regulations
Curriculum for Semesters I to VIII

Course Code	Course Title	Duration	Credits	Marks
19SHMG6101	Induction Program	3 Weeks	-	100

Semester I (2019 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1101	Matrices and Calculus	3	1	0	4	100	AU,ME,MC,PR CE,EC,EE&EI
19ENHG2101	Communication Skills – I	2	0	2	3	100	All
19CHBC2001	Chemistry for Electrical Sciences	3	0	2	4	100	EC, EE&EI
19ECSN2101	Fundamentals of Electrical and Electronics Engineering	3	0	2	4	100	---
19MESC2001	Introduction to Engineering	2	0	2	3	100	AU,ME,MC,PR EC,EE&EI
19PSHG3002	Personal Effectiveness	0	0	2	1	100	All
Total		**13**	**1**	**10**	**19**	**600**	

Semester II (2019 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1201	Ordinary Differential Equations and Complex Variables	3	1	0	4	100	AU,ME,MC,PR CE,EC,EE&EI
19ENHG2201	Communication Skills – II	2	0	2	3	100	All
19PHBC2001	Physics for Electrical Sciences	3	0	2	4	100	EC,EE & EI
19ECSN2201	Electric Circuits and Electron devices	3	0	2	4	100	---
19CSSC2001	C Programming	3	0	2	4	100	AU,ME,MC,PR CE,EC,EE&EI
19MESC4001	Engineering Drawing	1	0	3	2.5	100	EC,EI,CS&IT
19PSHG3001	Wellness for Students	0	0	2	1	100	All
19CHMG6201	Environmental Sciences	1	0	0	0	100	All
Total		**16**	**1**	**13**	**22.5**	800	

Passed in Board of Studies meeting
BOS Convener

Approved in Academic Council meeting
BOS Chairman

Programme: B.E Electronics and Communication Engineering
2019 Regulations
Curriculum for Semesters I to VIII

Course Code	Course Title	Duration	Credits	Marks
19SHMG6101	Induction Program	3 Weeks	-	100

Semester I (2020 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1101	Matrices and Calculus	3	1	0	4	100	AU,ME,MC,PR CE,EC,EE&EI
19ENHG2101	Communication Skills – I	2	0	2	3	100	All
19CHBC2001	Chemistry for Electrical Sciences	3	0	2	4	100	EC, EE&EI
19ECSN2101	Fundamentals of Electrical and Electronics Engineering	3	0	2	4	100	---
19MESC2001	Introduction to Engineering	2	0	2	3	100	AU,ME,MC,PR EC,EE&EI
19PSHG6001	Wellness for Students*	0	0	2	-	-	All
Total		**13**	**1**	**10**	**18**	**500**	

Semester II (2020 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1201	Ordinary Differential Equations and Complex Variables	3	1	0	4	100	AU,ME,MC,PR CE,EC,EE&EI
19ENHG2201	Communication Skills – II	2	0	2	3	100	All
19PHBC2001	Physics for Electrical Sciences	3	0	2	4	100	EC,EE & EI
19ECSN2201	Electric Circuits and Electron devices	3	0	2	4	100	---
19CSSC2001	C Programming	3	0	2	4	100	AU,ME,MC,PR CE,EC,EE&EI
19MESC4001	Engineering Drawing	1	0	3	2.5	100	EC,EI,CS&IT
19PSHG6001	Wellness for Students*	0	0	2	1	100	All
19CHMG6201	Environmental Sciences	1	0	0	0	100	All
Total		**16**	**1**	**13**	**22.5**	**800**	

* Annual Pattern

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1302	Numerical Methods and Linear Algebra	3	1	0	4	100	EC,EE,EI &MC
19ECCN1301	Analog Circuits- I	3	0	0	3	100	-
19ITSN2302	Data Structures and Algorithms - I	3	0	2	4	100	-
19ECCN2301	Transmission Lines and Waveguides	3	0	2	4	100	-
19ECCN1302	Digital Principles and System Design	3	1	0	4	100	-
19ECCN3301	Analog Circuits- I Laboratory	0	0	3	1.5	100	-
19ECCN3302	Digital Principles and System Design Laboratory	0	0	3	1.5	100	-
XXXXXXXXX	One Credit Course (OCC).	0	0	2	1	100	-
Total		**15**	**2**	**12**	**23**	**800**	

Semester IV

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABG1401	Probability and Statistics	3	1	0	4	100	All
19ECCN1401	Analog Circuits - II	3	1	0	4	100	-
19ITSN2401	Data Structures and Algorithms - II	3	0	2	4	100	-
19ECCN1402	Signals and Systems	3	1	0	4	100	-
19ECCN3401	Analog Circuits - II Laboratory	0	0	3	1.5	100	-
19ECPN6401	Mini- Project	0	0	4	2	100	-
XXXXXXXXX	One Credit Course (OCC)	0	0	2	1	100	-
19PSHG6002	Universal Human Values 2 :Understanding Harmony	2	1	0	3	100	All
Total		**14**	**4**	**11**	**23.5**	**800**	

Course Code	Course Title	Duration	Credits	Marks
19ECPN6001	Internship or Skill Development*	2 Weeks	1	100

*Refer to clause:4.8 in UG academic regulations 2019

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Semester V

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ECCN1501	Analog and Digital Communication	3	1	0	4	100	-
19ECCN1502	Control Systems	3	1	0	4	100	-
19ECCN2501	Digital Signal Processing	3	0	2	4	100	-
XXXXXXXXXX	Professional Elective - I	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - II	3	0	0	3	100	-
XXXXXXXXXX	Open Elective - I	3	0	0	3	100	-
19ECCN3501	Analog and Digital Communication Laboratory	0	0	3	1.5	100	-
19ECCN3502	Data Science Laboratory	0	0	3	1.5	100	-
19PSHG6501	Employability Skills 1: Teamness and Interpersonal Skills	0	0	2	1	100	All
Total		**18**	**2**	**10**	**25**	**900**	

Semester VI

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ECCN1601	VLSI System Design	4	0	0	4	100	-
19ECCN1602	Internet Of Things	3	0	0	3	100	-
19ECCN2601	Microcontroller and Its Interfacing Techniques	3	0	2	4	100	-
XXXXXXXXXX	Professional Elective - III	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - IV	3	0	0	3	100	-
XXXXXXXXXX	Open Elective - II	3	0	0	3	100	-
19ECPN6601	Innovative and Creative Project	0	0	4	2	100	-
19PSHG6601	Employability Skills 2: Campus to Corporate	0	0	2	1	100	All
Total		**18**	**0**	**8**	**23**	**800**	

Course Code	Course Title	Duration	Credits	Marks
XXXXXXXXXXX	Internship or Skill Development*	2 -4 Weeks	1	100

*Refer to clause: 4.8 in UG academic regulations 2019

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Semester VII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ECCN1701	RF and Microwave Engineering	3	0	0	3	100	-
19ECCN1702	Machine Learning	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - V	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - VI	3	0	0	3	100	-
XXXXXXXXXX	Open Elective - III	3	0	0	3	100	-
19ECCN3701	RF and Microwave Laboratory	0	0	3	1.5	100	-
19ECCN3702	VLSI Laboratory	0	0	3	1.5	100	-
Total		**15**	**0**	**6**	**18**	**700**	

Semester VIII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ECPN6801	Project	0	0	16	8	200	-
Total					**8**	**200**	

Course Code	Course Title	Duration	Credits	Marks
XXXXXXXXXXX	Internship or Skill Development*	8 -16 weeks	4	100

*Refer to clause: 4.8 in UG academic regulations 2019

Total Credits (2019 Batch only):168

Total Credits (2020 Batch onwards): 167

Passed in Board of Studies meeting

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PROFESSIONAL ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
Communication Domain							
19ECEN1002	Wireless Communication	3	0	0	3	100	-
19ECEN1003	Antenna and Wave Propagation	3	0	0	3	100	-
19ECEN1005	Electromagnetic Interference and Compatibility	3	0	0	3	100	-
19ECEN1006	Bluetooth Technology	3	0	0	3	100	-
19ECEN1007	Multimedia Communication	3	0	0	3	100	-
19ECEN1008	Telecommunication and Digital Switching Techniques	3	0	0	3	100	-
19ECEN1011	Television and Video Systems	3	0	0	3	100	-
19ECEN1013	Error Control Coding	3	0	0	3	100	-
19ECEN1024	Advanced Wireless Communication	3	0	0	3	100	-
19ECEN1025	Satellite Communication	3	0	0	3	100	-
19ECEN1026	Fiber Optic Communication	3	0	0	3	100	-
19ECEN1027	OFDM and MIMO Concepts	3	0	0	3	100	-
Networking Domain							
19ECEN1001	Computer Communication Networks	3	0	0	3	100	-
19ECEN1004	High Speed Networks	3	0	0	3	100	-
19ECEN1009	Wireless Sensor Networks	3	0	0	3	100	-
19ECEN1010	Cryptography and Network Security	3	0	0	3	100	-
19ECEN1028	Advanced Networking Technologies	3	0	0	3	100	-
19ECEN1029	Mobile Communication and Networks	3	0	0	3	100	-

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19ECEN1030	Cognitive Networks	3	0	0	3	100	-
Basic Electronics Domain							
19ECEN1012	High Speed Electronics	3	0	0	3	100	-
19ECEN1014	Biomedical Electronics	3	0	0	3	100	-
19ECEN1021	Advanced Microcontrollers	3	0	0	3	100	-
19ECEN1031	Introduction to MEMS	3	0	0	3	100	-
19ECEN1032	Nano electronics	3	0	0	3	100	-
Signal Processing Domain							
19ECEN1015	Wavelets and Its Applications	3	0	0	3	100	-
19ECEN1016	Digital Image and Video Processing	3	0	0	3	100	-
19ECEN1017	Speech and Audio Processing	3	0	0	3	100	-
19ECEN1018	Information Theory and Coding	3	0	0	3	100	-
19ECEN1033	Adaptive Signal Processing	3	0	0	3	100	-
VLSI Domain							
19ECEN1019	Computer Architecture	3	0	0	3	100	-
19ECEN1020	CMOS Analog IC Design	3	0	0	3	100	-
19ECEN1022	Low Power VLSI Design	3	0	0	3	100	-
19ECEN1023	Digital System Design and Verification	3	0	0	3	100	-
19ECEN1034	Testing of VLSI Circuits	3	0	0	3	100	-
19ECEN1035	ASIC Design	3	0	0	3	100	-

Software Engineering Domain							
19CSEC1001	Programming Using JAVA	3	0	0	3	100	-
19CSEC1002	Data Mining and Analytics	3	0	0	3	100	-
19CSEC1003	Software Testing	3	0	0	3	100	-
19CSEC1004	Database Management System Concepts	3	0	0	3	100	-
Control and Automation Domain							
19ECCN1036	Industrial Electronics	3	0	0	3	100	-
19EEEC1001	Industrial Automation	3	0	0	3	100	EC & EE
19EEEC1002	Automotive Electronics	3	0	0	3	100	EC & EE
19EEEC1003	Virtual Instrumentation	3	0	0	3	100	EC & EE
19EEEC1005	Industrial Safety	3	0	0	3	100	EC & EE
Management Domain							
19MEEC1014	Engineering Economics and Cost Analysis	3	0	0	3	100	AU,ME,EC EE &EI
19MEEC1015	Principles of Management	3	0	0	3	100	ME,MC EC,EE & EI
19EEEC1045	Disaster Management	3	0	0	3	100	EC,EE & EI
Mandatory Elective							
19CSEC6701	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	100	CS,IT &EC

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OPEN ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
19ECOC1001	In Vehicle Networking	3	0	0	3	100
19ECOC1002	Consumer Electronics	3	0	0	3	100
19ECOC1003	Internet Of Everything	3	0	0	3	100
19ECOC1004	Data Science Using Hadoop with R	3	0	0	3	100
19ECOC1005	Artificial Intelligence	3	0	0	3	100
19ECOC1006	Machine Vision System	3	0	0	3	100
19ECOC1007	Soft Computing	3	0	0	3	100

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BOS Convener BOS Chairman

Dr. Mahalingam College of Technology, Pollachi

2019 Regulations - Course Code Generation Procedure for UG Courses(v1)

Regulations

Mode of Assessment	
Character Type – Number	
1	Theory
2	Theory with Practical
3	Practical
4	Practical with Theory
5	Theory with SSU
6	Customized

Semester Number	
Character Type – Number	
1 to 8	Semester
0	Floating

Sequence Number
Character Type – Number
01, 02, 03, . . . , 99

1	2	3	4	5	6	7	8	9	10
1	9	A	U	B	G	1	1	0	1

Board/Department/Programme	
Character Type – Alphabet	
AU	Automobile
CE	Civil
CS	Computer Science
EC	Electronics and Communication
EE	Electrical and Electronics
EI	Electronics and Instrumentation
IT	Information Technology
MC	Mechatronics
ME	Mechanical
CH	Chemistry
EN	English
MA	Mathematics
PH	Physics
PS	Professional Skills
SH	Science and Humanities

Course Type	
Character Type – Alphabet	
B	Basic Science
S	Engineering Science
H	Humanities
C	Professional Core
E	Professional Elective
O	Open Elective
N	Online
I	Industry Offered
V	One Credit
P	Project/Skill Development/ Internship
M	Mandatory Non-Credit

Common to any Programme	
Character Type – Alphabet	
G	Generic
C	Common
N	Non-Common

OPEN ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
19ECOC1001	In Vehicle Networking	3	0	0	3	100
19ECOC1002	Consumer Electronics	3	0	0	3	100
19ECOC1003	Internet Of Everything	3	0	0	3	100
19ECOC1004	Data Science Using Hadoop with R	3	0	0	3	100
19ECOC1005	Artificial Intelligence	3	0	0	3	100
19ECOC1006	Machine Vision System	3	0	0	3	100
19ECOC1007	Soft Computing	3	0	0	3	100

Passed in Board of Studies meeting Approved in Academic Council meeting

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Regulations 2019

Detailed Syllabi for

Semesters I & VIII

Course Code: 19SHMG6101	Course Title: Induction Program (common to all B.E/B.Tech programmes)
Course Category: Mandatory Non-Credit Course	**Course Level: Introductory**
Duration: 3 Weeks	**Max. Marks:100**

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and society

List of Activities:

1. History of Institution and Management: Overview on NIA Education Institutions-Growth of MCET – Examination Process-OBE Practices – Code of Conduct – Centre of Excellence
2. Lectures by Eminent People, Motivational Talk – Alumni, Employer
3. Familiarization to Dept./Branch: HoD Interaction – Senior Interaction – Department Association
4. Universal Human Value Modules: Module 1, Module 2,Module 3 and Module 4
5. Orientation on Professional Skill Courses
6. Proficiency Modules – Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cell, Clubs and its events

8. Creative Arts: Painting, Music and Dance
9. Physical Activity: Games and Sports, Yoga and Gardening
10. Group Visits: Visit to Local areas and Campus Tour

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO2	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO4	2	-	-	-	-	-	-	2	1	2	-	-	-	-

High-3; Medium-2;Low-1

Assessment Pattern

Component	**Marks**	**Details**
Attendance	10	Minimum 80% and 1 mark for every 2% observed
Knowledge Test	40	Objective type questions
Work plan for future	50	Career plan developed consulting mentor
Total	**100**	

Non-letter Grades

Marks Scored	**Performance Level**
70 & above	Good
30 – 69	Average
< 30	Fair

Semester 1

<table>
<tr><td>Course Code:19MABC1101</td><td colspan="3">Course Title: Matrices and Calculus
(Common to AU,ME,MC,PR CE,EC,EE&EI)</td></tr>
<tr><td colspan="2">Course Category: Basic Science</td><td colspan="2">Course Level: Introductory</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 1: 0</td><td>Credits:4</td><td>Total Contact Hours:60</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Determine the canonical form of a Quadratic form using Orthogonal transformation
2. Use different testing methods to check the convergence of infinite series
3. Apply differential and integral calculus to determine the evoluteof a curve and improper integrals
4. Apply partial derivatives to find extreme values of functions of two variables
5. Apply multiple integrals to find area of plane curves and volume of solids

Unit I Matrices **9+3 Hours**

Rank of a matrix - System of linear equations – Symmetric - Skew symmetric and orthogonal matrices-(Definitions and examples only) - Eigenvalues and Eigenvectors - Diagonalization of symmetric matrices through orthogonal transformation – Cayley-Hamilton Theorem - Transformation of quadratic forms to canonical forms through orthogonal transformation.

Unit II Sequences And Series **9+3 Hours**

Sequences - Definition and Examples - Series- Tests for convergence- Power series - series for exponential, trigonometric and logarithm functions - Comparison Test – Integral Test - Cauchy's root test - D Alembert's ratio test - Alternating series- Leibnitz's test.

Unit III Differential and Integral Calculus **9+3 Hours**

Curvature – Radius of curvature - Evolutes and Involutes - Evaluation of definite and improper integrals - Beta and Gamma functions and their properties.

Unit IV Multivariable Differentiation 9+3 Hours

Limit – continuity - Mean value theorems and partial derivatives- Taylor's series and Maclaurin's series – Jacobian – Maxima, Minima and saddle points - Method of Lagrange's multipliers.

Unit V Multivariable Integration 9+3 Hours

Multiple Integration: Double integrals - Change of order of integration in double integrals - Change of variables (cartesian to polar, cartesian to spherical and cartesian to cylindrical) - Triple integrals - Applications: areas and volumes.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1:Determine the canonical form of a Quadratic form using Orthogonal transformation	Apply
CO2: Use different testing methods to check the convergence of infinite series	Apply
CO3:Determine the evolute of a curve and evaluate improper integrals using beta gamma functions	Apply
CO4:Apply partial derivatives to find extreme values of functions of two variables	Apply
CO5:Apply multiple integrals to find area of plane curves and volume of solids	Apply

Text Book(s):

T1.Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.

T2.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

T3.Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2.N.P.Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R3.B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2
3. https://nptel.ac.in/syllabus/111104092/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	1	1	1	1	2	3	-
CO2	3	2	1	1	-	1	-	1	1	1	1	2	3	-
CO3	3	2	1	1	-	1	-	1	1	1	1	2	3	-
CO4	3	2	1	1	-	1	-	1	1	1	1	2	3	-
CO5	3	2	1	1	-	1	-	1	1	1	1	2	3	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19ENHG2101	Course Title: Communication Skills – I (Common to all B.E/B.Tech Programmes)		
Course Category: Humanities		Course Level: Introductory	
L:T:P(Hours/Week)2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- The student should have undergone English as his/her first or second language in school.

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B1 of CEFR level
2. Speak in simple sentences to convey their opinions and ideas on par with B1 of CEFR level.
3. Read and infer a given text on par with B1 of CEFR level
4. Draft basic formal written communication on par with B1 of CEFR level

Unit I Listening 15 Hours

Importance of active listening –Physical condition needed for active listening-Identifying relevant points while taking notes.- Framing questions at different linguistic contexts - Listening for specific details of concrete monologues and dialogues – Listening to organize ideas - Developing ideas – Listening to compose paragraphs – Paraphrasing the aural input.

Unit II Speaking 15 Hours

Importance of note making to practice speaking - Traditional note making, developing Mind map - Collecting points from various sources - Identifying relevant ideas needed for the speech -Using mind-map to organize thought processing - Prioritizing the ideas - Types of sentences - Frequently used words (Institution, home and leisure) - Mother Tongue Influence - Expressing the thoughts in simple sentences - Tenses & Voices (Active & Passive) - Postures, gestures and eye contact - Intonation and Sentence stress - Express one's thoughts coherently.

Unit III Reading 15 Hours

Reading strategies - Skimming -Scanning - Interpretation of visual data - Factual texts on subjects of relevance - Inferring texts – Reading to write a review – Checking the accuracy of reading while presenting the interpreted data – Reading to comprehend

Unit IV **Writing** **15 Hours**

WritingSimple and short sentences - Writing E-mail, Memo, Note and Message - Letter Writing - Importance of punctuations -- Identifying the main points - Organising the main ideas - Writing a draft.

List of Tasks

1. BEC Preliminary Listening Test-I & Speaking Test-1.
2. BEC Preliminary Listening Test-2 & Speaking Test-2.
3. BEC Preliminary Listening Test-3 & Speaking Test-3.
4. BEC Preliminary Listening Test-4 & Speaking Test-4.
5. BEC Preliminary Listening Test-5 & Speaking Test-5.
6. BEC Preliminary Listening Test-6 & Speaking Test-6.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Listen actively and paraphrase simple messages and specific details of concrete monologues and dialogues	Apply
CO2: Express one's views coherently in a simple manner	Apply
CO3: Read and comprehend factual texts on subjects of relevance	Understand
CO4: Write texts bearing direct meanings for different contexts maintaining an appropriate style	Apply

Text Book(s):

T1. Whitby Norman, Business Benchmark Pre-intermediate to Intermediate Students' Book CUP Publications, 2nd Edition, 2014

T2. Wood Ian, Williams Anne, Cowper Anna, Pass Cambridge BEC Preliminary, Cengage Learning,2nd edition, 2015.

T3. Learners Book prepared by the Faculty members of Department of English

Reference Book(s):

R1. BEC-Preliminary - Cambridge Handbook for Language Teachers, 2nd Edition, CUP 2000

R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3rd Edition, 2013.

Web References:

1. http://www.grammarinenglish.com -Jan 23,2018
2. https://www.northshore.edu/support centre /pdf/listen-notes.pdf
3. http://www.examenglish.com/BEC/BEC Vantage.html- Jan 23, 2018

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO2	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO3	-	-	-	-	-	-	-	1	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	1	-	3	-	2	-	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	2,3,4	50	20
	CCET II	2,3,4	50	
	CCET III	2,3,4	50	
	Continuous Assessment – Practical	1,2	75	10
	Final Assessment – Practical	1,2	50	10
End Semester Examination	ESE	2,3,4	100	60
			Total	100

Course Code:19CHBC2001	Course Title: Chemistry for Electrical Sciences (Common to EC,EE &EI)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Higher Secondary Chemistry I and II

Course Objectives

The course is intended to:

1. Explain the principles of electrochemistry and batteries
2. Explain the mechanism of corrosion and corrosion control
3. Explain the concepts of spectroscopic techniques
4. Describe the basics of biofuels and fuel cells
5. Describe synthesis, properties and applications of nano materials

Unit I Electrochemistry and Batteries **9 Hours**

Cells – Types of cells– galvanic and electrolytic cells – emf and its measurement – Nernst equation –Batteries – types and Characteristics, Construction, working and applications - Alkaline battery, Lead –Acid battery, Nickel-Cadmium battery, Lithium ion battery

Unit II Corrosion and its Control **9 Hours**

Corrosion – dry and wet corrosion – mechanism of electrochemical corrosion – galvanic corrosion and concentration cell corrosion, Factors influencing corrosion. Corrosion Control methods – Cathodic protection methods, Metallic coating – Galvanizing, Tinning – Chrome plating and Electroless plating of Nickel

Unit III Spectroscopic Techniques **9 Hours**

Spectroscopy- Electromagnetic spectrum, Absorption and Emission spectroscopy – Relationship between absorbance and concentration – Derivation of Beer-Lambert's law (problems). UV – Visible Spectroscopy, Atomic Absorption Spectroscopy, Flame photometry – Principle, Instrumentation and applications.

Unit IV Biofuels and Fuel Cells **9 Hours**

Biomass – Biogas – Constituents, manufacture and uses. General outline of fermentation process – manufacture of ethyl alcohol by fermentation process. Combustion – Calorific values – Gross and bet calorific value – problems based on calorific value. Fuel cells – Construction working and applications of Hydrogen Oxygen fuel cells, methanol oxygen fuel cells, solid oxide fuel cells

Unit V Synthesis and Applications ofNano Materials 9 Hours

Introduction – Difference between bulk and Nano materials – size dependent properties. Nano scale materials –particles, clusters, rods and tubes. Synthesis of Nanomaterials: Sol-gel process, Electro deposition, Hydrothermal methods. Applications of Nano materials in Electronics, Energy science and medicines. Risk and future perspectives of nano materials.

List of Experiments 30 Hours

1. Estimation of iron in water by spectrophotometry
2. Estimation of Fe^{2+} by potentiometric titration
3. Determination of corrosion rate by weight loss method
4. Measurement of emf of electrochemical cell – Poggendorff's method
5. Determination strength of acid by pHmetry
6. Conduct metric titration of strong acid against strong base

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain batteries based on their characteristics, construction, working principle and applications	Understand
CO2: Explain the mechanism of corrosion and its control techniques	Understand
CO3: Use Beer- Lambert's law and other spectroscopic methods for chemical analysis	Apply
CO4: Calculate energy potential of fuel cells and calorific value of biofuels	Apply
CO5: Describe synthesis, properties and applications of nano materials	Understand

Text Book(s):

T1.P. C. Jain and Monica Jain, "Engineering Chemistry", 17^{th} Edition, Dhanpat Rai Pub, Co., New Delhi 2018.

T2.Wiley Engineering Chemistry, 2^{nd} Edition, Wiley India Pvt. Ltd. New Delhi, 2011.

Reference Book(s):

R1.Larry Brown and Tom Holme, Chemistry for Engineering Students, 3^{rd} Edition, Cengage Learning, 2010.

R2.S. S. Dara, S. S. Umare "A text book of Engineering Chemistry" 12^{th} edition S. Chand & Co. Ltd., New Delhi, 2014.

R3.Charles P. Poole, Jr., Frank J. Owens "Introduction to Nanotechnology" Wiley India Pvt. Ltd. New Delhi, 2003.

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/lec.23.pdf
2. https://nptel.ac.in/courses/104106075/Week1/MODULE%201.pdf
3. https://nptel.ac.in/courses/103102015/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	3	3	2	3	2	-	-	-	-
CO2	2	1	-	-	-	3	3	2	3	2	-	-	-	-
CO3	3	2	1	1	-	3	3	1	-	-	-	-	-	-
CO4	3	2	1	1	-	3	3	1	-	1	-	-	-	-
CO5	2	1	-	-	-	3	3	1	-	1	-	-	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III		50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code:19ECSN2101</td><td colspan="2">Course Title: Fundamentals of Electrical and Electronics Engineering</td></tr>
<tr><td colspan="2">Course Category: Engineering Science</td><td colspan="2">Course Level: Introductory</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 2</td><td>Credits:4</td><td>Total Contact Hours:75</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Analyze the electric circuits.
2. Explain the construction and operation of DC and AC Electrical machines
3. Explain the operation of basic measuring instruments and transducers
4. Design simple Electronic circuits
5. Explain the construction, operation and applications of special semiconductor devices

Unit I **Introduction to DC Circuits** **9 Hours**

Circuit Laws: ohms law - Kirchhoff's current law and voltage law - series and parallel circuit analysis - voltage and current division rule - source transformation - star delta transformation

Unit II **Electrical Machines** **9 Hours**

Constructional details of DC machine - operation of DC motor- torque equation - constructional details and operation of 1-phase and 3-phase induction motor, stepper motor and brushless DC motor –1-phase Transformer constructional details and principle of operation.

Unit III **Basic Measuring Instruments** **9 Hours**

Units and standards– Types of error - Transducers - classification of transducers - Static and dynamic characteristics– Moving coil and Moving iron meters –Oscilloscopes: DSO - LVDT – Strain gauge - RTD – Capacitive transducer.

Unit IV Introduction to Semiconductor Devices 9 Hours

PN junction Diode – characteristics-half wave rectifiers - full wave rectifiers - clippers and clampers- Zener diode characteristics – Zener diode as voltage regulator- Construction and operation of BJT and FET - Parameters of JFET.

Unit V Special Semiconductor Devices 9 Hours

Construction, operation and applications of Varactor Diode, Tunnel Diode, PIN diode, UJT,SCR, Photodiode and Phototransistor.

List of Experiments 30 Hours

1. Verification of Kirchhoff's Voltage and Current laws
2. Voltage and frequency measurement using CRO
3. Half wave and full wave rectifiers
4. Clippers and Clampers
5. Voltage regulator using Zener diode
6. Characteristics of UJT

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Analyze the electric circuits using circuit laws	Apply
CO2: Explain the construction and operation of DC and AC Electrical machines	Understand
CO3: Explain the operation of basic measuring instruments and transducers for Electrical and Electronic circuits.	Understand
CO4: Design simple Electronic circuits using semiconductor devices	Apply
CO5: Explain the construction, operation and applications of special semiconductor devices	Understand

Text Books:

T1.M.Arumugham and N.Premkumar, “Electric Circuit Theory”, Khanna publishers, 2010.

T2.Kalsi .H.S, “Electronics Instrumentation”, 3rd Edition (copyright 2010, Second Reprint 2011) Tata McGraw Hill, New Delhi, 2010.

T3.Millman J, Halkias .C and Satyabratajit, “Electronic Devices and Circuits”, 2^{nd} Edition, Tata McGraw-Hill, New Delhi, 2007.

Reference Books:

R1.Theraja.B.L, “Electrical Technology Volume-II AC/DC Machines”, S.Chand and Company Ltd., New Delhi (India),2008.

R2.Anil K.Maini, Varsha Agarwal, “Electronic Devices and Circuits”, Wiley India Private Ltd, New Delhi, 1^{st} Edition. 2015.

R3.A Sudhakar, S Shyam mohan and Pillai, “Circuits and Network (Analysis and synthesis)”, Tata McGraw-Hill, 2004

R4.Sawhney .A.K, “A Course in Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai& Sons, New Delhi, 18^{th}Edition, 2001.

Web References:

1. http://nptel.ac.in/video.php?subjectId=117103063
2. http://nptel.ac.in/video.php?subjectId=122106025
3. http://nptel.ac.in/courses/108108076/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	3	2	-	1	2	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	2	-	-	-	2	3	2	-	1	2	2
CO5	2	2	2	2	-	-	-	2	3	2	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19MESC2001	Course Title: Introduction to Engineering (Common to AU,ME,PR,MC,EC,EE&EI)		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week)2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the career opportunities in engineering
2. Explain how to acquire engineering competencies
3. Explain how to remain, relevant and versatile as an engineer
4. Observe engineering products and processes
5. Take ownership for learning and development
6. Identify and rectify unsafe conditions and acts

Unit I Career Opportunities in Engineering 5 Hours

Technicians, engineers and scientists, history of engineering. 17 sustainable development goals set by UNO, concept of small e to big E. career choices for an engineer, types of industries, academia and research as career choices, entrepreneurship as a career choice, various departments in engineering industries, roles available in engineering industries. innate skills, learnt skills (competencies), graduate attributes, roles of engineers and the corresponding competencies, career opportunities in engineering in terms of roles & competencies

Unit II Developing Specific Skills and Competencies 5 Hours

OBE Model, PEOs and POs, technical POs, professional POs, mapping with Graduate attributes, Classification of courses, resources available in the campus and e-resources, resources and facilities available to acquire specific competencies, on-campus and off-campus activities, the methods by which students can systematically involve in activities, significance of professional skill courses, plan for utilizing the resources and facilities to develop specific competencies.

Unit III **Staying Relevant through Continuous Improvement / Environmental Versatility** **7 Hours**

Rate of change, technology life cycle (TLC), features of a dynamic and complex environment in which students operate or will operate, impact of globalization & technical advancements, importance of remaining, relevant and versatile in a dynamic and complex environment with the help of technology life cycle, activities/process to remain relevant and versatile, environmental scanning, Life- long learning.

Unit IV **Observe Every Product and Process with an Engineering Perspective And Inquisitiveness** **4 Hours**

Product -Need, purpose - primary and secondary function, various stages of manufacturing and its processes. Product - assembly of several simple engineering devices/systems. Product-Parts, principles and laws (mechanical, electrical and electronics), functional relationship between the parts, role of programming in engineering products. Significance of materials and their advancements in improvements in product.

Unit V **Learning and Development Leveraging the Resources and Infrastructure** **6 Hours**

Process Of Learning, Situated Learning with Examples, Own Learning (Not Copying), Differences between Real Life and Simulated Environment, the Sprit Of Experimentation, Various Learning Enablers, Measure the performance against the plan.

Unit VI **Unsafe Conditions and Acts and Following Environment Friendly Practices** **3 Hours**

Safety-definition, importance of personal safety. Statistics of road accidents. Unsafe condition and unsafe act- definition, cause and effects, identification of the unsafe conditions and acts in home/hostel, labs, class rooms, public places. Importance of environment friendly practices.

Course Outcomes At the end of this course, students will be able to:	Cognitive Level
CO1: Explain the career opportunities in engineering in terms of roles & competencies	Understand
CO2: Explain how a student can acquire the competencies	Understand
CO3: Explain how to remain, relevant and versatile in a dynamic and complex environment	Understand
CO4: Observe every product and processes with an engineering perspective and inquisitiveness	Apply
CO5: Choose to take ownership for his/her learning and development leveraging the resources and infrastructure	Understand
CO6: Identify and rectify unsafe conditions and acts and follow environment friendly practices	Understand

Text Book(s):

T1. Worksheets and Handouts prepared by MCET team.

Reference Book(s):

R1. L. A Bloomfield, "How things work: The physics of everyday life", Wiley, 5th Edition, 2013.

R2. C. Mason, "How things work," Usborne Publishing Ltd 2009.

R3. D.K. Publishing, "How things work encyclopedia", 2010.

R4. J. E. Gordon, "The New Science of Strong Materials or Why You Don't Fall through the Floor" Princeton University Press; With a New introduction by Philip Ball,2018.

R5. R.P. Feynman," Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher", Basic Books; 4th Edition 2011.

Web References:

1. https://en.wikibooks.org/General_Engineering_Introduction/Engineering_Science
2. https://science.howstuffworks.com/engineering-channel.html

List of Ria Lab Exercises **30 Hours**

1. Career opportunities with roles and responsibilities

2. Observe every product and processes with an engineering perspective and inquisitiveness

a) Primary and Secondary functions of products and their equivalents

b) Primary and Secondary functions of parts of the products, their manufacturing processes and materials

c) Structural and functional relations of the product

3. Safe and unsafe acts and conditions in day-to-day life and professional practices.

4. Skills for Hobby project (At least TWO)

a) Soldering and de-soldering practices

b) Circuit and component testing using multi-meter & CRO

c) Battery operated circuit connections and testing

d) Simple switching circuits using relays and transistors

e) Adhesives used in part assembly

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO2	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO3	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO4	3	2	1	1	-	2	2	1	3	1	-	1	-	-
CO5	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO6	2	1	-	-	-	2	2	1	3	1	-	1	-	-

High-3; Medium-2; Low-1

Assessment Pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,4	50	20
	CCET II	2,3	50	
	CCET III	5,6	50	
	Continuous Assessment – Practical	1,2,3,4,5,6	75	10
	Final Assessment – Practical	2,4	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td>Course Code:19PSHG3002</td><td colspan="3">Course Title: Personal Effectiveness
(Common to all B.E/B.Tech Programmes)
(2019 Batch Only)</td></tr>
<tr><td colspan="2">Course Category: Humanities</td><td colspan="2">Course Level: Introductory</td></tr>
<tr><td>L:T:P(Hours/Week)0: 0: 2</td><td>Credits: 1</td><td>Total Contact Hours: 30</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Set SMART goals for academic, career and life
2. Identify strength, weaknesses and opportunities
3. Plan for achieving the goals
4. Apply time management techniques
5. Create time and pursue activities of self interest

Unit I The Importance of Envisioning

Importance of positive self-perception – Principle of dual creation (Everything gets created twice – Envisioning) - Understanding Vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people – Importance of goal setting – Importance of planning and working to time.

Unit II Fundamental Principles of Goal Setting and Working to Time

Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume

Unit III Goal Setting and Action Orientation

Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment – Importance of action orientation - Converting goals to actionable tasks – Establishing road map – Using Gantt chart for planning and progress

Unit IV **Time Management - Tools and Techniques**

Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

Unit V **Putting into Practice**

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes
At the end of this course, students will be able to:
CO1.Identify the strengths, weaknesses and opportunities
CO2.Set well-articulated goals for academics, career, and personal aspirations
CO3. Establish the road map to realize the goals
CO4. Apply time management techniques to complete planned tasks on time
CO5. Create time and pursue activities of self-interest that add value

Text Book(s):

T1. Reading material, workbook and journal prepared by PS team of the college.

Reference Book(s):

R1.Stephen R Covey, "First things first", Simon & Schuster Uk, Aug 1997.

R2.Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster Uk, 2004.

Course offering:

Orientation Programme (2 days)	CO1 and CO2
Student practice (weekly review classes)	CO3
Student journal writing (interim reviews)	CO4 and CO5

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	-	1	1	-	1	-	-
CO2	-	-	-	-	-	-	1	-	-	-	1	1	-	-
CO3	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	1	1	-	-	-
CO5	-	-	-	-	-	1	1	-	-	-	-	1	-	-

High-3; Medium-2; Low-1

Assessment Pattern

<table>
<tr><th></th><th>Assessment Component</th><th>CO.No.</th><th>Marks</th><th>Total</th></tr>
<tr><td rowspan="6">Continuous Assessment</td><td>Yoga:</td><td rowspan="6">1,2,3,4,5</td><td></td><td rowspan="6">75</td></tr>
<tr><td>Physical Exercises, KayaKalpa</td><td>15</td></tr>
<tr><td>Meditation</td><td>15</td></tr>
<tr><td>Assessment of student's workbook</td><td>10</td></tr>
<tr><td>Sports:
Physical Exercises, KayaKalpa</td><td>20</td></tr>
<tr><td>Assessment of student's workbook</td><td>15</td></tr>
<tr><td rowspan="3">End Semester Examination
(combined for yoga and sports)</td><td>Written test (MCQ and short answers)</td><td rowspan="3">1,2,3,4,5</td><td>30</td><td rowspan="3">Marks out of 100 is reduced to 25</td></tr>
<tr><td>Physical exercises</td><td>50</td></tr>
<tr><td>Viva-voce</td><td>20</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

Course Code:19MABC1201	Course Title: Ordinary Differential Equations and Complex Variables (Common to AU,ME,MC,PR CE,EC,EE&EI)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week)3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- 19MABC1101-Matrices and Calculus

Course Objectives

The course is intended to:

1. Explain the concepts of vector differentiation and integration.
2. Determine the solution of second and higher order ordinary differential equations
3. Construct analytic functions
4. Use the concept of complex integration to evaluate definite integrals.
5. Apply Laplace transform techniques to solve ordinary differential equations

Unit I Vector Calculus **9+3 Hours**

Gradient – Divergence – Curl – Line integrals – Surface integrals – Volume integrals – Theorems of Green, Gaussand Stokes (without proof)and their applications.

Unit II Complex Variables (Differentiation) **9+3Hours**

Cauchy-Riemann equations – Analytic functions – Properties – Harmonic functions – Finding harmonic conjugate – Conformal mapping (w=z+a, w= az, w=1/z) – Mobius transformation and their properties.

Unit III Complex Variables (Integration) **9+3 Hours**

Contour integrals – Cauchy Integral formula (without proof) – Cauchy Integral theorem – Taylor's series – Singularities of analytic functions – Laurent's series–Residues – Cauchy Residue theorem (without proof) – Evaluation of real definite integrals around unit circle and semi-circle (Excluding poles on the real axis).

Unit IV Ordinary Differential Equations of Higher Orders **9+3 Hours**

Second and higher order linear differential equations with constant coefficients – Second order linear differential equations with variable coefficients (Cauchy - Euler equation–Legendre's equation) – Method of variation of parameters – Solution of first order simultaneous linear ordinary differential equations

Unit V Laplace Transform **9+3 Hours**

Laplace Transform – Properties of Laplace Transform – Laplace transform of integrals – Laplace transform of periodic functions -Inverse Laplace transforms - Convolution theorem – Solution of ordinary differential equations by Laplace Transform method– Applications on engineering problems.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the concepts of vector differentiation and integration.	Apply
CO2: Use the concept of complex variables to construct analytic functions	Apply
CO3: Use the concept of complex integration to evaluate definite integrals	Apply
CO4: Determine the solution of second and higher order ordinary differential equations	Apply
CO5: Apply Laplace transform techniques to solve ordinary differential equations	Apply

Text Book(s):

T1.Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.

T2.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

T3.Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2. N.P.Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2

3. https://nptel.ac.in/courses/111105035/22

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	1	1	1	1	2	2	-
CO2	3	2	1	1	-	1	-	1	1	1	1	2	2	-
CO3	3	2	1	1	-	1	-	1	1	1	1	2	2	-
CO4	3	2	1	1	-	1	-	1	1	1	1	2	2	-
CO5	3	2	1	1	-	1	-	1	1	1	1	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="5">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

<table>
<tr><td>Course Code:19ENHG2201</td><td colspan="3">Course Title: Communication Skills – II
(Common to all B.E/B.Tech Programmes)</td></tr>
<tr><td colspan="2">Course Category: Humanities</td><td colspan="2">Course Level: Introductory</td></tr>
<tr><td>L:T:P(Hours/Week)2: 0: 2</td><td>Credits:3</td><td>Total Contact Hours:60</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ENHG2101-Communication Skills- I

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B2 of CEFR level
2. Speak in simple sentences to convey their opinion and ideas on par with B2 of CEFR level
3. Read and infer a given text on par with B2 of CEFR level
4. Draft basic formal written communication on par with B2 of CEFR level

Unit I Listening 15 Hours

Importance and purpose of extensive listening and intensive listening -Body Language – Listening tasks on complex and abstract themes- Correlating Ideas related to listening input – importance of empathetic- listening for main ideas – Paraphrasing- Listening to native speakers English –Compound and Complex sentences - Developing ideas – Listening to compose paragraphs.

Unit II Speaking 15 Hours

Jotting down ideas collected from listening to speak – organising the ideas – Expressing one's view coherently – Understanding grammatical elements (Noun – Pronoun Antecedent) – Expressing ideas assertively – Answering questions during presentations – Understanding the use of discourse markers – word stress and sentence stress – voice modulation and pauses – Highlighting significant points – interpretation of visual data – Using verbal cues - Preparing simple hand - outs.

Unit III Reading 15 Hours

Reading strategies – Skimming &Scanning – Inferring meaning- Barriers to reading – sub vocalisation, Eye fixation, Regression – Speed Reading Techniques - Reading different types of texts and their contexts with speed – Note making – Reading a review – Paraphrasing – Reading to comprehend

Unit IV Writing 15 Hours

Reported speech& Concord (Subject - verb Agreement) - Report writing - Different kinds of Report - Structure of the report - Writing Proposal - Plagiarism – References – Appendices – Techniques for Report writing – Registers.

List of Tasks:

1. BEC Vantage Listening Test- I & Speaking Test-1.
2. BEC Vantage Listening Test-2 & Speaking Test-2.
3. BEC Vantage Listening Test-3 & Speaking Test-3.
4. BEC Vantage Listening Test-4 & Speaking Test-4.
5. BEC Vantage Listening Test-5 & Speaking Test-5.
6. BEC Vantage Listening Test-6 & Speaking Test-6.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Listen actively and empathetically, and paraphrase discussions and presentations on complex and abstract themes and topics	Apply
CO2: Express one's views coherently, fluently and confidently highlighting the significant points with supporting details	Apply
CO3: Read and comprehend different types of texts and their contexts reasonably at moderate speed	Understand
CO4: Write detailed reports on variety of subjects synthesizing information gathered during listening & reading citing appropriate references	Apply

Text Book(s):

T1. Whitby Norman, Business Benchmark Upper Intermediate Students' Book CUP Publications, 2nd Edition, 2014

T2. Learners Book prepared by the Faculty members of Department of English

Reference Book(s):

R1.Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002

R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3rd Edition, 2013.

Web References:

1. http://www.grammarinenglish.com -Jan 23, 2018
2. https://www.northshore.edu/support_centre /pdf/listen-notes.pdf

3. http://www.examenglish.com/BEC/BEC_Vantage.html- Jan 23, 2018

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO2	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO3	-	-	-	-	-	-	-	1	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	1	-	3	-	2	-	-

High-3; Medium-2; Low-1

Assessment pattern:

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	2,3,4	50	20
	CCET II	2,3,4	50	
	CCET III	2,3,4	50	
	Continuous Assessment – Practical	2,3,4	75	10
	Final Assessment – Practical	1,2	50	10
End Semester Examination	ESE	2,3,4	100	60
			Total	100

Course Code:19PHBC2001	Course Title: Physics for Electrical Sciences (common to EC,EE,EI)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the concepts of static electric field
2. Explain the concepts of static magnetic field
3. Explain the behavior of materials in electric and magnetic fields
4. Explain electric and magnetic fields using Maxwell's equation
5. Explain the phenomenon of Electromagnetic wave propagation

Unit I Electrostatics 9 Hours

Definition of electric charge-Coulomb's Law – Electric field intensity – Field intensity due to point and line charges – Electric flux density -Gauss's law-Application ofGauss's law: Due to a line charge and a plane sheet of charge – Electric potential-Equipotential surfaces-Potential gradient.

Unit II Magnetostatics 9 Hours

Definition of magnetic flux- magnetic field intensity-Lorentz Law of force-Biot–savart Law, Ampere's Law-Application of Ampere's Law: Magnetic induction due to a long linear conductor and solenoid- Magnetic field due to straight conductors- circular loop – Magnetic flux density (B) - Magnetic potential.

Unit III Electric and Magnetic Fields in Materials 9 Hours

Dielectrics: An atomic view-Dielectric Polarization-Dielectrics and Gauss's law-Dielectric Strength- Energy stored in a dielectric medium - Capacity of a condenser - Capacitance - coaxial, Spherical capacitor- Poisson and Laplace Equation.

Magnetic susceptibility and permeability-properties of dia, para and ferro magnetic materials-hysteresis loop.

Unit IV Electromagnetic Induction 9 Hours

Faraday's law – Lenz's law–Time varying magnetic field-self Inductance - self Inductance of a solenoid- Mutual inductance- Mutual inductance of two solenoids. Charge conservation law-continuity equation- displacement current- Maxwell's equations

Unit V Electromagnetic Waves 9 Hours

Electromagnetic waves in free space-Poynting vector-Propagation of electromagnetic waves in dielectrics– Phase velocity- Propagation of electromagnetic waves through conducting media-penetration or skin depth.

List of Experiments 30 Hours

1. Verification of Ohms 'law.
2. Test the Faraday's hypothesis of magnetic field induction.
3. Determination of inductance using Maxwell's bridge.
4. Determination of specific resistance of the given material using Carey foster's bridge.
5. Determination of wavelength of the given light source using spectrometer.
6. Determination of Dielectric constant of a given material.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the laws and concepts of static electric field.	Understand
CO2: Explain the laws and concepts of static magnetic field.	Understand
CO3: Explain the behavior of materials in electric and magnetic fields.	Understand
CO4: Explain time varying electric and magnetic fields using Maxwell's equation.	Understand
CO5: Explain the phenomenon of Electromagnetic wave propagation in different media.	Understand

Text Book(s):

T1. R.K.Gaur and S.L.Gupta, "Engineering Physics", DhanpatRai publications, New Delhi, 8^{th} edition, 2011.

T2. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand and Company Ltd., New Delhi, 2014.

T3. W. H. Hayt and John A. Buck, “Engineering Electromagnetics”, Tata McGraw Hill, New Delhi. 6th Edition, 2014.

Reference Book(s):

R1.David Griffiths, “Introduction to Electrodynamics”, 4th Edition, Pearson Education, 2013.

R2.D. Halliday., R. Resnick and J. Walker, “Fundamentals of Physics”, Wiley Publications, 2008.

R3.K. A. Gangadhar and P. M. Ramanathan, “ Electromagnetic Field Theory”, Khanna Publishers, New Delhi, 5th Edition, 2013.

R4.Mathew. N. O. Sadiku, “ Elements of Electromagnetics”, 4th Edition, Oxford University Press, 2009.

R5.John D. Kraus and Daniel A. Fleisch, “ Electromagnetic with Applications”, Tata McGraw Hill, New Delhi. 5th Edition, 2010.

Web References :

1. http://openems.de/start/index.php
2. http://nptel.iitm.ac.in

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	1	2	3	1	-	1	-	-
CO2	2	1	1	-	-	-	1	2	3	2	-	1	-	-
CO3	2	1	1	-	-	-	1	2	3	2	-	1	-	-
CO4	2	1	1	-	-	-	1	2	3	2	-	1	-	-
CO5	2	1	1	-	-	-	1	1	-	1	-	1	-	-

Assessment pattern:

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19ECSN2201	Course Title: Electric Circuits and Electron Devices		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours: 75	Max Marks:100

Pre-requisites

- 19ECSN2101-Fundamentals of Electrical and Electronics Engineering

Course Objectives

The course is intended to:

1. Analyze DC circuits
2. Analyze AC circuits
3. Analyze steady state and transient response of Electric circuits
4. Explain the characteristics, biasing techniques and applications of Bipolar Junction Transistor.
5. Explain the characteristics, biasing techniques and applications of Field Effect Transistor.

Unit I DC Analysis of Electric Circuits 9 Hours

Mesh current and node voltage method of analysis - Network Theorems: Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Unit II AC Analysis of Electric Circuits 9 Hours

Mesh current and node voltage method of analysis - Network Theorems: Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Unit III Steady State and Transient Analysis 9 Hours

Steady state and Transient response - DC response of an R-L, R-C and R-L-C circuits – AC response of an R-L, R-C and R-L-C circuits.

Unit IV Bipolar Junction Transistors 9 Hours

Characteristics of BJT - Transistor as a switch and Amplifier-Transistor Biasing: Q-point - AC and DC load line analysis - Voltage divider Bias – Bias stability- Bias compensation techniques.

Unit V Field Effect Transistors **9 Hours**

Characteristics of FET- FET biasing: Voltage divider bias – Applications of FET as VVR – Comparison of BJT and FET - MOSFET: Symbol- Structure - Operation – Drain and transfer characteristics- MOSFET Biasing: Voltage Divider Bias- Introduction to CMOS.

List of Experiments **30 Hours**

1. Verification of Superposition theorem
2. Verification of Thevenin's theorem.
3. Verification of Maximum Power transfer theorem.
4. Verification of Series and Parallel RLC circuits under resonance condition.
5. Characteristics of BJT under CE mode
6. Characteristics of FET under CS mode

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze Electric circuits under DC conditions using Appropriate network theorems.	Analyze
CO2: Analyze Electric circuits under AC conditions using Appropriate network theorems.	Analyze
CO3: Analyze steady state and transient response of Electric circuitsusing step and sinusoidal signals	Analyze
CO4: Explain the characteristics, biasing techniques and applications of Bipolar Junction Transistor.	Understand
CO5: Explain the characteristics, biasing techniques and applications of Field Effect Transistor.	Understand

Text Book(s):

T1. M.Armugam and N.Premkumar, "Electric Circuit Theory",4th Edition, Kanna Publishers,2010

T2. Millman J, Halkias.C and Sathyabratajit, "Electronic Devices and Circuits" 2nd edition, Tata McGraw-Hill, New Delhi, 2007.

Reference Book(s):

R1.Circuits and Networks, Sudhakar & Shyammohan, 4thEdition, Tata McGraw-Hill,2010.

R2. Networks and systems, D. Roy Choudhary, 1st Edition, New Age International Publishers

R3. Solid State Electronic Devices, G. Streetman, and S. K. Banerjee, 6th Edition Pearson , 2006.

R4. Donald A Neaman, —Semiconductor Physics and Devices‖, 4th Edition, Tata McGrawHill Inc. 2012.

R5. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, —Electronic Devices and circuits,3rd Edition, Tata McGraw- Hill, 2008.

Web References:

1.https://nptel.ac.in/downloads/108105053/

2.https://nptel.ac.in/courses/108105053/pdf/L-10(GDR)(ET)%20((EE)NPTEL).pdf

3.https://www.btechguru.com/courses--nptel--metallurgy-and-material-science--electronic-materials,-devices,-and-fabrication-video-lecture--MMS--MM113106062V.html

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	1	1	3	1	-	1	3	2
CO2	3	3	2	2	-	1	1	1	3	1	-	1	3	2
CO3	3	3	2	2	-	1	1	1	3	1	-	1	3	2
CO4	3	2	2	2	-	1	1	1	3	1	-	1	3	2
CO5	3	2	2	2	-	1	1	1	3	1	-	1	3	2

High-3; Medium-2; Low-1

Assessment pattern:

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19CSSC2001	Course Title: C Programming (Common to AU, ME,MC,PR CE,EC,EE&EI)		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week)3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain about computer organization and problem solving techniques
2. Write programs using appropriate programming constructs
3. Develop programs using arrays, functions & strings
4. Implement programs using pointers, structures& unions
5. Write programs using files & preprocessor directives

Unit I Introduction 7 Hours

Generation and Classification of Computers –Basic Organization of a Computer – Software development life cycle – Problem Solving Techniques :Algorithm,Pseudocode andFlow Chart.

Unit II C Programming Basics 10 Hours

Introduction to C programming – Structure of a C program – Keywords – Identifiers-Constants–Variables –Data Types– Operators and Expressions –Formatted & Unformatted I/O functions–Decision statements –Loop control statements.

Unit III Arrays,Functions and Strings 10 Hours

Arrays:Characteristics –One-dimensional and Two-dimensional arrays – Functions: Declaration&Definition of function –Built in function – User defined function –Types of functions –Call by value &reference– Strings: Formatting strings–String handling functions.

Unit IV Pointers, Structures & Union 9Hours

Pointers: Features and Types of pointers – Arithmetic operations with pointers–Pointers and Arrays –Structures: Features– Operations on Structures–Array of structures – Unions.

Unit V Files & Pre-Processor Directives 9 Hours

Introduction to Files –Stream and File Types–File operations (Open,close,read,write) – Command line arguments–Pre-processor Directives: Macro Expansion, File Inclusion, Conditional Compilation.

List of Exercises **30 Hours**

1. Programs to process data types, operators and expression evaluation(any 1)
   a. To find area of rectangle/circle/square
   b. To find the simple interest and compound interest
2. Programs using decision and looping statements(any 2)
   a. To find the maximum number among 3 given numbers
   b. To check whether given year is leap year or not
   c. To display the Fibonacci series
   d. To find the factorial of a number
3. Programs using Arrays
   a. To search for particular number among N numbers(1D array)
   b. To compute matrix addition (2 D array)
4. Programs using Functions and Strings(any 2)
   a. To swap two numbers using call by reference
   b. To find the cube of a number
   c. To manipulate strings using string functions
   d. To check whether the string is palindrome or not
5. Programs using Pointer, Structure & Union
   a. To perform arithmetic operations using pointers
   b. To display the information of N students using Structure
   c. To display the employee details using Union
6. Programs using Files (any 1)
   a. To read the contents of a text file
   b. To copy the contents from one file into another

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Explain about computer organization and problem solving techniques	Understand
CO2: Write programs for the given scenario using appropriate programming constructs	Apply
CO3: Develop programs using arrays, functions & strings for the given scenario	Apply
CO4: Implement programs for given application using pointers, structures& unions	Apply
CO5: Write programs using files & preprocessor directives for simple problems	Apply

Text Book(s):

T1.Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, Third Edition, Pearson Education, 2015.

Reference Book(s):

R1. Ajay Mittal, “Programming in C-A Practical Approach ”,Third Edition, Pearson Education, 2010.

R2. Yashavant P.Kanetkar, “Let Us C”, 16thEdition,BPB Publications,2018

R3. PradipDey,Manas Ghosh, “Computer Fundamentals and Programming in C”, 2nd Edition,Oxford University Press,2013

Web References:

1. http://www.cprogramming.com/
2. http://www.c4learn.com/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	2	1	1	2	3	2	-	1	2	2
CO3	3	2	2	2	2	1	1	2	3	2	-	1	2	2
CO4	3	2	2	2	2	1	1	2	3	2	-	1	2	2
CO5	3	2	2	2	2	1	1	2	3	2	-	1	2	2

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19MESC4001	Course Title: Engineering Drawing (Common to EC,EI,CS & IT)		
Course Category :Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week)1: 0: 3	Credits: 2.5	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Develop skills for communication of concepts and ideas.
2. Expose them to existing national standards related to technical drawings.

Unit I Orthographic Projection 12 Hours

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Visualization principles –conversion of pictorial into orthographic views.

Unit II Projection of Solids 12 Hours

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

Unit III Projection of Sectioned Solids 12 Hours

Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other – Orthographic views of sections of simple solids.

Unit IV Development of Surfaces 12 Hours

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

Unit V Isometric Projection and Computer Aided Drafting 12 Hours

Principles of isometric projection – Isometric scale –Isometric projections of simple solids and truncated solids.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Sketch the orthographic projections of the given pictorial view of the object using first angle projection	Apply
CO2: Sketch the projections of simple solids such as prism, pyramid, cylinder and cone using rotating object method	Apply
CO3: Sketch the projections of simple sectioned solids with all necessary dimensions meeting the standards	Apply
CO4: Sketch the lateral surface of simple solids using straight line and radial line development methods	Apply
CO5: Sketch the isometric view of simple solids and truncated solids using principles of isometric projection	Apply

Text Book(s):

T1. Cencil Jensen, Jay D.Helsel and Dennis R. Short, " Engineering Drawing and Design", Tata McGraw Hill India, New Delhi, 7th Edition (2017).

T2. Bhatt N.D. and Panchal V.M., "Engineering Drawing",Charotar Publishing House, Gujarat, 53rd edition (2015).

T3. K. V. Natrajan, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 48th edition (2018).

Reference Book(s):

R1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill India, New Delhi, 2nd edition, 2013.

R2. John K.C., "Engineering Graphics", PHI Learning, Delhi, 1stt edition 2009.

R3. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw India, New Delhi, 3rd edition,2008,.

<u>Publications of Bureau of Indian Standards</u>

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://en.wikipedia.org/wiki/Engineering_drawing

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	3	2	-	1	-	-
CO2	3	2	2	2	-	-	-	2	3	2	-	1	-	-
CO3	3	2	2	2	-	-	-	2	3	2	-	1	-	-
CO4	3	2	2	2	-	-	-	2	3	2	-	1	-	-
CO5	3	2	2	2	-	-	-	2	3	2	-	1	-	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	Each Lab Experiment	1,2,3,4 ,5	75	75
	Cycle Test 1	1,2,3	50	25
	Cycle Test 2	4,5	50	
			Total	100

Course Code:19PSHG3001	Course Title: Wellness for Students (Common to all B.E/B.Tech Programmes) (2019 Batch Only)		
Course Category: Humanities		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours: 30	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Articulate the importance of wellness for success in life
2. Understand the dimensions of wellbeing and relevant practices
3. Guide in adopting such practices to improve wellness
4. Reflect the impact of changes sensed on personal and social effectiveness.

Unit I Wellness - Importance and Dimensions

Values and aspirations – goals – SMART Goals – means for achieving goals – job Vs career – success in life – attributes of successful persons. Maslow's Hierarchy of needs motivation - Concept of wellness – impact of absence of wellness - Wellness as important component to achieve success.

Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods – Guna – causes and impact - multiple dimensions of human structure (physical, astral, causal bodies) – human-panchabootha relationship.

Unit II Practices for Physical Wellness through Yoga

Simplified Physical Exercises: Hand, Leg, Neuromuscular breathing, eye exercises, kapalabathy, makarasanam 1 & 2, body massage, 14-points acupressure – Suryanamaskar - relaxation. Simple asanas.

Unit III Practices for Physical Wellness through Exercises

Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Exercises related ailment and injuries - safety and precautions - first aid.

Fitness development: Muscular strength – exercises (calisthenics): pull-up, sit-up, push-up and weight training; Explosive power – exercises: vertical jump, long jump; Cardio respiratory endurance– exercises: walking, jogging, treadmill, stair climbing, bicycling, skipping; Flexibility – exercises: stretching.

Speed, agility, balance and coordination – exercises: sprint, cone drill, ladder drill, hurdle drill, ball throw - mental agility exercises.

Unit IV Practices for Mental Wellness

Meditation: Mind and its functions - mind wave frequency - Agna, Thuriyam and Shanthi meditation – introspection: analysis of thoughts, moralization of desire, neutralization of anger and eradication of worries - simple mindfulness exercises.

Unit V Practices for Social and Spiritual Wellness

Kayakalpa yoga - youthfulness and life force - cultural education – greatness of guru – universal compassion – fivefold culture. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.
Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas.

Course Outcomes
At the end of this course, students will be able to:
CO1.Explain the concept of wellness and its importance to be successful in career and life
CO2.Explain the dimensions of wellness and practices that can promote wellness
CO3.Demonstrate the practices that can promote wellness
CO4. Sense and improve the wellness periodically and its impact on personal effectiveness
CO5. Maintain harmony with self, family, peers, society and nature

Text Book(s):

T1. Reading material and workbook prepared by PS team of the college.

Reference Book(s):

R1. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar ,"Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, I Ed. (2010).

R2. Dr.R.Nagarathna, Dr.H.R.Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.

R3. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English).

Course offering:

Orientation programme (3 days)	CO1 and CO2
Student practice (weekly review classes)	CO3
Student journal writing (interim reviews)	CO4 and CO5

.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1 -	- 1	1 1	- 1	-	-	-	-
CO2	-	-	-	-	-	-	1 1	- 1	- 1	-	- 1	- 1	-	-
CO3	-	-	-	-	-	- 1	1	- 1	- 1	-	-	- 1	-	-
CO4	-	-	-	-	-	- 1	1	-	1	- 1	- 1	-	-	-
CO5	-	-	-	-	-	1	1	-	- 1	-	-	1	-	-

High-3; Medium-2;Low-1

Course Code:19CHMG6201	Course Title: Environmental Sciences (Common to all B.E/B.Tech Programmes)		
Course Category: Mandatory Non-Credit Course		Course Level: Introductory	
L:T:P(Hours/Week)1: 0: 0		Total Contact Hours:15	Max. Marks: 100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Create awareness for conservation and equitable use of natural resources.
2. Explain the measures of prevention of pollution and disaster management.
3. State the importance of environmental legislation in India.
4. Expose the general environmental issues relevant to human health.
5. Explain the innovative measures for day to day environmental issues.

Unit I Natural Resources 2 Hours

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Unit II Environmental Pollution and Disaster Management 2 Hours

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

Unit III Environmental Ethics and Legislations 2 Hours

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

Unit IV Environmental Issues and Public Awarness 2 Hours

Public awareness - Environment and human health

Unit V Environmental Activities 7 Hours

(a) Awareness Activities:

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste

ii) Slogan making event

iii) Poster making event

b) Actual Activities:

i) Plantation

ii) Cleanliness drive

iii) Drive for segregation of waste

iv) To know about the different varieties of plants

v) Shutting down the fans and ACs of the campus for an hour or so

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the measures for conservation and equitable use of natural resources	Understand
CO2: Describe the measures for pollution prevention and disaster management	Understand
CO3: Brief the importance of environmental legislation in India	Understand
CO4: Explain the general environmental issues in relevant to human health	Understand
CO5: Demonstrate innovative measures for day to day environmental issues	Understand

Text Book(s):

T1.Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

T2.Mackenzie Davis and Susan Masten, "Principles of environmental engineering and science", Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R1.Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.

R2.Cunningham, W.P.Cooper,T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	1	-	1	-	-	1	2	2	1	-	-	1	-	-
CO2	1	-	1	-	-	1	2	2	1	-	-	1	-	-
CO3	1	-	1	-	-	1	2	2	1	-	-	1	-	-
CO4	1	-	1	-	-	1	2	2	1	-	-	1	-	-
CO5	1	-	1	-	-	1	2	2	1	-	-	1	-	-

High-3; Medium-2; Low-1

Assessment Pattern

Component	Marks	Details
Attendance	10	Minimum 80% and 1 mark for every 2% observed
Knowledge Test	40	Objective type questions
Activity(ies)	50	Report on the activity performed
Total	**100**	

Non-letter Grades

Marks Scored	Performance Level
70 & above	Good
30 – 69	Average
< 30	Fair

<table>
<tr><td colspan="2">Course Code: 19PSHG6001</td><td colspan="2">Course Title: Wellness for Students
(Common to all B.E/B.Tech Programmes)
(2020 Batch onwards)</td></tr>
<tr><td colspan="2">Course Category: Humanities</td><td colspan="2">Course Level: Introductory</td></tr>
<tr><td>L:T:P(Hours/Week)0: 0: 2</td><td>Credits:1</td><td>Total Contact Hours:30</td><td>Max. Marks:100</td></tr>
</table>

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Set SMART goals for academic, career and life
2. Apply time management techniques
3. Articulate the importance of wellness for success in life.
4. Understand the dimensions of wellbeing and relevant practices

Unit I Goal Setting

Understanding Vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

Unit II Time Management - Tools and Techniques

Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

Unit III **Practices for Physical Wellness**

Concept of wellness – impact of absence of wellness - Wellness as important component to achieve success. Well being as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

Simplified Physical Exercises. Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

Unit IV **Practices for Mental Wellness**

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas

Unit V **Putting into Practice**

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes	**Cognitive/ Affective**
At the end of this course, students will be able to:	
CO1.Set well-articulated goals for academics, career, and personal aspirations	Apply
CO2.Apply time management techniques to complete planned tasks on time	Apply
CO3.Explain the concept of wellness and its importance to be successful in career and life	Apply
CO4.Explain the dimensions of wellness and practices that can promote wellness	Apply
CO5.Demonstrate the practices that can promote wellness	Valuing

Text book(s):

T1. Reading material, workbook and journal prepared by PS team of the college.

Reference Book(s):

R1. Stephen R Covey, "First things first", Simon & Schuster Uk, Aug 1997.

R2. Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster Uk, 2004.

R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, "Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, I Ed. (2010).
R4. Dr. R. Nagarathna, Dr.H.R. Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.
R5. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English).

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	-	-	-	-	-	-	-	-	1	-	1	1
CO3	-	-	-	-	-	-	-	-	1	-	-	1
CO4	-	-	-	-	-	-	-	-	1	-	-	1
CO5	-	-	-	-	-	1	1	-	1	-	-	1

High-3; Medium-2; Low-1

Assessment Pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	Personal Effectiveness	1,2,5	35	75
	Yoga and physical Exercise:	3,4,5		
	Physical Exercises		20	
	Meditation		10	
	Assessment of student's workbook		10	
End Semester Examination	Written test (MCQ and short answers)	1,2,3,4,5	30	Marks out of 100 is reduced to 25
	Physical exercises		50	
	Viva-voce		20	
			Total	100

Semester - III

Course Code: 19MABC1302	Course Title: NUMERICAL METHODS AND LINEAR ALGEBRA (Common to EC, EE , EI & MC)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- 19MABC1102 -Matrices and Calculus
- 19MABC1201-Ordinary Differential Equation and Complex variables

Course Objectives

The course is intended to:

1. Solve the system of linear equations, nonlinear equations &calculate the dominant Eigen value
2. Determine the unknown values from the given set of data & Compute derivatives and integrals
3. Solve first ordinary differential equation
4. Apply the concept of vector spaces to electrical network problems
5. Apply the concept of Inner product spaces in Fourier approximation

Unit I Solution Of Equations And Eigen value Problems 9+3 Hours

Solution of system of linear equations – Direct methods: Gaussian elimination method – Indirect methods: Gauss Jacobi method, Gauss-Seidel method – sufficient conditions for convergence – Solution of nonlinear equations: Newton Raphson method – Power method to find the dominant Eigen value and the corresponding Eigen vector. Application of Eigen value and the corresponding Eigen vector.

Unit II Interpolation, Numerical Differentiation And Integration 9+3Hours

Newton's forward, backward interpolation — Lagrange's interpolation. Numerical Differentiation and Integration — Trapezoidal rule — Simpson's 1/3 rule — Double integration using Trapezoidal rule.

Unit III **Numerical Solution Of Ordinary Differential Equation** **9+3Hours**

Numerical solution of first order ordinary differential equation-Single step method: Taylor's series-Euler's method - Runge-Kutta method of fourth order — Multi step method: Milne's and Adams – Bash forth predictor corrector methods for solving first order equations.

Unit IV **Vector Spaces** **9+3 Hours**

System of linear equations -Vector spaces- Subspace of a vector space- basis and dimension of vector space - linear combination and spanning sets of vectors -linear independence and linear dependence of vectors-Row space, Column space and Null space- Rank and nullity of subspaces. Applications to linear equations: Simple electrical network problems to find loop current using Kirchhoff's voltage law.

Unit V **Orthogonally And Inner Product Spaces** **9+3 Hours**

Inner product of vectors: length of a vector, distance between two vectors, and orthogonality of vectors-Orthogonal projection of a vector-Gram-Schmidt process to produce orthogonal and orthonormal basis -Inner product spaces- Fourier approximation of continuous functions using inner product spaces.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Solve the system of linear equations, nonlinear equations & calculate the dominant Eigen value	Apply
CO2: Determine the unknown values from the given set of data & compute derivatives and integrals	Apply
CO3: Solve first ordinary differential equation	Apply
CO4: Apply the concept of vector spaces to electrical network problems	Apply
CO5: Apply the concept of Inner product spaces in Fourier approximation	Apply

Text Book(s):

1. Grewal, B.S. and Grewal, J. S., "Numerical Methods in Engineering and Science", Eleventh Edition, Khanna Publishers, New Delhi, 2013.
2. David C Lay, "Linear Algebra and its Applications', Fifth Edition, Pearson Education, 2015.

Reference Book(s):

1. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", Seventh Edition, Pearson Education Asia, New Delhi, 2006.
2. Jain M. K., Iyengar, S. R. and Jain, R. K, "Numerical Methods for Scientific and Engineering Computation', New Age Publishers, 2012.
3. Sastry.S.S, "Introductory Methods of Numerical Analysis", 3 Edition, PHI, 2003.
4. Gilbert Strang, "Linear algebra and its Applications', Fourth Edition, Cengage Learning India Private Limited, 2012.

Web References:

1. http://nptel.ac.in/courses/122104018/node2.html
2. http://nptel.ac.in/courses/111105038/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	1	1	1	1	2	2	2
CO2	3	2	1	1	-	1	-	1	1	1	1	2	2	2
CO3	3	2	1	1	-	1	-	1	1	1	1	2	2	2
CO4	3	2	1	1	-	1	-	1	1	1	1	2	2	2
CO5	3	2	1	1	-	1	-	1	1	1	1	2	2	2

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	Retest	1,2,3,4	50	
	CCET 3	5	50	
	Tutorial	1,2,3,4,5	30	10
	Quiz	1,2,3,4,5		
	Assignment	1,2,3,4,5		
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code: 19ECCN1301	Course Title: Analog Circuits- I		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECSN2101- Fundamentals of Electrical and Electronics Engineering
- 19ECSN2201- Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Analyze BJT and FET Amplifiers
2. Select the appropriate Power Amplifier for a given application
3. Analyze various feedback amplifiers
4. Analyze Tuned Amplifier
5. Explain the characteristics of Operational Amplifier

Unit I Analysis of BJT and FET Amplifiers **9 Hours**

Analysis of BJT amplifier: LF response of CE, CB and CC Amplifier using h-parameter model. HF response of Common emitter amplifier-Hybrid π model – Definition of Cut off frequencies and bandwidth. High frequency response of Common source FET amplifier.

Unit II Large Signal Amplifiers **9 Hours**

Classification of Large signal amplifiers: Class A- direct coupled and transformer coupled. Class B- push pull and complementary symmetry –Cross over distortion- Class AB Power amplifier.

Unit III Feedback Amplifiers **9 Hours**

Types of Feedback- The four basic feedback topologies - Input and Output resistances with Negative feedback - Method of identifying feedback topologies.

Unit IV Tuned Amplifiers **9 Hours**

Single tuned amplifier– Effect of cascading single tuned amplifiers on bandwidth – Stagger tuned amplifiers –Class C tuned amplifier. Neutralization - Hazeltine neutralization and Rice neutralization.

Unit V OP-AMP and Its Characteristics **9 Hours**

Block Diagram of Op-amp –CMRR- Ideal Op-amp characteristics and its equivalent circuit – DC characteristics - AC characteristics – Concept of frequency compensation-methods of improving slew rate.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze BJT and FET Amplifiers at low and high frequency using h-parameter and hybrid- π model	Analyze
CO2: Select the appropriate Power Amplifier for a given application	Analyze
CO3: Analyze various Feedback Amplifiers using appropriate feedback topologies	Analyze
CO4: Analyze the frequency response characteristics of Tuned Amplifier and it's neutralization techniques	Analyze
CO5: Explain the characteristics of Operational Amplifier in terms of AC and DC parameters	Understand

Text Book(s):

T1. Anil K.Maini and VarshaAgarwal, "Electronic Devices and Circuits", Wiley India Private Ltd, New Delhi, 2009.

T2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Second Edition, Tata McGraw-Hill, New Delhi, 2007.

Reference Book(s):

R1. Roy Choudhary.D., Sheil.B.Jani, "Linear Integrated Circuits", Second Edition, New Age, 2003.

R2. Robert L. Boyelstad and Louis Nasheresky, "Electronics Devices and Circuit Theory", Ninth Edition, Pearson Education/ PHI, New Delhi 2002.

R3. David A. Bell, "Electronics Devices and Circuits", Fifth Edition, Oxford University Press, 2008.

R4. Sedra/ Smith, "Micro Electronic Circuits" Oxford University Press, 2004.

Web References:

1. https://nptel.ac.in/courses/117/107/117107094/
2. https://nptel.ac.in/courses/117/106/117106088/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	2	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ITSN2302	**Course Title: Data Structures and Algorithms - I**		
Course Category: Engineering Science		**Course Level: Practice**	
L:T:P(Hours/Week) 3: 0: 2	**Credits:4**	**Total Contact Hours:75**	**Max. Marks:100**

Pre-requisites

- 19CSSC2001- C Programming

Course Objectives

The course is intended to:

1. Construct programs using pointers
2. Write programs using structures and unions
3. Implement linear data structures
4. Develop programs using stack and queue
5. Demonstrate a familiarity with sorting and searching techniques in data structures

UNIT I Pointers 9 Hours

Introduction to pointers- Accessing the address of a variable- Declaring & Initializing pointer Variable- Accessing a variable through its pointers- Pointer & Arrays- Array of pointers- Pointers as Function arguments- Pointers to Functions.

UNIT II Structures and Union 9 Hours

Structures: Declaration & Initialization of Structures - Structure within Structure - Array of Structures -Pointer to Structures - Structure and Functions –Typedef- Union: Declaration & Initialization of Union -Operations on Union -Enumerations.

UNIT III Linear Data structure - List 9 Hours

Data Structures types - Abstract Data Types - List ADT: Array and Linked List Implementation -Doubly Linked List - Circularly Linked List-Applications of List: Radix sort.

UNIT IV **Linear Data structures-Stack and Queue** **9 Hours**

Stack ADT: Stack Model - Array and Linked List Implementation of Stack - Applications :Balancing Symbols - Postfix Expressions- Infix to Postfix Conversion – Queue ADT: Queue Model -Array and Linked List Implementation of Queue - Applications of Queue.

UNIT V **Sorting and Searching Techniques** **9 Hours**

Sorting Techniques: Bubble sort - Merge sort - Quick sort - Applications of Sorting - Searching Techniques: Linear Search - Binary Search- Applications of Searching.

List of Exercises **30 Hours**

1. Develop C program using array of pointers
2. Develop C program using Structure pointers
3. Create a C program to implement Singly Linked list using Linked list implementation
4. Create a C program to implement Stack using array and linked list implementation
5. Create a C program to implement Queue using array and linked list implementation
6. Create a C program to implement Merge Sort / Quick Sort / Bubble Sort

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Construct programs using pointers for given scenario	Apply
CO2: Write programs using structures and unions for various real time applications	Apply
CO3: Implement Linear data structures such as Linked List using C	Apply
CO4: Develop programs using stack and queue for given application	Apply
CO5: Implementation of Sorting and Searching Techniques	Apply

Text Book(s):

T1. E.Balagurusamy, "Programming in ANSI C", 4th Edition, Tata McGraw-Hill Education,2017. (UNIT I,II)

T2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 2011. (UNIT III,IV,V)

Reference Book(s):

R1. Ajay Mittal, "Programming in C - A Practical Approach", 3rd Edition, Pearson Education, 2010.

R2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education; Third edition, 2017.

Web References:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. http://www.csse.monash.edu.au/~lloyd/tildeAlgDS
3. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
4. http://www.c4learn.com

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO2	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO3	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO4	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO5	3	2	1	1	2	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN2301	**Course Title: Transmission Lines and Waveguides**		
Course Category: Professional Core		**Course Level: Practice**	
L:T:P(Hours/Week) 3: 0: 2	**Credits:4**	**Total Contact Hours:75**	**Max Marks:100**

Pre-requisites

- 19PHBC2001- Physics for Electrical Sciences

Course Objectives

The course is intended to:

1. Analyze two port network and transmission line parameters
2. Analyze power measurement in transmission lines
3. Select appropriate matching sections for impedance matching
4. Analyze various modes of propagation in parallel plane and rectangular waveguides
5. Analyze various modes of propagation in circular waveguides and cavity resonator

Unit I Transmission Line Theory 9 Hours

Introduction – Definition of Two Port Network parameters - The Lumped element circuit model for a transmission line – General solution of transmission line-propagation constant, characteristic impedance - reflection on a line not terminated by Z_o - Waveform distortion, condition for distortion less line.

Unit II High Frequency Transmission Lines 9 Hours

Approximations at high frequencies - Line of zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines.

Unit III Impedance Matching in Transmission Lines 9 Hours

Impedance matching: Quarter wave transformer, Half wave line, Eighth wave line – Smith chart – transmission line calculations using Smith chart - Single stub matching.

Unit IV Parallel Plane and Rectangular Waveguides 9 Hours

Parallel Plane Waveguides: Waves between parallel planes – TE, TM and TEM waves-Characteristics, Velocities of propagation.

Rectangular Waveguides: TE and TM waves - characteristics, Impossibility of TEM waves in hollow wave guides- Dominant Mode - definition of Wave Impedance

Unit V Circular Waveguides and Rectangular Cavity Resonator 9 Hours

Circular Waveguides: Bessel's function, Solution of the field equation in cylindrical co-ordinates, TE and TM waves, Characteristics.
Rectangular Cavity Resonator: Rectangular cavity, TE and TM mode, resonant frequency, dominant mode, Q factor – Unloaded Q for TE_{101} mode.

List of Experiments 30 Hours

1. Measurement of cutoff frequency and attenuation in a coaxial line
2. Determination of SWR and reflection coefficient of a device using VNA
3. Determination of line parameters using Smith chart utility software
4. Design of Quarter wave transformer
5. Determination of VSWR and Reflection coefficient using slotted line section
6. Measurement of frequency and wavelength of dominant mode in RWG

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Analyze the basic transmission line parameters using the analogy between lumped and distributed model	Analyze
CO2: Analyze power measurement in transmission lines at high frequencies by approximating their parameters	Analyze
CO3: Select appropriate matching sections to minimize the impedance mismatch in a transmission line	Apply
CO4: Analyze various modes of propagation in parallel plane and rectangular waveguides by using wave equations	Analyze
CO5: Analyze various modes of propagation in circular waveguides and cavity resonator by using wave theory approach	Analyze

Text Book(s):

T1. A Sudhakar, S Shyam mohan and Palli, Circuits and Network (Analysis and synthesis) Tata McGraw-Hill, 2010.

T2. John D Ryder, "Networks, Lines and Fields", PHI, 2nd Edition New Delhi, 1999

T3. Jordan. E.C. and Balmain.K.G, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, New Delhi, 1995.

Reference Book(s):

R1. Alexander C. and Sadiku M. N. O., —Fundamentals of Electric Circuits ", Tata McGraw Hill, New Delhi, 2013.

R2. Umesh Sinha,"Transmission Lines and Networks", Satya Prakashan (Tech. India Publications, New Delhi), 2001

R3. David M. Pozar, "Microwave Engineering", Third Edition, John Wiley, 2009.

R4. David K. Cheng,"Field and Wave Electromagnetics", Pearson Education, Second Edition,2004

R5. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition 2005.

Web References:

1. http://www.nptel.ac.in/courses/117101057/
2. http://www.amanogawa.com/archive/transmissionB.html
3. http://www.falstad.com/circuit/e-tl.html
4. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-fall-2005/lecture-notes/
5. http://www.indiabix.com/electronics-circuits/simple-transmission-lines/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	2	3	2	-	2	2	-
CO2	3	3	2	2	2	-	-	2	3	2	-	2	2	-
CO3	3	2	1	1	2	-	-	2	3	2	-	2	2	
CO4	3	3	2	2	2	-	-	2	3	2	-	2	2	-
CO5	3	3	2	2	2	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN1302	Course Title: Digital Principles and System Design		
Course Category:Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites: The student should have undergone the course(s):

- 19ECSN2201- Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Illustrate the number systems and boolean laws
2. Explain minimization techniques and operation of logic families
3. Develop combinational logic
4. Design synchronous sequential circuits
5. Design asynchronous sequential circuits

Unit I Basic Concepts in Boolean Algebra 10 Hours

Number System: Review of decimal, binary, octal and hexadecimal numbers –Complements: 1's and 2's – Arithmetic operation of Signed binary numbers - Digital Logic Gates – Universal gate Implementation.

Boolean algebra: Basic Theorems, properties and– Representation of Boolean functions in Canonical and standard forms.

Unit II Minimization Techniques and Logic Families 12 Hours

Minimization Techniques: Simplifications of Boolean expression using 3 and 4 variable K map method and Mc-Cluskey method.

Logic Families: Characteristics and operation of TTL, ECL, CMOS logic.

Unit III Combinational Logic 12 Hours

Combinational Circuits: Design Procedure of adder-half adder, full adder,4-bit RCA, Subtractor: half subtractor, full subtractor,4-bit subtractor, Comparator: 4-bit magnitude comparator, code converters-binary to excess-3,binary to gray,Encoders-8 to 3, Decoders- 3 to 8, Multiplexers-8 X 1 and De-multiplexers-1 X 8.

Unit IV Synchronous Sequential Logic 13 Hours

Flip flops: SR, JK, T, D -- Level and Edge Triggering – Analysis of sequential circuits - Design of sequential circuits– **Registers:** Shift registers – SISO, SIPO, PISO, PIPO –**Counters:** Design of 3-bit synchronous and ripple counter.

Unit V Asynchronous Sequential Logic 13 Hours

Analysis of Asynchronous Sequential Circuits - Design of Asynchronous Sequential Circuits with primitive flow table, state reduction and state assignment – Races, Cycles and Hazards: Static, Dynamic, Essential, Hazards elimination.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Illustrate the number systems and boolean laws used in digital design	Understand
CO2: Explain minimization techniques in boolean algebra and logic Families	Understand
CO3: Develop combinational circuits using simplification techniques	Apply
CO4: Design synchronous sequential circuits using flip-flops	Apply
CO5: Design an asynchronous sequential circuit eliminating hazards and races.	Apply

Text Book(s):

T1. Morris Mano. M., "Digital Design", Third Edition, Pearson Edn.,2001

T2. William I. Fletcher, "An Engineering Approach to Digital Design ", Prentice-Hall of India, 1980.

Reference Book(s):

R1. Donald D. Givone, "Digital Principles and Design", TMH, 2003

R2. Salivahanan. S and Arivazhagan. S., "Digital Circuits and Design", Fourth Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.

R3. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007

Web References:

1. http://www.learnabout-electronics.org//Digital/dig10.php
2. http://nptel.ac.in/courses/117103064/
3. https://nptel.ac.in/courses/108105132/
4. http://www.allaboutcircuits.com/textbook/digital/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	2	3	2	-	2	-	3
CO2	3	2	1	1	2	-	-	2	3	2	-	2	-	3
CO3	3	3	2	2	2	-	-	2	3	2	-	2	-	3
CO4	3	3	2	2	2	-	-	2	3	2	-	2	-	3
CO5	3	3	2	2	2	-	-	2	3	2	-	2		3

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN3301	Course Title: Analog Circuits-I Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19ECSN2101- Fundamentals of Electrical and Electronics Engineering
- 19ECSN2201- Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Construct BJT amplifiers and draw their frequency response characteristics
2. Construct FET amplifier in CS configuration and draw its frequency response characteristics
3. Construct Power Amplifiers using BJT and estimate their efficiencies
4. Construct Feedback amplifiers using BJT and draw its frequency response characteristics
5. Construct and test simple electronic circuits using BJT

LIST OF EXPERIMENTS:

1. Frequency response characteristics of CE amplifier
2. Frequency response characteristics of CC amplifier
3. Frequency response characteristics of CS amplifier
4. Two stage RC coupled amplifier
5. Class A power amplifier
6. Complementary symmetry class-B amplifier
7. Feedback amplifiers using BJT
8. Class C tuned amplifier
9. Relay driver using BJT/FET amplifier
10. Fixed voltage Power supply

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Construct BJT amplifiers in both CE and CC configurations and draw their frequency response characteristics.	Apply
CO2: Construct FET amplifier in CS configuration and draw its frequency response characteristics.	Apply
CO3: Construct Power Amplifiers using BJT and estimate their efficiencies.	Apply
CO4: Construct Feedback amplifiers using BJT and draw its frequency response characteristics.	Apply
CO5: Construct simple electronic circuits and test its performance.	Apply

Reference(s)

R1.Analog Circuits I Laboratory Manual

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO2	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO3	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO4	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO5	3	2	2	2	-	-	-	2	3	2	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern:

Continuous comprehensive Evaluation	Assessment component	Marks	Total Marks
	Each Lab Experiment	75	75
	Cycle Test 1	50	25
	Cycle Test 2	50	
	Total		100

Course Code: 19ECCN3302	Course Title: Digital Principles and System Design Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19ECSN2201- Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Understand number representations and conversion between different representations in digital electronic circuit.
2. Understand simplification of Boolean expressions and operation of logic families.
3. Understand various combinational circuits.
4. Understand concepts of asynchronous sequential circuits.
5. Understand different concepts of synchronous sequential logic circuits.

LIST OF EXPERIMENTS:

1. Realization and logic verification of full adder and full subtractor using gates.
2. Implementation of 4*1 multiplexer and 1*4 demultiplexer using gates.
3. Design and logic verification of 3-bit comparator using gates.
4. Design and logic verification of binary to BCD converter and BCD to seven segment display using gates.
5. Design and logic verification of 4-bit Serial In-Parallel out shift register using gates..
6. Design and logic verification of 3-bit synchronous Counter using gates..
7. Design and simulation of 3 to 8 decoder and 8 to 3 encoder using Verilog HDL code .
8. Design and simulation of 4-bit RCA using Verilog HDL code.

9. Design and simulation of JK Flip flop using Verilog HDL code

10. Design and simulation of synchronous counter which counts for specified states using Verilog HDL code.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Build different types of codes and number systems which are used in digital Communications.	Apply
CO2: Apply minimization techniques to simplify digital circuits and compare different types of logic families.	Apply
CO3: Analyze and design Combinational Circuits.	Analyze
CO4: Analyze and design Synchronous Sequential logic circuits.	Analyze
CO5: Analyze and design Asynchronous Sequential logic circuits.	Analyze

Reference(s)

R1. Laboratory manual prepared by the department of ECE

R2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis, Second edition, Prentice Hall, 2003.

R3. Donald E.Thomas, Philip R.Moorby, " The Verilog Hardware description Language",Fifth Edition, Kluwer Academic Publishers, 2002.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	2	3	2	-	2	-	3
CO2	3	2	1	1	2	-	-	2	3	2	-	2	-	3
CO3	3	3	2	2	2	-	-	2	3	2	-	2	-	3
CO4	3	3	2	2	2	-	-	2	3	2	-	2	-	3
CO5	3	3	2	2	2	-	-	2	3	2	-	2	-	3

High-3; Medium-2;Low-1

Assessment pattern:

<table>
<tr><th rowspan="4">Continuous comprehensive Evaluation</th><th>Assessment component</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Each Lab Experiment</td><td>75</td><td>75</td></tr>
<tr><td>Cycle Test 1</td><td>50</td><td rowspan="2">25</td></tr>
<tr><td>Cycle Test 2</td><td>50</td></tr>
<tr><td colspan="2">Total</td><td></td><td>100</td></tr>
</table>

Course Code: 19MABG1401	Course Title: Probability and Statistics (common to all B.E/B.Tech programmes)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week)3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Calculate expectations and variances of random variables
2. Apply the concepts of standard distributions to solve practical problems
3. Calculate the correlation and regression for two variables
4. Test the samples based on hypothesis
5. Analyze the samples based on variance

UNIT I Probability and Random Variables 9+3 Hours

Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties.

Unit II Standard Distributions 9+3Hours

Binomial- Poisson- Uniform –Exponential- Normal Distributions and their properties-Functions of a random variable.

UNIT III Two Dimensional Random Variables 9+3Hours

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.

UNIT IV Testing of Hypotheses 9+3Hours

Sampling Distributions- Testing of hypotheses for mean, variance, proportions and differences using Normal, t, Chi-Square and F distributions – Tests for independence of attributes and Goodness of fit.

UNIT V Design of Experiments 9+3 Hours

Analysis of Variance (ANOVA)- One way Classification – Completely Randomized Design(CRD) – Two way Classification – Randomized Block Design (RBD) – Latin square.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Calculate expectations and variances of random variables	Apply
CO2: Apply the concepts of standard distributions to solve practical problems	Apply
CO3: Calculate the correlation and regression for two variables	Apply
CO4: Test the samples based on hypothesis	Apply
CO5: Analyze the samples based on variance	Apply

Text Book(s):

T1. Veerarajan T, "Probability, Statistics and Random process", 4thEdition, Tata McGraw-Hill, New Delhi, 2013.

T2. Dr.J.Ravichandran, "Probability and Statistics for Engineers", 1stEdition, Wiley India Pvt.Ltd.,2010.

Reference Book(s):

R1. R.E. Walpole,R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", 9thEdition Pearson Education, Asia, 2016.

R2. M.R. Spiegel,J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", 3rdEdition,Tata McGraw Hill edition, 2009.

R3. Morris DeGroot, Mark Schervish, "Probability and Statistics", Pearson Educational Ltd,4th Edition, 2014.

R4. Johnson and C.B. Gupta,"Probability and Statistics for Engineers", 9thEdition,Pearson Education, Asia, 2016.

Web References:

1. Unit I to Unit IV: https://onlinecourses.nptel.ac.in/111105041/
2. Unit I to Unit IV: https://nptel.ac.in/courses/111105090/
3. Unit V : https://nptel.ac.in/courses/111104075/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	1	1	1	1	2	2	1
CO2	3	2	1	1	-	1	-	1	1	1	1	2	2	1
CO3	3	2	1	1	-	1	-	1	1	1	1	2	2	1
CO4	3	2	1	1	-	1	-	1	1	1	1	2	2	1
CO5	3	2	1	1	-	1	-	1	1	1	1	2	2	1

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	Retest	1,2,3,4	50	
	CCET 3	5	50	
	Tutorial	1,2,3,4,5	30	10
	Quiz	1,2,3,4,5		
	Assignment	1,2,3,4,5		
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code: 19ECCN1401	Course Title: Analog Circuits- II		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)3: 1: 0	Credits:4	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- 19ECCN1301- Analog Circuits I

Course Objectives

The course is intended to:

1. Design arithmetic, calculus and rectifier circuits using op-amps
2. Design comparators and data converters using op-amps
3. Design Oscillators using op-amps/BJT
4. Design Wave shaping circuits using op-amps and BJT
5. Analyze the applications of special function ICs

Unit I Application of OP-AMP **9 +3 Hours**

Inverting and Non-inverting amplifier - Voltage follower – Summing amplifier – Subtractor - Instrumentation Amplifier- OP-AMP circuits using diodes: Half wave, full wave rectifiers and precision rectifiers.–Integrator – Differentiator.

Unit II Comparators and Converters **9 +3 Hours**

Comparator- Zero crossing detector, DAC and ADC - specifications –Weighted resistor type and R-2R ladder type - Flash type, Successive approximation type and dual slope type.

Unit III Oscillators **9+3 Hours**

RC Oscillators using OP-AMP: RC phase shift and Wein bridge. LC oscillators using BJT: Hartley and Colpitt's oscillator. Crystal oscillator.

Unit IV Wave shaping Circuits **9 +3 Hours**

Multivibrators: Astable, Monostable and Bistable - Schmitt trigger using BJT and OP-AMP.

Unit V Special Function ICs and its Applications **9 +3 Hours**

IC 555 timer and IC 565 PLL - applications. Fixed and variable voltage regulators.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Design arithmetic, calculus and rectifier circuits using op-amps	Apply
CO2: Design comparators and data converters using op-amps	Apply
CO3: Design RC Oscillators using op-amps and LC Oscillators using BJT	Apply
CO4: Design waveshaping circuits using op-amps and BJT	Apply
CO5: Analyze the applications of special function ICs such as timer, PLL and voltage regulator	Analyze

Text Book(s):

T1. Roy Choudhary.D., Sheil.B.Jani, "Linear Integrated Circuits", Second Edition, New Age, 2003.

T2. S.Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Second Edition, Tata McGraw-Hill, New Delhi, 2007.

T3. RamakantA.Gayakward, "Op-amps and Linear Integrated Circuits", Fourth edition, Pearson Education, 2003.

Reference Book(s):

R1. Anil K.Maini and Varsha Agarwal, "Electronic Devices and Circuits", WileyIndia Private Ltd, New Delhi, 2009.

R2. Robert L. Boyelstad and Louis Nasheresky, "Electronics Devices and Circuit Theory", Ninth Edition, Pearson Education/ PHI, New Delhi 2002.

R3. David A. Bell, "Electronics Devices and Circuits", Fifth Edition, Oxford University Press, 2008.

R4. Sedra/ Smith, “Micro Electronic Circuits” Oxford University Press, 2004.

Web References:

1.https://nptel.ac.in/courses/117101106/

2.https://freevideolectures.com/course/2915/linear-integrated-circuits

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO2	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	1	2	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ITSN2401	Course Title: Data Structures and Algorithms - II		
Course Category: Engineering Science		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max. Marks:100

Pre-requisites

- 19ITSN2302-Data Structures and Algorithms - I

Course Objectives

The course is intended to:

1. Write java programs using appropriate programming paradigm
2. Understand the principles of inheritance, polymorphism and interfaces
3. Obtain code reusability and explore exception handling mechanism
4. Perform various operations on trees
5. Implement the traversal methods on graphs

UNIT I INTRODUCTION 9 Hours

Introduction to java – Basics of OOPS Concepts - Java Virtual Machine - Structure of Java Program -Java Tokens - Constants - Variables -Data Types - Scope of Variables - Operators - Java Statements -Defining a Class - Defining Methods -Creating Objects - Accessing Class Members-Arrays-Applications of Java: Server, Client and Embedded Devices.

UNIT II OBJECT ORIENTED PROGRAMMING USING JAVA 9 Hours

Constructors - Garbage Collection - Method Overloading -Static Members -Inheritance: Extending a Class -Overriding Methods - Super Keyword -Final Variables and Methods - Final Classes - Abstract Classes and Methods – Interfaces- Extending Interfaces - Implementing Interfaces.

UNIT III PACKAGES, STRING AND EXCEPTION HANDLING 9 Hours

Packages –Creating and Importing Packages - Visibility Control - String Class -String Buffer - Exception Types -Uncaught Exceptions -Using Try Catch -Multiple Catch -Nested Try -Throw - Throws - Finally.

UNIT IV TREES **8 Hours**

Tree - Preliminaries - Binary tree - Tree traversal - Applications - Expression tree - Binary search tree - BST Operations - AVL tree.

UNIT V GRAPHS **10 Hours**

Representation of graph - Graph Traversals: Depth first and Breadthfirst traversal - Applications of graphs - Topological sort - Shortest path algorithms: Dijkstra's & Floyd's algorithms - Minimum Spanning Tree: Prim's and Kruskal'salgorithms.

List of Exercises **30 Hours**

1. Creation of classes and use of different types of functions
2. Programs using Inheritance
3. Developing user defined interfaces
4. Creation of User defined package with appropriate usage of access modifiers
5. Implementation of Binary search tree
6. Implementation of Dijkstra's algorithm

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Write java programs to solve simple business problems	Apply
CO2: Apply inheritance and interfaces in order to attain code minimization and reusability	Apply
CO3: Create user defined packages and exception handling mechanism to obtain data encapsulation	Apply
CO4: Implement various operations on trees for real world applications	Apply
CO5: Implement the graph traversal methods	Apply

Text Book(s):

T1. Schildt. H., “Java - The complete Reference”, 10th Edition, McGraw Hill Education, 2014. (Unit 1, 2 & 3)

T2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in Java”, Pearson Education Asia, New Delhi, Third Edition, 2012. (Unit 4 & 5)

Reference Book(s):

R1. Deitel and Deitel,” Java How to Program”, Prentice Hall, 10th Edition, 2014

R2. Bert Bates &Kathy Sierra, “ Head First Java: A Brain-Friendly Guide”,2nd Edition,O'Reilly Media, 2009

R3. Lafore, “Data Structures & Algorithms in Java”, 2nd Edition, Pearson, 2007

R4. Goodrich M T and Tamassia R, “Data Structures and Algorithms in Java”, 5th edition, Wiley publication, 2010.

Web References:

1. https://nptel.ac.in/courses/106105191/
2. https://nptel.ac.in/courses/106102064/
3. https://www.coursera.org/learn/object-oriented-java?specialization=java-object-oriented
4. https://www.coursera.org/learn/data-structures

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO2	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO3	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO4	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO5	3	2	1	1	2	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="6">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">20</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Continuous Assessment – Practical</td><td>1,2,3,4,5</td><td>75</td><td>10</td></tr>
<tr><td>Final Assessment – Practical</td><td>1,2,3,4,5</td><td>50</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

<table>
<tr><td colspan="2">Course Code: 19ECCN1402</td><td colspan="3">Course Title: Signals and Systems</td></tr>
<tr><td colspan="3">Course Category: Professional Core</td><td colspan="2">Course Level: Practice</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 1: 0</td><td colspan="2">Credits:4</td><td>Total Contact Hours:60</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19MABC1201 -Ordinary Differential Equations and Complex Variables

Course Objectives

The course is intended to:

1. Classify various continuous time and discrete time signals
2. Classify various continuous time and discrete time systems
3. Interpret the spectral characteristics of continuous time periodic and aperiodic signals
4. Analyse Linear Time Invariant (LTI) continuous time systems
5. Understand the sampling process

Unit I Classification of Signals 9+4Hours

Continuous Time (CT) and Discrete Time (DT) signals – Deterministic and Random signals Periodic and Aperiodic signals – Even and Odd signals – Energy and Power Signals – Unit step and Unit ramp Unit impulse signals - Operation on signals: Time shifting, scaling and folding.

Unit II Classification of Systems 9+4Hours

Continuous time systems – Discrete time systems – Linear system – Time invariant system – causal system – BIBO stable system – system with and without memory – LTI system.

Unit III Analysis of Continuous Time Signals 9+4Hours

Fourier Series – Representation of Continuous time Periodic signals – properties of Continuous Time Fourier Series – Fourier Transform – Representation of Continuous time signals – properties of Continuous Time Fourier Transform.

Unit IV Analysis of Continuous Time Systems 9+4Hours

System modeling: Differential equation – impulse response – convolution integral – Laplace transform – properties of Laplace transform – Analysis and characterization of LTI systems using Laplace transform.

Unit V Sampling and Reconstruction 8 Hours

Sampling of continuous time signals – Frequency domain representation of sampling – Sampling theorem – Effects of under sampling – Aliasing – Reconstruction of continuous time signals from samples.

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO1: Apply mathematical operations to classify various continuous time and discrete time signals based on their properties	Apply
CO2: Apply mathematical operations to classify various continuous time and discrete time systems based on their properties	Apply
CO3: Interpret the spectral characteristics of continuous time periodic and aperiodic signals using Fourier analysis	Apply
CO4: Apply Laplace Transform to represent and study the characteristics of Linear Time Invariant(LTI) continuous time systems	Apply
CO5: Understand the process of sampling and the effects of under sampling	Understand

Text Book(s):

T1. Allan V. Oppenheim, S. Wilsky and S.H.Nawab "Signals and System", Pearson Education, 2007

T2. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley &Sons, 2004.

Reference Book(s):

R1. H P Hsu, RakeshRanjan, "Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007

R2. Edward W Kamen, Bonnie S Heck, "Fundamentals of Signals and Systems Using the Web and MATLAB", Pearson Education, 2007

R3. Vinay K Ingle, John G Proakis, "Digital Signal Processing using MATLAB", Cengage Learning, 3rd edition, 2011

R4. Sanjit K Mithra, "Digital Signal Processing Laboratory using MATLAB", Tata McGraw Hill, 1999

Web References:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/
2. http://www.ws.binghamton.edu/fowler/Fowler%20Personal%20Page/EECE301%20-%20Flipped.htm
3. https://nptel.ac.in/courses/117/104/117104074/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO2	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	1	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN3401	Course Title: Analog Circuits - II Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19ECCN1301-Analog Circuits – I
- 19ECCN3301-Analog Circuits - I laboratory

Course Objectives

The course is intended to:

1. Design and Verify arithmetic and Calculus operations using op-amp circuits
2. Design and verify Digital to Analog Converters
3. Design and verify RC and LC oscillators
4. Construct and test square wave generator and squaring circuit and voltage regulator circuit
5. Design and verify simple electronic circuits

LIST OF EXPERIMENTS:

1. Arithmetic operations using op-amp.
2. Calculus circuits using op-amp.
3. Comparator circuits using op-amp.
4. Digital to Analog converter
5. RC Phase shift oscillator using Op-amp
6. LC oscillators using BJT
7. Application of Astable Multivibrator
8. Regenerative comparator.
9. Applications of 555
10. Voltage regulator

Course Outcomes At the end of this course, students will be able to:	Cognitive Level
CO1: Design and Verify arithmetic and Calculus operations using op-amp circuits	Apply
CO2: Design and verify Digital to Analog Converters	Apply
CO3: Design and verify RC and LC oscillators	Apply
CO4: Construct and test square wave generator and squaring circuit and Voltage regulator circuit using op-amp	Apply
CO5: Design and verify simple electronic circuits using timer and PLL	Apply

Reference(s)

R1.Analog Circuits -II Laboratory Manual

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO2	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO3	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO4	3	2	2	2	-	-	-	2	3	2	-	1	2	-
CO5	3	2	2	2	-	-	-	2	3	2	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern:

Continuous comprehensive Evaluation	Assessment component	Marks	Total Marks
	Each Lab Experiment	75	75
	Cycle Test 1	50	25
	Cycle Test 2	50	
	Total		100

Course Code: 19PSHG6002	Course Title: Universal Human Values 2 :Understanding Harmony		
Course Category: Humanities		Course Level: Practice	
L:T:P (Hours/Week) 2:1: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19SHMG6101- Induction Program (UHV1)

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act

Unit I Introduction to Value Education **6+3 Hours**

Need for the Value Education;. Self -exploration as the process for value education ; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities ; Happiness and Prosperity: current scenario ; Method to fulfill the Basic human aspirations

Unit II Harmony in Human Being **6+3 Hours**

Human being as a co-existence of self ('I') and the material 'Body'; needs of Self ('I') and 'Body'; The Body as an instrument of 'I' ; Harmony in the self('I'); Harmony of the self('I') with body ;Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III Harmony in the Family and Society **6+3 Hours**

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmony in the society (society being an extension of family); Vision for the universal human order

Unit IV Harmony in the Nature

6+3 Hours

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

Unit V Harmony on Professional Ethics **6+3 Hours**

Natural acceptance of human values ;Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics ;Case study: holistic technologies, management models and production systems ;Strategy for transition towards value based life and profession.

Course Outcomes	**Affective Level**
At the end of this course, students will be able to:	
CO1: Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO2: Appraise physical, mental and social well being of self and practice techniques to promote well being.	Responding
CO3: Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO4: Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO5: Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Text Book(s):

T1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Book(s):

R1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
R2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
R3. The story of stuff, Annie Leonard, Free Press, New York 2010.

Web References:

1. https://aktu.ac.in/hvpe/ResourceVideo.aspx
2. http://hvpenotes.blogspot.com/
3. https://nptel.ac.in/courses/109/104/109104068/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	2	-	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	1	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	1	-	2	-	-
CO4	-	-	-	-	-	2	2	2	2	-	-	2	-	-
CO5	-	-	-	-	-	1	2	2	2	-	-	2	-	-

High-3; Medium-2; Low-1

Assessment Pattern

	Assessment component	CO No.	Marks	Total marks weightage
Continuous assessment	Socially relevant project/Group Activities/ Assignments	1,2,3,4,5	20	75%
	Assessment by faculty mentor		10	
	Self-assessment		10	
	Assessment by peers		10	
End Semester Examination	Part A – Objective type – 20x1=20 marks Part B – Short answer questions – 15x 2 = 30 marks Part C – Descriptive Type Questions (Either or Pattern) – 5 x 10 = 50 marks	1,2,3,4,5	100	25%
			Total	100%

Course Code: 19ECPN6401	Course Title: MINI-PROJECT		
Course Category: Project		**Course Level: Practice**	
L:T:P (Hours/Week) 0: 0: 4	**Credits: 2**	**Total Contact Hours:60**	**Max. Marks:100**

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Identify the practical problems and develop a novel solution.
2. Design a software/hardware prototype based on the solution.
3. Demonstrate time management by following a proper time line to execute the project
4. Effectively communicate the results of projects in a written and oral format

The objective of Mini-Project is to enable the student to take up investigative study in the broad field of Electronics and Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignments normally included as given below:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Oral Presentation before a departmental committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the problem statement by doing literature survey.	Apply

CO2: Develop an ability to prepare a proposal with the novel solution for the problem statement.	Apply
CO3: Practice the time management ability by preparing and executing a work plan.	Apply
CO4: Design a hardware/software prototype based on the solution developed for the problem	Create
CO5: Demonstrate the results by making presentation and reports	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	3	3	3	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO3	-	-	-	-	-	3	-	3	3	-	3	3	-	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO5	3	3	-	-	3	3	3	3	3	3	-	3	3	3

High-3; Medium-2; Low-1

Semester-V

Course Code: 19ECCN1501	**Course Title: Analog and Digital Communication**		
Course Category: Professional Core		**Course Level: Practice**	
L:T:P(Hours/Week)3: 1: 0	**Credits:4**	**Total Contact Hours: 60**	**Max Marks:100**

Pre-requisites

- 19ECCN1301- Analog Circuits - I
- 19ECCN1401- Analog Circuits - II
- 19ECCN1402- Signals and Systems

Course Objectives

The course is intended to:

1. Analyze and compare different analog modulation techniques.
2. Analyze and compare different pulse modulation techniques.
3. Analyze the different baseband and passband transmission systems.
4. Analyze various error control codes
5. Analyze the behaviour of digital communication system using spread spectrum modulation.

Unit I Analog Modulation Systems 9+3 Hours

Amplitude Modulation: AM power Distribution - Generation of AM waves: DSBSC - SSB - VSB Detection of AM Waves: Super heterodyne Receiver. Angle Modulation Systems: Narrow band and wideband FM - Generation of FM waves: Direct and Indirect methods - Detection of FM waves: Foster Seeley Discriminator - Principle of Phase Modulation systems- Noise in Analog Modulation systems.

Unit II Pulse Modulation Systems 9+3 Hours

Sampling Process - Quantization and its types - Analog Pulse Modulation systems: PAM - PWM - PPM - Digital Pulse Modulation systems: Pulse Code Modulation - Concept of Linear Prediction filtering - DPCM- Delta Modulation - Adaptive Delta Modulation- Noise consideration in Pulse-Code Modulation and Delta Modulation systems.

Unit III Baseband and Passband Systems 9+3 Hours

Baseband transmission: Line codes & its properties - ISI - Nyquist Criteria for distortion less transmission -Correlative coding - Eye Pattern - Principle of Equalization technique. Pass band transmission: Generation, Detection & BER of Coherent BFSK, BPSK, QAM - Principle of DPSK.

Unit IV Error Control Coding 9+3 Hours

Channel coding theorem - Linear Block codes - Hamming codes - Convolutional codes - Viterbi decoding - Trellis coding.

Unit V Spread Spectrum Modulation 9+3 Hours

Pseudo noise sequences - properties of spread spectrum - Direct sequence spread spectrum: Signal space dimensionality, Probability of error, processing gain - Frequency hopping spread spectrum, Overview of Spread spectrum modulation in 4G & 5G Technologies.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze and compare different analog modulation techniques in time and frequency domains.	Analyze
CO2: Analyze and compare different pulse modulation techniques in terms of Signal to Quantization Noise Ratio.	Analyze
CO3: Analyze and compare different baseband and pass band transmission systems.	Analyze
CO4: Analyze and compare various error control codes.	Analyze
CO5: Analyze the behaviour of digital communication system using spread spectrum modulation.	Analyze

Text Book(s):

T1. Simon Haykin, “Communication Systems”, John Wiley and Sons, Inc, Fourth edition, 2010.

T2. Simon Haykin, “Digital Communications”, John Wiley and Sons, Inc, First Edition, 2013.

Reference Book(s):

R1. George Kennedy and Bernad Davis, "Electronic Communication Systems", Tata McGraw Hill, Fourth Edition, 2008.

R2. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", Pearson Education, Fifth Edition, 2009.

R3. Proakis J. G. and Salehi M, "Communication Systems Engineering", Pearson Education, 2002.

R4. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications: Fundamentals and Applications", Pearson Education, Second Edition, 2009.

R5. Leon W Couch, “Digital and Analog Communication Systems”, Sixth Edition, Prentice Hall, 2001.

R6. M. Bala Krishna, Jaime Lloret Maur, “Advances in Mobile Computing and Communications Perspectives and Emerging Trends in 5G Networks”, CRC Press; First edition, 2016.

Web References:

1. https://nptel.ac.in/courses/117/105/117105143/
2. https://nptel.ac.in/courses/117/101/117101051/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz /Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE1	,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN1502		**Course Title: Control Systems**		
Course Category: Professional Core			**Course Level: Practice**	
L:T:P(Hours/Week) 3: 1: 0	**Credits:4**		**Total Contact Hours: 60**	**Max Marks:100**

Pre-requisites

- 19MABC1201 - Ordinary Differential Equations and Complex Variables
- 19ECCN1402 - Signals and Systems

Course Objectives

The course is intended to:

1. Compute the transfer function of electrical and mechanical control systems.
2. Calculate the time response and time domain specifications.
3. Determine the frequency domain specifications from frequency response curves.
4. Analyze the stability of control system.
5. Derive various state space models and test Controllability and observability of the given system.

Unit I Control System Modelling 9+3 Hours

Basic elements of control systems - Open and closed loop systems - Transfer function - Mathematical modelling of electrical and mechanical systems - Analogies between electrical and mechanical systems - Block diagram reduction technique - Signal flow graph.

Unit II Time Domain Analysis 9+3 Hours

Standard test signals - Type and order of the systems - Impulse and step response of first and second order systems - Transient and steady state response - Time domain specifications - Steady state errors and error constants - Analytical design for PD, PI,PID control systems-Industrial application of PID controllers

Unit III Frequency Domain Analysis 9+3 Hours

Frequency response - Frequency domain specifications - correlation between time and frequency domain specifications - Bode plot - Polar plot - Basic concepts of lag, lead and lag - lead compensators.

Unit IV Stability Analysis 9+3 Hours

Stability - characteristic equation - location of roots in s - plane - Routh Hurwitz stability criterion - Concept of Root locus technique - Construction of Root locus - Effect of pole-zero additions on the root loci - Nyquist stability criterion.

9+3 Hours

Unit V State Variable Analysis of Continuous Time Systems

Concepts of state - State variable - State model - Controllable canonical form and Observable canonical form - State transition matrix - Properties of State transition matrix - Solution of state equations - Concepts of controllability & observability.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Compute the transfer function of electrical and mechanical systems through block diagram reduction technique and Signal flow graph.	Apply
CO2: Calculate the time response and time domain specifications of first and second order systems.	Apply
CO3: Determine the frequency domain specifications from frequency response curves of the given system using Bode plots and Polar plots.	Apply
CO4: Analyze the stability of control system by using Root locus, Routh Hurwitz and Nyquist stability criteria.	Analyze
CO5: Derive various state space models and test Controllability and Observability of the given system.	Apply

Text Book(s):

T1. Benjamin.C.Kuo, "Automatic Control Systems", PHI, New Delhi, 7th Edition, 1995.

T2. Nagrath.J and Gopal.M, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

Reference Book(s):

R1. Norman.S.Nise, "Control Systems Engineering", Wiley, 4th Edition, 2003.

R2. Gopal.M, "Control System - Principles and Design", TMH, New Delhi, 2nd Edition, 2002.

R3. Ogata.K, "Modern Control Engineering", 5th Edition, Pearson Education India, New Delhi, 2010.

R4. S. Palani, "Control Systems Engineering", TMH, New Delhi, 2nd Edition, 2020.

Web References:

1. https://www.electrical4u.com/mathematical-modelling-of-various-system/
2. https://nptel.ac.in/courses/108/106/108106098/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/lecture-notes-labs/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO2	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19ECCN2501</td><td colspan="2">Course Title: Digital Signal Processing</td></tr>
<tr><td colspan="2">Course Category: Professional Core</td><td colspan="2">Course Level: Practice</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 2</td><td>Credits:4</td><td>Total Contact Hours:75</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECCN1402- Signals and Systems

Course Objectives

The course is intended to:

1. Analyze Discrete Time systems
2. Compute Discrete Fourier Transform(DFT) and Inverse Discrete Time Fourier Transform(IDFT)
3. Design Linear Phase Finite Impulse Response(FIR) digital filters
4. Design Infinite Impulse Response(IIR) digital filters
5. Analyze the effects of finite word length

Unit I Z Transform 9 Hours

Z transform – properties – Inverse Z transform – Difference equation – impulse response – convolution sum – Transfer function – poles and zeros – Analysis of LTI system using z transform

Unit II Fast Fourier Transform 9 Hours

Discrete Fourier Transform (DFT) – relationship between DTFT and DFT – Magnitude and phase spectrum – properties of DFT – Radix-2 FFT algorithms: Decimation in Time (DIT-FFT) and Decimation in Frequency (DIF-FFT) algorithms. Fast Convolution – Overlap add method – Overlap save method

Unit III Finite Impulse Response Digital Filters 9 Hours

Introduction to linear phase filters – Window functions: Rectangular, Hamming and Hanning- Design of Linear phase FIR filters using windowing techniques – Realization of FIR filters: Direct, Linear phase structures

Unit IV Infinite Impulse Response Digital Filters **9 Hours**

Introduction to Butterworth and Chebyshev Filters – Design of analog IIR Filters – Analog to digital filter transformation – Design of digital IIR filters – Realization of IIR filters: Direct form I, Direct Form II

Unit V Finite Word Length Effects **9 Hours**

Fixed point and Floating point Representation – Quantization – Truncation and Rounding- Quantization of Filter Coefficients – Quantization noise power – Product Quantization – Limit Cycle Oscillations.

List of Exercises **30 Hours**

1. Generation of basic signals: unit impulse & unit step
2. Spectral analysis of sinusoidal signals using FFT
3. FIR and IIR Low pass digital filter design
4. Effect of coefficient quantization on the frequency response of digital filters
5. Notch and Comb filter design based on pole-zero placement
6. Implementation of FFT using Digital Signal Processor

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze discrete time LTI systems represented by difference equations using Z transform	Analyze
CO2: Compute Discrete Fourier Transform(DFT) and Inverse Discrete Fourier Transform(IDFT) of a given discrete time sequence using Fast Fourier Transform algorithms	Apply
CO3: Design linear phase Finite Impulse Response(FIR) digital filters using windowing techniques	Apply
CO4: Design Infinite Impulse Response(IIR) digital filters from analog Butterworth filters for a given specification	Apply
CO5: Analyze the effects of finite word length on filter implementation	Analyze

Text Book(s):

T1. Allan V. Oppenheim and Ronald W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, Third Edition, 2002

T2. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Third Edition, Pearson Education/Prentice Hall, 2003

T3. Lonnie C. Ludeman, “Fundamentals of Digital Signal Processing”, John Wiley and Sons Network, 2004

Reference Book(s):

R1. Emmanuel C. Ifeachor and Barrie W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education/Prentice Hall, 2002

R2. Li Tan, “Digital Signal Processing: Fundamentals and Applications”, Academic Press, 2008

R3. Johnny R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall of India, 2001

R4. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California Technical Publications, 1999

R5. Sanjit K. Mitra, “Digital Signal Processing: A computer based approach”, Tata McGraw Hill, 2011

R6. Ashok Ambardar, “Digital Signal Processing: A Modern Introduction”, Thomson Learning, 2007

Web References:

1. http://nptel.ac.in/courses/117102060
2. https://nptel.ac.in/courses/108/105/108105055/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	2	3	2	-	2	2	-
CO2	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO3	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO4	3	2	1	1	2	-	-	2	3	2	-	2	2	-
CO5	3	3	2	2	2	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment-Practical	1,2,3,4,5	75	10
	Final Assessment-Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN3501	Course Title: Analog and Digital Communication Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN3401- Analog Circuits - II Laboratory

Course Objectives

The course is intended to:

1. Analyze the various analog modulation systems
2. Categorize different pulse modulation techniques
3. Verify various error control coding schemes
4. Analyze the various digital modulation schemes
5. Analyze the various analog and digital modulation methods using software tools

List of Experiments

1. Simulate and Perform Amplitude modulation/Demodulation
2. Simulate and Perform Frequency modulation/Demodulation
3. Carry out Pre-Emphasis and De-Emphasis
4. Verify sampling theorem in the hardware and simulate
5. Carry out PAM, PPM and PWM
6. Perform PCM encoding/ decoding operation
7. Simulate and Perform ASK and FSK
8. Simulate and Perform BPSK and QPSK
9. Simulate CRC Error control coding and carry out in the hardware.
10. Simulate Convolutional coding and carry out in the hardware.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyze the various analog modulation systems with various modulation index	Analyze
CO2: Categorize different pulse modulation techniques based on its characteristics	Analyze
CO3: Verify various error control coding schemes by using a suitable encoding and decoding methods.	Analyze
CO4: Analyze the various digital modulation schemes using their appropriate characteristics	Analyze
CO5: Analyze the various analog and digital modulation methods using Matlab	Analyze

Reference Book(s):

R1. John G.Prokias, Masoud Salehi and Gerhard Bauch, "Contemporary Communication Systems using MATLAB", 3rd Edition, Cengage learning, 2012.
R2. "Communication Systems Laboratory manual", prepared by the ECE Department.
R3. Kwonhue Choi, Huaping Liu, "Problem-Based Learning in Communication Systems Using MATLAB and Simulink", Wiley IEEE Press, 2016.

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO2	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO3	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO4	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO5	3	3	2	2	3	-	-	2	3	2	-	2	2	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	Marks	Total
Continuous Comprehensive Evaluation	Each Experiment	75	75
	Cycle Test 1	50	25
	Cycle Test 2	50	
		Total	100

Course Code:19ECCN3502	**Course Title: Data Science Laboratory**		
Course Category: Professional Core		**Course Level: Practice**	
L:T:P(Hours/Week)0: 0: 3	**Credits:1.5**	**Total Contact Hours:45**	**Max Marks:100**

Pre-requisites

- 19CSSC2001 - C programming
- 19MABG1401 - Probability and statistics

Course Objectives

The course is intended to:

1. Analyse the dataset and its features
2. Extract the useful information from the data
3. Apply visualization techniques
4. Analyse the time series data
5. Apply data science concepts in Raspberry Pi

LIST OF EXPERIMENTS

1. Study the software packages for data science
2. Read and Write the different file types of datasets
3. Handle and manipulate the data
4. Convert unstructured dataset in to structured dataset
5. Perform pre-processing steps in the Data
6. Analyse time Series Data
7. Carry out analysis of data using visualization techniques
8. Identify the scores and ranking of data
9. Calculate and visualize the correlation and co-variance of given dataset
10. Perform Dimensionality reduction in data
11. Interfacing Raspberry Pi with sensors
12. Convert unstructured sensor data in to structured data

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyse the dataset and its features with Python packages	Analyze
CO2: Extract the useful information by correlate, summarize and visualizing the data	Apply
CO3: Apply visualization techniques for analysing the data	Apply
CO4: Analyse the time series data with python packages	Analyze
CO5: Apply data science concepts in Raspberry Pi for real time sensor data	Apply

Text Book(s):

T1. Jake VanderPlas, "Python Data Science Handbook: Essential Tool for working with Data", O'Reilly,United States, 2016.

T2. Steven S. Skiena , "The Data Science Design Manual", Second Edition, Springer, Switzerland, 2017.

Reference Book(s):

R1. John Paul Mueller, Luca Massaron, "Data Science Programming All-in-One For Dummies",Wiley,2020

R2. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press,2020

R3. Joel Grus, "Data Science from Scratch: First Principles with Python",O'Reilley, 2015

R4. Prabhanjan Tattar, Tony Ojeda, Sean Patrick Murphy, "Practical Data Science Cookbook"

Web References:

1. https://www.edx.org/course/subject/data-science
2. https://www.coursera.org/degrees/master-of-data-science-hse

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO2	3	2	2	2	3	-	-	2	3	2	-	2	2	-
CO3	3	2	2	2	3	-	-	2	3	2	-	2	2	-
CO4	3	2	2	2	3	-	-	2	3	2	-	2	2	-
CO5	3	3	2	2	3	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="4">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>Each Lab Experiment</td><td>1,2,3,4,5</td><td>75</td><td>75</td></tr>
<tr><td>Cycle Test 1</td><td>1,2,3</td><td>50</td><td rowspan="2">25</td></tr>
<tr><td>Cycle Test 2</td><td>4,5</td><td>50</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

<table>
<tr><td>Course Code: 19PSHG6501</td><td colspan="3">Course Title: Employability Skills 1: Teamness and Interpersonal Skills</td></tr>
<tr><td>Course Category: Professional Skills</td><td colspan="3">Course Level: Introductory</td></tr>
<tr><td>L: T:P (Hours/Week): 0:0:2</td><td>Credit :1</td><td>Total Contact Hours: 30</td><td>Total Marks: 100</td></tr>
</table>

Pre-requisites:

- NIL

Course objectives:

The course is intended to

1. Enrich effective communicative attributes and facilitate presentation and public speaking skills
2. Identify and explore the true self and handle negatives
3. Develop interpersonal skills and to groom as a professional
4. Educate the importance of Nonverbal skill set to attain perfection
5. Build teamness and its ethics to facilitate corporate working

UNIT I EFFECTIVE COMMUNICATION & PRESENTATION SKILLS 6

Barriers of Communication -Fear Of English - Handling Social Factors -Handling Psychological Factors -Handling Practical Problems -Do's & Don't's- Effective Presentation - Presentation - Importance of Presentation - Slide orientation – Introduction in a presentation - Styles of a slide - Slide Templates- Font, color, Background -Graph Diagrammatic representation - Delivery of presentation - Body Language &Gestures - Verbal Attributes - Communication - Handling stammers and breaks - Handling fear of stage - Maintaining Confidence - Content delivery methods- Do's and Don'ts in a presentation- Tips to handle it-Effective Conclusion

UNIT II POSITIVE ATTTITUDE &HANDLING REJECTIONS 6

A,B,C's Of Attitude -Influencing Factors -Individual Factors -Character Comparison -Strategies to Handle ourselves-Benefits of Positive Attitude - Do's & Don't's - Handling Rejections-Identifying Negativities -Nuances of handling it -Necessary changes -To do List -Creating One's self - Self Qualifiers

UNIT III INTERPERSONAL SKILLS 6

Life skills -Core IP Skills -Importance of IP Skills -Tips to improve IP Skills-Necessity of IP Skills

UNIT IV BODY LANGUAGE, DRESSING &GROOMING 6

Unconscious Physical moments - Metrics of Body Language - Good Posture -Head Motion - Facial Expression - Eye contact -Gestures -Dressing - Grooming & Outlook - Necessity of good Body Language

UNIT V TEAM ETHICS 6

Team Ethics-Necessity of Team Work- Teams Everywhere - Benefits of team culture -Reason for team failure -Conflicts - Handling Conflicts -Being a team player -Work difference from college

COURSE OUTCOMES:

Course Outcomes	**Cognitive Level**
At the end of the course students will be able to:	
CO1:Demonstrate effective communicative attributes as part of their skills and facilitate presentation & public speaking skills	Apply
CO2: Identify and explore the true self and handle negatives	Apply
CO3: Develop interpersonal skills and to groom as a professional	Apply
CO4: Explain the importance of Nonverbal skill set to attain perfection	Understand
CO5: Build team ness and its ethics to facilitate corporate working	Apply

Text Books

T1. John C Maxwell, " The 17 Indisputable Laws of Teamwork: Embrace Them and Empower Your Team", Harper Collins Leadership Publishers, 2013

Reference Books

R1. Patrick Lencioni, " The Five Dysfunctions of a Team: A Leadership Fable" Jossey Bass Publishers, 2006
R2. Malcolm Gladwell, "Talking to Strangers: What We Should Know about the People We Don't Know" Penguin Publishers, 2019
R3. Harvey Segler, " Body Language: Discovering & Understanding the Psychological secrets behind reading & Benefiting from Body Language" Kindle Edition, 2016

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	1	1	1
CO2	-	-	-	-	-	-	-	-	2	-	-	1	1	1
CO3	-	-	-	-	-	-	-	-	2	-	1	1	1	1
CO4	-	-	-	-	-	-	-	-	-	1	-	1	1	1
CO5	-	-	-	-	-	-	-	2	1	-	-	1	1	1

High-3; Medium-2; Low-1

Mode of Delivery:

1. Continuous learning and reviews guided by faculty
2. Guided Learning Workshop

Assessment pattern

Assessment	Details	Weight (%)	Remarks
Formative Assessment	Diagnostic assessment of a student's communication skills, cognitive abilities, and behavioural traits during the course	25	Continuous
Continuous Evaluation	MCQs/Diagnostic tests and Viva-voce	25	Two per semester - After CCET1 and after CCET2
Final Assessment	MCQs/Diagnostic tests and Viva-voce	50	End of Semester

Semester-VI

Course Code: 19ECCN1601	**Course Title: VLSI System Design**		
Course Category: Professional Core		**Course Level: Practice**	
L:T:P(Hours/Week)3:1: 0	**Credits:4**	**Total Contact Hours: 60**	**Max Marks:100**

Pre-requisites

- 19ECCN1301- Analog Circuits-I
- 19ECCN1302- Digital Principles and System Design

Course Objectives

The course is intended to:

1. Explain the VLSI design flow and CMOS design processes
2. Describe the characteristics of MOSFET and FINFET.
3. Apply the various CMOS logic styles to design digital circuits.
4. Design digital sub systems using HDL.
5. Implement digital sub systems on FPGA.

Unit I Introduction 10 Hours

VLSI Design process: Design specification- design entry – functional simulation – planning, placement and routing - timing simulation, Flip-flop and Latch related timing issues, fabricating into chip- CMOS processing technologies - nWell - pWell - Twin tub - Silicon on insulator.

Unit II MOS Transistors and Inverters 12 Hours

Basic MOS Transistors and Operation: NMOS enhancement transistor - PMOS enhancement transistor - Threshold Voltage-Derivation of drain current- Channel length modulation- Body Effect -Trans conductance – MOSFETs as Switches - CMOS Inverter – Latch-up in CMOS Circuit - Power dissipation in CMOS Circuits. Basics of FINFET Technology and Operation SPICE simulations on NMOS and PMOS characteristics.

Unit III Logic Design with CMOS 14 Hours

Combinational Circuit Design: Logic gates in Static CMOS - Transistor sizing - Stick diagram, Layout diagrams and design rules - Rationed circuits: Pseudo NMOS - cascade voltage switch logic - Dynamic CMOS logic: domino logic, dual rail domino logic -Transmission gate - pass-transistor circuits - Basic gates and D-Flip Flop using Multiplexer-Moore's law, Basics and recent trends in scaling. CMOS design and Functional Verification of Basic logic gates.

UNIT IV Subsystem Design 12 Hours

Synthesis and simulation using HDLs – Logic synthesis using Verilog, System Verilog – Introduction, Design hierarchy, Data types, Memories, Tasks and Functions, Interfaces, OOPS Basics.Logic Synthesis of Adder Circuits.

Unit V System Design using FPGA 12 Hours

Introduction to FPGA fabrics: FPGA architectures – SRAM-based FPGAs – Permanently programmed FPGAs – Circuit design of FPGA fabrics – Architecture of FPGA fabrics – Logic implementation of FPGAs – Physical design for FPGAs - FPGA design cycle using Xilinx ISE webpack. FPGA Implementation of Half Adder and Full Adder circuits.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the VLSI design flow and CMOS design processes with appropriate fabrication technologies.	Understand
CO2. Describe the characteristics of MOSFET with relevance to power dissipation and basics of FINFET operation.	Understand
CO3. Apply the various CMOS logic styles to design digital circuits and address the effects of scaling.	Apply
CO4. Model digital sub systems using Verilog and System Verilog HDL.	Apply
CO5. Employ FPGA to implement digital sub systems.	Apply

Text Book(s):

T1. Weste and Harris, “CMOS VLSI Design”, Third edition, Pearson Education, 2005.

T2. Samir Palnitkar, “Verilog HDL”, Second edition, Pearson Education, Ninth Impression 2010.

T3. Neil H.E. Weste and Kamran Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education ASIA, 2nd edition, 2000.

T4. Wayne Wolf, “FPGA-Based System Design”, First Edition, Prentice Hall India Private Limited, 2004

Reference Book(s):

R1. John P.Uyemura “Introduction to VLSI Circuits and Systems”, John Wiley and Sons, Inc.,2002

R2. Eugene D.Fabricius, “Introduction to VLSI Design”, McGraw Hill International Edition,1990

R3. Pucknell, “Basic VLSI Design”, Prentice Hall of India Publication, 1995

R4. Wayne Wolf, “Modern VLSI Design System on chip”, Pearson Education, 2002

Web References:

1. http://nptel.ac.in/downloads/117101058/
2. http://www.nptel.ac.in/downloads/117106093/
3. https://www.youtube.com/watch?v=VUSTLyPtPgk

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	1	2
CO2	2	1	-	-	-	-	-	1	1	1	-	1	1	2
CO3	3	2	1	1	-	-	-	1	1	1	-	1	1	2
CO4	3	2	1	1	-	-	-	1	1	1	-	1	1	2
CO5	3	2	1	1	-	-	-	1	1	1	-	1	1	2

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN1602		**Course Title: Internet Of Things**		
Course Category: Professional Core		**Course Level: Mastery**		
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**		**Max Marks:100**

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the concepts of Internet of Things (IoT)
2. Describe basic knowledge of RFID Technology, Sensor Technology and Satellite Technology
3. Interpret communication protocols in IoT
4. Illustrate the challenges due to privacy and security in IoT
5. Design IoT applications in Business domain

Unit I Introduction of IOT **9 Hours**

Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies, Physical design of IoT, IoT enabling technologies, IoT Issues and Challenges-Planning, Costs and Quality ,Security and Privacy, Risks.

Unit II Fundamental IoT Mechanisms and Key Technologies **9 Hours**

Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology.

Unit III Communication under IoT **9 Hours**

IoT Protocols: MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT Communication technologies: Bluetooth, BLE, Zigbee, Zwave, NFC, RFID, LiFi, Wi-Fi, Interfacing of wifi, RFID, Zigbee and NFC with development board.

Unit IV Privacy, Security and Governance 9 Hours

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Security model for IoT.

Unit V Business Models for IoT 9 Hours

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things. Internet of Things Application: Smart Metering, Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the fundamental concepts on Internet of Things (IoT)	Understand
CO2. Describe basic knowledge of RFID Technology, Sensor Technology and Satellite Technology	Understand
CO3. Interpret communication protocols in IoT	Understand
CO4. Illustrate the challenges due to privacy and security in IoT	Understand
CO5. Design IoT applications in Business domain	Understand

Text Book(s):

T1. A.McEwen, H.Cassimally," Designing the Internet of Things ", Wiley, 2013.

T2. A Bahaga, V Madisetti, " Internet of Things - Hands on approach", VPT Publisher, 2014

Reference Book(s):

R1. Cuno P fister, "Getting started with Internet of Things", 1st Edition, Maker Media, 2011.

R2. Samuel Greenguard,"Internet of things", MIT Press, 2015.

R3. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw-Hill Education, 2017.

R4. David Hanes, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", Cisco Press, 2017.

Web References:

1. Introduction to Internet of Things - https: //nptel.ac.in/courses/106105166/-
2. https://online.stanford.edu/courses/xee100-introduction-internet-things

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN2601	**Course Title: Microcontroller And Its Interfacing Techniques**		
Course Category: Professional Core		**Course Level: Practice**	
L:T:P(Hours/Week)3: 0: 2	**Credits:4**	**Total Contact Hours: 75**	**Max Marks:100**

Pre-requisites

- 19ECCN1302- Digital Principles and System Design

Course Objectives

The course is intended to:

1. Explain the microprocessor and microcontroller architecture.
2. Discuss the microcontroller instruction set with programming concepts
3. Explain the on-chip peripheral interfacing techniques
4. Develop Embedded program for on - chip peripherals-I
5. Develop Embedded program for on - chip peripherals-II

Unit I Introduction to 8-Bit Microprocessor and Microcontroller 9 Hours

Evolution of Microprocessor - 8 bit Microprocessor Architecture, Microprocessor and Microcontrollers, Architecture of 8051- Hardware, input/output pins ports and circuits, timer/counter, serial data input/output, interrupts

Unit II Instruction Set And Programming Techniques 9 Hours

Addressing modes- Data transfer, Arithmetic, logic instructions and programs, Jump, loop and call instructions, Boolean and bit manipulation- Simple Assembly language programs.

Unit III On-Chip Peripherals And Interfacing Techniques 9 Hours

Parallel Port and bit-manipulation programming, timer/counter: Programming 8051 Timers -Counter Programming, Serial Communication: UART-Operating Modes-RS232 Standards-8051 connection to RS232-Serial Port Programming. Interrupt: Programming timer Interrupts, external hard ware interrupts and serial communication interrupts

Unit IV Off-Chip Peripherals Interfacing and Programming- I 9 Hours

LED 7-segment and multiplexing techniques, LCD Interfacing, Push-to-On switch and Matrix Keyboard Interfacing

Unit V Off-Chip Peripherals Interfacing And Programming - II 9 Hours

ADC, DAC and Sensor Interfacing, RTC interfacing, Relay Interfacing, DC Motor, stepper motor and PWM.

MICROCONTROLLER LABORATORY 30 Hours

Assembly Language:

1. Single byte arithmetic operation using 8051(ADD, SUB, MUL, DIV)

2. Multi-byte arithmetic operation using 8051(ADD, SUB)

3. Sorting of data a) Ascending order b) Descending order

4. Searching a given number in an array

Embedded C:

5. On and Off the LED with time delay using inbuilt timer in 8051

6.Switch and 7 segment display interfacing

7. Transmitting and receiving a byte of data using on-chip UART

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the architecture of 8 bit microprocessor and microcontroller	Understand
CO2: Discuss the 8051 instruction set with programming concepts	Understand
CO3: Explain the various on -chip peripheral and interfacing techniques	Understand
CO4: Develop Embedded ‘C’ program for Off-Chip Peripherals-I	Apply
CO5: Develop Embedded ‘C’ program for Off-Chip Peripherals-II	Apply

Text Book(s):

T1. The 8051 Microcontroller, Kenneth J. Ayala, 3rd Edition, Thompson Delmar Learning, New Delhi, 2007.

T2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Pearson education, 2011

Reference Book(s):

R1. Krishna Kant, "Microprocessor and Microcontroller Architecture, Programming and System Design using 8085, 8086, 8051 and 8096", PHI, 2011.

R2. Robert L. Boyelstad and Louis Nasheresky, "Electronics Devices and Circuit Theory", 9th Edition, Pearson Education/ PHI, New Delhi 2002.

R3. David A. Bell, "Electronics Devices and Circuits", 5th Edition, Oxford University Press, 2008

R4. Sedra/ Smith, "Micro Electronic Circuits" Oxford University Press, 2004.

Web References:

1. https://nptel.ac.in/courses/117/104/117104072/
2. https://nptel.ac.in/courses/108/105/108105102/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	-	2	-	1	2	1
CO2	2	1	-	-	2	-	-	2	-	2	-	1	2	1
CO3	2	1	-	-	2	-	-	2	-	2	-	2	2	1
CO4	3	2	1	1	2	-	-	2	-	2	-	2	2	1
CO5	3	2	1	1	2	-	-	2	-	2	-	2	2	1

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment practical	1,2,3,4,5	75	10
	Final Assessment practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECPN6601	Course Title: INNOVATIVE AND CREATIVE PROJECT		
Course Category: Project		**Course Level: Practice**	
L:T:P (Hours/Week) 0: 0: 4	**Credits:2**	**Total Contact Hours:60**	**Max. Marks:100**

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Identify the problem statement by doing literature survey
2. Develop a novel solution for the problem statement and design a software/hardware prototype based on the solution.
3. Demonstrate time management by following a proper time line to execute the project
4. Effectively communicate the results of projects in a written and oral format

The objective of Project is to enable the student to take up investigative study in the broad field of Electronics and Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation forthe student(s) in R&D work. The assignments normally included as given below:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Oral Presentation before a departmental committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Define problem statement in the opted domain by doing literature survey	Apply

CO2: Develop a novel solution for the identified problem statement with the help of engineering knowledge.	Apply
CO3: Demonstrate time management by following a proper time line to execute the project	Apply
CO4: Design a hardware/software prototype based on the solution developed for the problem.	Create
CO5: Demonstrate the results by making presentations and preparing reports	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	3	3	3	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO3	-	-	-	-	-	3	-	3	3	-	3	3	-	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO5	3	3	-	-	3	3	3	3	3	3	-	3	3	3

High-3; Medium-2; Low-1

Course Code: 19PSHG6601	Course Title: Employability Skills 2: Campus to Corporate		
Course Category: Professional Skills	Course Level: Introductory		
L: T:P (Hours/Week): 0:0:2	Credit :1	Total Contact Hours: 30	Total Marks: 100

Pre-requi s:

- NIL

Course objectives:

The course is intended to:

1. Understand emotions and necessity to handle it to evolve as an effective social animal
2. Build effective resumes to project the positives to be employable
3. Facilitate working in a collaborative work environment and to engage in healthy agreements for building person's professional facet
4. Formulate the growth attribute to outperform, initiate and grow in professional arena
5. Explain time management and impart leadership skills

UNIT I Emotional Intelligence 6 Hours

Nature of Emotions - Importance of EI -EQ vs IQ -Behavioral difference between EQ & IQ - Acquiring Emotional Intelligence -Benefits of high EI -Steps to develop EI -Role of EI in Interviews

UNIT II Resume Preparation 6 Hours

Importance of Resume - Good Resume -Planning Resume -Organizing Resume - Spell check – Benefits of good resume – Resume Writing

UNIT III Group Discussion 6 Hours

Purpose of GD -Prerequisites of GD-Benefits of GD-Features of GD- Do's & Don'ts in GD-

Accept Criticism &Feedback-Accepting Suggestions-GD Phrases-Effective Introduction & Conclusion- Preferred Etiquette of GD.

UNIT IV Interview Etiquette(Netiquette) 6 Hours

Definition of Interview-Types of Interview -Prior interview-Know the Company -Employer's perspective in interview- Non Verbal etiquette-Dressing -Verbal Communication in Interview--Facing Rejection in Interview-Do's & Don'ts in an Interview-Common Interview Questions – Handling Stress Questions – Handling Telephonic Interviews.

UNIT V Leadership Skills and Time Management 6 Hours

Leadership –Leadership Traits -Leadership styles -Types of Leaders -Qualities of a leader – Developing Perspectives

Time Management -Necessity of Time Management – Types of time -Estimation of time – Process of Time management -Efficient utilization of Time -Time wasting culprits – Tips to manage time – Goal setting in Time Management

Course Outcomes	**Cognitive Level**
At the end of the course students will be able to:	
CO1: Understand the emotions and necessity to handle them	Understand
CO2: Build effective resumes to project the positives to be employable	Apply
CO3: Facilitate collaborative work environment and to engage in healthy agreements for building person's professional facet	Understand
CO4: Formulate the growth attribute to outperform, initiate and grow in professional arena	Apply

CO5: Explain time management and impart leadership skills	Understand

Course Outcomes
At the end of this course, students will be able to:
CO1. Understand the emotions and necessity to handle them
CO2. Build effective resumes to project the positives to be employable
CO3. Facilitate collaborative work environment and to engage in healthy agreements for building person's professional facet
CO4. Formulate the growth attribute to outperform, initiate and grow in professional arena
CO5. Explain time management and impart leadership skills

Text Books

T1: Thea Kelley, "Get That Job! The Quick and Complete Guide to a Winning Interview " Plover crest Press, 2017

Reference Books

R1. Daniel Goleman, " Emotional Intelligence Reader's Guide", BANTAM PUBLISHERS, 1997

R2. Daniel Goleman, Richard Boyatzis & Annie McKee, " Primal Leadership: Unleashing the Power of Emotional Intelligence" Harvard Business Review Press; Anniversary edition, 2013

R3. Stephen R Covey, " The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change" Simon & Schuster; Anniversary edition, 2013

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	-	1	-	1	1	1
CO2	-	-	-	-	-	-	-	-	-	2	-	1	1	1
CO3	-	-	-	-	-	-	-	-	1	1	-	1	1	1
CO4	-	-	-	-	-	-	-	-	1	-	-	1	1	1
CO5	-	-	-	-	-	-	-	1	-	-	1	1	1	1

High-3; Medium-2; Low-1

Mode of Delivery:

1. Continuous learning and reviews guided by faculty
2. Guided Learning Workshop

Assessment pattern

Assessment	Details	Weight (%)	Remarks
Formative Assessment	Diagnostic assessment of a student's communication skills, cognitive abilities, and behavioral traits during the course	25	Continuous
Continuous Evaluation	MCQs/Diagnostic tests and Viva-voce	25	Two per semester - After CCET1 and after CCET2
Final Assessment	MCQs/Diagnostic tests and Viva-voce	50	End of Semester

Semester VII

Course Code:19ECCN1701	Course Title: RF and Microwave Engineering		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19PHBC2001 - Physics for Electrical Sciences
- 19ECCN2301 -Transmission lines and Wave guides

Course Objectives

The course is intended to:

1. Analyze the given High Frequency networks
2. Classify the Microwave Passive Components
3. Analyze the characteristics of Microwave solid state devices
4. Classify the Microwave tubes and Measuring techniques
5. Design Impedance Matching networks

9 Hours

Unit I TWO PORT NETWORK THEORY

Review of Low frequency parameters: Impedance, admittance, hybrid and ABCD parameters - High Frequency parameters, Formulation of S parameters for a Two port Network, Scattering Matrix representation of N port Network, Properties and proof of S parameters: Reciprocal and lossless Network, Components at high frequencies – Wire, Resistor, Capacitor, Inductor, Transmission Lines.

9 Hours

Unit II MICROWAVE PASSIVE COMPONENTS

Microwave frequency range, Applications-Principles of Operation and S Matrix derivation of Microwave junctions: E-plane Tee, H-plane Tee, Magic Tee – Microwave Power Dividers-Corners, bends, twists and matched terminations - Directional couplers-Two hole directional coupler-Phase shifters-Isolator-Three port Circulator -Attenuator

Unit III MICROWAVE SOLID STATE DEVICES 9 Hours

Microwave Transistors: Construction and Functionality of FETs, HEMT- Principle of Schottky Barrier diodes – Transferred Electron Devices: Gunn diode- Avalanche Transit time devices: IMPATT Diode – RF MEMS. Parametric devices: Principles of operation, Applications of parametric amplifier - Microwave monolithic integrated circuit (MMIC): Materials and fabrication techniques

Unit IV MICROWAVE TUBES AND MEASUREMENTS 9 Hours

Microwave tubes- High frequency limitations - Principle of operation of Two cavities Klystron, Reflex Klystron, Helix Traveling Wave Tube and Cylindrical Magnetron. Microwave measurements: Measurement of VSWR, Power, Impedance and EMI/EMC

Unit V MICROWAVE AMPLIFIER DESIGN AND MATCHING NETWORKS 9 Hours

Amplifier power relation, stability considerations, Stabilization Methods, Principle of Single stage Transistor Amplifier Design for maximum Gain, Noise figure, Impedance matching networks: Impedance Matching Using Discrete Components-T and π matching networks-Microstrip line matching networks

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze the given High Frequency networks using S parameters	Analyze
CO2: Classify the Microwave Passive Components based on its operating principle	Apply
CO3: Analyze the characteristics of Microwave solid state devices with its Application	Analyze
CO4: Classify the Microwave tubes and measuring techniques based on device construction	Apply
CO5: Design Impedance matching networks for Single Stage Transistor Amplifiers	Apply

Text Book(s):

T1. Liao, S.Y., “Microwave Devices & Circuits”, Prentice Hall of India, 2006

T2. Ludwig, R and Bogdanov, G., “RF Circuit Design: Theory and Applications”, PearsonEducation, Inc., 2009.

Reference Book(s):

R1. Robert E. Collin, “Foundationsfor Microwave Engineering”, 2nd edition, John Wiley & Sons, 2009

R2. Annapurna Das and Das, S. K., “Microwave Engineering”, Tata McGraw Hill Inc., 2009

R3. Radmanesh, M. M., “RF & Microwave Electronics Illustrated”, Pearson Education, 2007

R4. Pozar,D.M.,“Microwave Engineering”, 4th Edition, John Wiley & Sons,2012.

R5. Henry W.Ott.,“Electromagnetic Compatibility Engineering”, John Wiley and Sons Inc., 2009

Web References:

1. http://home.sandiego.edu/~ekim/e194rfs01/
2. http://nptel.ac.in/courses/117105130/
3. http://nptel.ac.in/syllabus/117105029/
4. http://nptel.ac.in/courses/117101119/23
5. https://www.microwaves101.com
6. http://www.iec.ch/emc/explained/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	1	1	-	2	2	-
CO2	3	2	1	1	-	-	-	1	1	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	1	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	1	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	1	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN1702	Course Title: Machine Learning		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19MBAC1202-Calculus and Transforms
- 19CSCN4401- Python Programming Laboratory
- 19ECCN3502 - Data Science Laboratory

Course Objectives

The course is intended to:

1. Describe the types and challenges in Machine learning
2. Illustrate the machine learning framework
3. Interpret the supervised learning techniques
4. Demonstrate the un-supervised learning methods
5. Construct the Neural network and deep learning models

Unit I INTRODUCTION 9 Hours

Introduction to Machine Learning – Types of Machine Learning systems – Challenges in Machine Learning - Overfitting and Under fitting - Testing and Validating the model - Bias and Variance

Unit II MACHINE LEARNING FRAMEWORK 9 Hours

Problem Formulation – Get the data - analyze and visualize the data – Prepare the data for ML algorithms – sample complexity - Hypothesis space – Model evaluation and Improvement: Cross validation – Grid search – Evaluation Metrics – Kernel functions

Unit III SUPERVISED LEARNING 9 Hours

Linear and Logistic Regression – Eigen Values and Eigen vectors - Naïve Bayes Classifier: Maximum Likelihood, Minimum Description Length – Gradient Descent -

Decision Trees – Ensembles of Decision Trees – Support Vector Machine(SVM)

Unit IV UNSUPERVISED LEARNING 9 Hours

Clustering: k-Means clustering- Agglomerative Clustering – DBSCAN- Gaussian Mixtures- precision and recall - Collaborative filtering and Content Filtering

Unit V NEURAL NETWORK AND DEEP LEARNING 9 Hours

Biological Neuron – Logical computation with Neuron – Perceptron – Sigmoid and softmax functions - Multi Layer Perceptron(MLP) with Back propagation – Regression MLPs – Classification MLPs – Fine Tuning NN models – Convolutional Neural Network: Architecture of Visual cortex – Convolutional Layers – Stacking Multiple Feature Maps-CNN architectures

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1:Describe the types and challenges in Machine learning for exploring the machine learning concepts	Understand
CO2:Illustrate the machine learning framework for implementation of machine learning projects	Apply
CO3:Interpret the supervised learning techniques for classification	Apply
CO4:Demonstrate the un-supervised learning methods for clustering and classification	Apply
CO5:Construct the Neural network and deep learning models for classification	Apply

Text Book(s):

T1. AurélienGéron,” Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow”, Second edition, O’Reilly Media, Inc,2019

T2. Andreas C. Müller and Sarah Guido, ”Introduction to Machine Learning with Python A Guide for Data Scientists”, First Edition,O’Reilly,2017

Reference Book(s):

R1. Ethem Alpaydin, “Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)”, 3rd Edition, MIT Press, 2014

R2. Jason Bell, “Machine learning - Hands on for Developers and Technical Professionals”,1st Edition, Wiley, 2014

R3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1st Edition, Cambridge University Press, 2012.

Web References:

1. https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners
2. https://nptel.ac.in/courses/106/106/106106139/
3. https://archive.ics.uci.edu/ml/datasets.php

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	1	-	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment Pattern

	Assessment Component	CO.No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Final Assessment - Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECCN3701	**Course Title: RF and Microwave Laboratory**		
Course Category: Professional Core		**Course Level: Mastery**	
L:T:P (Hours/Week) 0 :0: 3	**Credits:1.5**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19PHBC2001 - Physics for Electrical Sciences
- 19ECCN2301-Transmission Lines and Wave Guides
- 19ECEN1003 -Antenna and Wave Propagation

Course Objectives

The course is intended to:

1. Measure the losses in optical fibre and its numerical aperture
2. Examine the characteristics of optical sources
3. Analyze the working Principle of Microwave sources
4. Analyze the characteristics of optical fibre.
5. Measure the performance parameters of microwave components and devices

LIST OF EXPERIMENTS

1. Measurement of Numerical Aperture and bending losses in Optical Fiber.
2. Measurement of Power Distribution in directional coupler and Magic Tee.
3. VI characteristics of LED and LASER Diode.
4. Characteristics of Gunn Diode Oscillator
5. Characteristics of Reflex Klystron Oscillator
6. Measurement of Antenna parameters and RF passive component characteristics using Vector Network Analyzer
7. Radiation pattern measurement of Horn Antenna.
8. Optical Time Domain Reflect meter

9. Design of low pass and high pass filters using ADS
10. Discover the source of EMI emissions in with near-field probes

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Measure the losses in optical fibre and its numerical aperture	Analyze
CO2: Examine the characteristics of optical sources used in optical communication systems	Analyze
CO3: Analyze the working Principle of Microwave sources with its design Mechanism	Analyze
CO4: Analyze the Charecteristics if optical fibre using OTDR	Analyze
CO5: Measure the performance parameters of microwave components and devices using an appropriate equipment	Analyze

References :

Lab manual prepared by the department.

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO2	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO3	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO4	3	3	2	2	3	-	-	2	3	2	-	2	2	-
CO5	3	3	2	2	3	-	-	2	3	2	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

Type	Assessment Component	CO. No.	Marks	Total
Internal Assessment	Observation and record	1,2,3,4,5	75	75
End Semester Examination	Cycle Tests	1,2,3,4,5	50	25
				100

Course Code: 19ECCN3702	Course Title: VLSI Laboratory		
Course Category: Professional Core	Course Level: Mastery		
L:T:P (Hours/Week) 0 :0: 3	Credits:1.5	Total Contact Hours: 45	Max Marks:100

Prerequisites:

- 19ECCN1302- Digital Principles and System Design

Course Objectives:

The course is intended to:

1. Design and simulate Combinational and sequential circuits.
2. Design and Verify Combinational and Sequential circuits.
3. Implement Combinational and sequential circuits on FPGA.
4. Design and simulate inverter and universal gates using SPICE tool.
5. Perform physical design of inverter and universal gates using SPICE tool.

LIST OF EXPERIMENTS:

1. Design and Simulation of Adders (4 bit Half adder, 4 bit full adder, 4 bit Ripple carry adder).
2. Design and Simulation of Flip-Flops. (S-R Flip-flop, JK Flip-flop, D Flip-flop, T Flip-flop).
3. Design & Verification of 4bit Adder using System Verilog.
4. Design & Verification of D flipflop using System Verilog.
5. FPGA Implementation of 4 bit Synchronous Counter.
6. FPGA Implementation of 4 bit Asynchronous Counter.
7. Schematic design and simulation of Inverter.

8. Schematic design and simulation of 2 input NAND and NOR gate.
9. Layout Design of Inverter.
10. Layout Design of 2 input NAND and NOR gate.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Develop and verify functionality of Combinational and sequential circuits.	Apply
CO2. Solve errors in Combinational and Sequential circuit designs.	Apply
CO3. Apply FPGA implementation for combinational and sequential circuits.	Apply
CO4. Construct and simulate inverter and universal gates using SPICE tool.	Apply
CO5. Model physical design of inverter and universal gates using SPICE tool.	Apply

Reference Books:

1. “VLSI Laboratory manual”, prepared by the ECE department.
2. Morris Mano.M, “Digital Design”, 3rd edition, Prentice Hall of India Pvt.Ltd, / Pearson Education Pvt.Ltd, 2003.

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	2	3	2	-	2	1	3
CO2	3	3	2	2	3	-	-	2	3	2	-	2	1	3
CO3	3	3	2	2	3	-	-	2	3	2	-	2	1	3
CO4	3	3	2	2	3	-	-	2	3	2	-	2	1	3
CO5	3	3	2	2	3	-	-	2	3	2	-	2	1	3

High-3; Medium-2; Low-1

Assessment pattern

Type	Assessment Component	CO. No.	Marks	Total
Internal Assessment	Observation and record	1,2,3,4,5	75	75
End Semester Examination	Cycle Tests	1,2,3,4,5	50	25
				100

PROFESSIONAL ELECTIVES (PE)

Course Code:19ECEN1002	Course Title: Wireless Communication		
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week):3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501 - Analog and Digital Communication

Course Objectives

The course is intended to:

1. Explain the spectrum allocation for wireless Communication
2. Analyze various propagation models.
3. Design various signaling schemes
4. Analyze the performance of multipath mitigation techniques.
5. Analyze the performance of multiple antenna techniques.

Unit I Cellular Architecture 9 Hours

Multiple Access techniques: FDMA- TDMA- CDMA, Cellular concept: Frequency reuse – Channel assignment- hand off- interference and system capacity- trunking and grade of service – coverage and capacity improvement.

Unit II Wireless Channels 9 Hours

Large scale path loss: path loss models- Free space propagation model- Two Ray model, Link Budget Design, Small scale fading: parameters of mobile multipath channels: Time dispersion parameters- coherence bandwidth- Doppler spread and coherence time, Fading due to multipath time delay spread: flat fading - Frequency selective fading, Fading due to Doppler spread: fast fading – slow fading.

Unit III Digital Signaling For Fading Channels 9 Hours

Structure of a wireless communication link, Modulation formats: principles of Offset QPSK - π/4 DQPSK, Minimum shift keying, Gaussian minimum shift keying, Error performance in fading channels, OFDM: Principle - cyclic prefix – Channel estimation – PAPR.

Unit IV Multipath Mitigation Techniques 9 Hours

Equalization - Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity - Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

Unit V Multiple Antenna Techniques 9 Hours

Smart antenna: Capacity increase - Receiver structure, MIMO systems: Spatial multiplexing - system model – channel state information – capacity in fading and non-fading channels – diversity – pre-coding – Beam forming

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1.Explain the spectrum allocation for wireless communication using Multiple access techniques	Understand
CO2. Analyze various propagation models for wireless channels	Analyze
CO3. Design various signaling schemes for wireless communication	Apply
CO4. Analyze the performance of multipath mitigation techniques for reliable wireless communication.	Analyze
CO5. Analyze the performance of multiple antenna techniques for improving channel capacity	Analyze

Text Book(s):

T1. T.S.Rappaport, ¯Wireless Communications: Principles and Practice, 2^{nd} Edition, Prentice Hall of India, Tenth Impression, 2013.

T2. Andreas.F. Molisch, ¯Wireless Communications‖, 2^{nd} Edition, John Wiley -India, 2007.

Reference Book(s):

R1.David Tse and pramod viswanath, ¯Fundamentals of Wireless Communication‖, 2^{nd} Edition, Cambridge University press, 2005

R2.Upena Dalal, ¯Wireless Communication‖, 2nd Edition, Oxford University Press, 2010.

R3. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications‖, 2nd Edition, Artech House Publisher,2000.
R4. Simon haykins and Michael Moher, ―Modern Wireless Communications‖, 2nd Edition, Pearson Education,2007.

Web References:

1. http://www.ifp.illinois.edu/~pramodv/Chapters_PDF/Fundamentals_Wireless_Communication_chapter1.pdf
2. https://www.cyut.edu.tw~yfahuang/huang/EX0387CH07.pdf
3. http://nptel.ac.in/courses/117102062
4. http://textofvideo.nptel.iitm.ac.in/video.php?courseid=117104099

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1003	Course Title: Antenna and Wave Propagation		
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN2301- Transmission Lines and Waveguides
- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Analyze the power radiation from diploe antennas.
2. Analyze Antenna Arrays.
3. Analyze the working principle of aperture antennas.
4. Select an appropriate antenna for the given application.
5. Analyze the propagation of radio waves.

Unit I Antenna Fundamentals & Dipole Antennas 9 Hours

Fundamental concepts: Radiation pattern – Radiation Intensity- Radiation Resistance – Beam Solid Angle – Antenna gain – Directivity – Efficiency – Beamwidth – Near and Far Field regions- Effective Aperture. Radiation from Diploe antennas - Principle of Loop antenna.

Unit II Antenna Arrays 9 Hours

Types of antenna arrays- Broadside array, End fire array, Hansen- Woodyard end fire array, Parasitic array, Binomial array.

Unit III Aperture Antennas 9 Hours

Huygen‘s Principle – Slot antenna – Radiation from sectorial and pyramidal horn antennas – Comparison between slot antenna and horn antenna - Parabolic reflector and its feed systems.

Unit IV Special Antennas **9 Hours**

Log Periodic Dipole Array - Helical antenna - Rhombic antenna - Microstrip patch antenna: Characteristics and feeding methods - Smart Antenna: Concept and benefits, fixed-weight beam forming & Adaptive beam forming.

Unit V Radio Wave Propagation **9 Hours**

Ground wave propagation: Attenuation characteristics for ground wave propagation – wave tilt. Sky wave Propagation: Structure of ionosphere – Critical frequency – Virtual height – skip distance – Refractive index- MUF. Space wave propagation: Calculation of LOS distance and field strength at a distance- Duct Propagation.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Analyze the power radiation from dipole antennas in terms of their field components.	Analyze
CO2. Analyze antenna arrays using their field patterns and directivity.	Analyze
CO3. Analyze the working principle of aperture antennas using Huygen‘s principle.	Analyze
CO4. Select an appropriate antenna for the given application based on their characteristics.	Apply
CO5. Analyze the propagation of radio waves as ground wave, sky wave and space wave.	Analyze

Text Book(s):

T1. Karus,J.D. and Marhefka , R., ¯Antennas‖, 3^{rd} Edition, Tata McGraw – Hill, 2002.

T2. Jordan, E. C and Balmain, ¯Electromagnetic Waves and radiating systems‖, 2^{nd} Edition, PHI, 1968, Reprint 2003.

Reference Book(s):

R1. Balanis, C.A, ¯Antenna Theory‖, 2^{nd} Edition, John Wiley & Sons, 2003.

R2. Collin R.E, Antenna and Radio Wave Propagation‖, McGraw – Hill College, 1987.

R3. Warren, I. S. and Gary, A.T., ¯Antenna Theory and Design‖, Second Edition, John Wiley & Sons, 1998.

R4. Harish, A.R., and Sachidanada, M., ¯Antennas and Wave propagation‖, Oxford University Press, 2007.

Web References:

1. https://nptel.ac.in/courses/108/101/108101092/
2. https://nptel.ac.in/courses/117/101/117101056/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	1	1	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1005		Course Title: Electro Magnetic Interference and Compatibility	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19PHBC2001 - Physics for Electrical Sciences
- 19ECCN2301- Transmission Lines and Wave Guides

Course Objectives

The course is intended to:

1. Identify various sources of EMI and their impacts on society.
2. Discuss various EMI coupling techniques in Electromagnetic Environment
3. Differentiate the various EMI mitigation techniques
4. Select a suitable EMC standard for given products
5. Choose an appropriate EMI measurement techniques for given products

Unit I Basics Of EMI/ EMC Concepts 9 Hours

Definition of EMI and EMC, Intra and Inter system EMI, Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility, Transient and ESD, Case Histories: Radiation Hazards to humans

Unit II Coupling Mechanism 9 Hours

Coupling: Common mode coupling- Differential mode coupling- Common impedance coupling-Ground loop coupling, Field to cable coupling, Cable to cable coupling, Power mains and Power supply coupling.

Unit III EMI Control Techniques 9 Hours

Shielding – principle, choice of materials for H, E and free space fields and thickness, EMI gaskets, Bonding, Grounding: circuits- system and cable grounding, Filtering, Transient EMI control devices and applications, PCB Zoning, Component selection, mounting, trace routing.

Unit IV Standards and Regulation **9 Hours**

National and International standardizing organizations, Common EMC Standards: FCC, CISPR, ANSI, Frequency assignment, spectrum conversation

Unit V EMI Measurements **9 Hours**

Open area test site, TEM cell, EMI test shielded chamber and shielded ferrite lined anechoic Chamber, Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors, EMI Rx and Spectrum analyser.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify various sources of EMI and their impacts on society.	Apply
CO2: Discuss various EMI coupling techniques in Electromagnetic Environment	Understand
CO3: Differentiate the various EMI mitigation techniques	Apply
CO4: Select a suitable EMC standard for given products	Apply
CO5: Choose an appropriate EMI measurement techniques for given products	Apply

Text Book(s):

T1. Kodali V. P., ¯Engineering EMC Principles, Measurements and Technologies‖, 2^{nd} edition, IEEE Press, Newyork, 2001.

T2. Henry W. Ott. ¯Electromagnetic Compatibility Engineering‖, 1^{st} edition John Wiley and Sons Inc., 2009

Reference Book(s):

R1. Keiser B., ¯Principles of Electromagnetic Compatibility‖, 3^{rd}edition, Artech house, Norwood, 1987.

R2. Archambeault B. R., BrenchC. And Ramahi O. M., ¯EMI/EMC Computational Modeling Handbook‖, 2^{nd} edition, Springer, 2001.

R3. Paul R. C., ¯Introduction to Electromagnetic compatibility‖, 2^{nd} edition, Wiley India PVT Limited, 2010.

R4. Scott Bennett, ¯Control and Measurement of Unintentional Electromagnetic Radiation‖,1^{st} edition ,John Wiley and Sons Inc., 1997.

Web References:

1. https://www.nasa.gov/centers/johnson/pdf/639521main_EMI_EMC_User_Test_Planning_Guide.pdf
2. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/
3. http://www.iec.ch/emc/explained/
4. https://www.dare.eu/testing/emc
5. https://onlinecourses-archive.nptel.ac.in/noc19_ee17/course

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	1	-	1	-	2	2	-
CO2	2	1	-	-	-	1	1	1	-	1	-	2	2	-
CO3	3	2	1	1	-	1	1	1	-	1	-	2	2	-
CO4	3	2	1	1	-	1	1	1	-	1	-	2	2	-
CO5	3	2	1	1	-	1	1	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1006	Course Title: Bluetooth Technology		
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Explain the basic operation of Bluetooth.
2. Classify Bluetooth protocol and its functions.
3. Analyze the various operational parameters.
4. Explain the functions of logical link control and adaptation protocol
5. Illustrate the various security methods

Unit I Basic Concepts 9 Hours

Bluetooth: Origin and Advantages – Technology – Topology – Problems - Basic Concepts: Spread Spectrum - Circuit and Packet Switching - Time Division duplexing - Physical Links - Peeking into Packets - Bluetooth Packets - Logical Channels - Client Server Architecture - Service Discovery.

Unit II Bluetooth Protocol Architecture 9 Hours

Bluetooth network Architecture - Open System Interconnection - Bluetooth Protocol Stack - Bluetooth core Protocols - Cable Replacement Protocols - Adopted Protocols - Usage Models and Profiles.

Unit III Bluetooth Link Management 9 Hours

Types of PDUs - Authentication – Pairing - Changing the Link Key – Encryption - Clock offset request - Timing accuracy information Request - LMP version - Switching of Master-Slave Role - Name Request - Detach - Hold mode - Sniff mode - Park Mode - Power Control – QoS - Paging Scheme - Link Supervision - Connection establishment - Test Modes.

Unit IV Logical Link Control **9 Hours**

L2CAP Functions: Basic operation - State Machine - Data packet format – Signaling - Configuration Parameter Options - Service primitives.

Unit V Bluetooth Security **9 Hours**

Security Modes: Link level security – Implementation - Architecture overview - Security level of Services - Connection setup - Connectionless L2CAP - Security Manager - Interface to L2CAP - Interface to other Multiplexing Protocols.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the basic operation of Bluetooth using its architecture.	Understand
CO2. Classify Bluetooth protocol and its functions for the interactive services between various interconnected devices.	Analyze
CO3. Analyze the various operational parameters of Bluetooth link.	Analyze
CO4. Explain the functions of logical link control and adaptation protocol in Bluetooth baseband specification.	Understand
CO5. Illustrate the various security methods used in Bluetooth technology.	Understand

Text Book(s):

T1.Nathan J Muller, ―Bluetooth Demystified‖,1st Edition, Tata McGraw-Hill, New Delhi, 2001.

T2.Brent A. Miller, Chatschik Bisdikian ―Bluetooth Revealed‖, 2nd Edition, Prentice Hall, 2001

Reference Book(s):

R1. Jennifer Bray and Charles F. Sturman, ―Bluetooth 1.1 Connect without Cables‖, 2nd edition, Prentice Hall, 2006.

R2. Christian Gehrmann, Joakim Persson, Ben Smeets, ―Bluetooth security‖, 1st edition, Arch tech House Inc, 2004.

R3. C.S.R.Prabhu, A.Prathap Reddi, ¯Bluetooth Technology and its Applications with Java and J2ME‖, 1st edition, Prentice -Hall of India Private Limited, New Delhi, 2004

R4. Robert Morrow, ¯Bluetooth operation and Use‖, 1st edition, McGraw-Hill, 2002.

Web References:

1. http://www.nptel.ac.in/courses/106105080
2. http://www.engineersgarage.com/articles/bluetooth-technology
3. http://searchmobilecomputing.techtarget.com/definition/Bluetooth
4. https://www.bluetooth.com

Course Articulation matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1007	Course Title: Multimedia Communication		
Course Category: Professional elective		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Select different multimedia systems based on their requirements.
2. Apply various coding techniques for Audio and Video compression.
3. Apply various coding techniques for text and image compression.
4. Explain the concept of VOIP Technology.
5. Explain the process of multimedia streaming.

Unit I Multimedia Components 9 Hours

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

Unit II Audio and Video Compression 9 Hours

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 Hours

Compression principles- Source Encoders and Destination Encoders- Lossless and Lossy Compression - Entropy encoding - Source encoding -Text Compression: Static and Dynamic Huffman coding - Arithmetic Coding -Lempel-ziv-welch Compression - Image Compression.

Unit IV VOIP Technology 9 Hours

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 Hours

Multimedia networking – Applications - streamed stored and audio-making the best Effort service - protocols for real time interactive Applications - distributing multimedia - beyond best effort service - scheduling and policing Mechanisms.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Select different multimedia systems based on their requirements.	Apply
CO2: Apply various coding techniques for Audio and Video compression.	Apply
CO3: Apply various coding techniques for text and image compression.	Apply
CO4: Explain the concept of VOIP Technology.	Understand
CO5: Explain the process of multimedia streaming across networks	Understand

Text Book(s):

T1. Fred Halshall, ―Multimedia communication - Applications, Networks, Protocols and Standards‖, 2nd Edition, Pearson Education, 2007.

T2. Khalid Sayood, ―Introduction to Data Compression‖, 2nd Edition, Morgan Kauffman Harcourt India, 2000.

Reference Book(s):

R1: Tay Vaughan, ―Multimedia: Making it work‖, 7th Edition, TMH 2008.

R2: Kurose and W.Ross ―Computer Networking - A Top Down Approach‖, 6th Edition, Pearson Education, 2005.

R3: KR. Rao, Z S Bojkovic, D A Milovanovic, ―Multimedia Communication Systems:Techniques, Standards, and Networks‖, Pearson Education, 2007.

R4: R.Steinmetz, K.Nahrstedt, ―Multimedia Computing, Communications and Applications‖,6th Edition, Pearson Education, 2009.

Web References:

1. http://nptel.ac.in/downloads/117105083/
2. http://nptel.ac.in/courses/117105081/

3. http://nptel.ac.in/courses/106105082/38
4. http://nptel.ac.in/courses/117105081/32

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO2	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials/ Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19ECEN1008</td><td colspan="2">Course Title: Telecommunication and Digital Switching Techniques</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week)3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECCN1401- Analog Circuits II
- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Explain Various multiplexing and switching techniques
2. Analyze different digital switching systems
3. Analyze the need for network synchronization and management
4. Explain the essential concepts of ISDN and various types of Digital subscriber loops
5. Apply traffic theory to understand the characteristics of the telephone systems

Unit I Evolution of Switching Systems 9 Hours

Digital Transmission: Frequency Division Multiplexing - Time Division Multiplexing - Message Switching - Circuit Switching - Packet Switching - Manual Switching system, Strowger or Step by Step System, Electronic Switching, Control of Switching systems.

Unit II Digital Switching 9 Hours

Switching functions: Space Division Switching – Time Division Switching, Two-dimensional Switching: STS Switching – TST Switching, No. 4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment, Elements of SSN 07 Signalling.

Unit III Network Synchronization Control And Management 9 Hours

Timing: Timing Recovery – Phase Locked Loop, Clock Instability, Jitter Measurements: Systematic Jitter, Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

Unit IV Digital Subscriber Access **9 Hours**

ISDN :L ISDN Basic Rate Access Architecture - ISDN D Channel Protocol - Digital Subscriber Loops: High Data Rate DSL - Asymmetric DSL – VDSL.

Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems – Integrated Digital Loop Carrier Systems – Next Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Coax Systems, Voice Band Modems, PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

Unit V Traffic Analysis **9 Hours**

Traffic Characterization, Traffic Measurements: Arrival Time Distributions – Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential Service Times - Constant Service Times, Finite Queues, Tandem Queues.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain various multiplexing and switching techniques involved in Telecommunication	Understand
CO2. Analyze different digital switching systems for reliable Telecommunication	Analyze
CO3. Analyze the need for network synchronization and management in Telecommunication	Analyze
CO4. Explain the essential concepts of ISDN and various types of Digital subscriber loops based on their characteristics	Understand
CO5. Apply traffic theory to understand the characteristics of the telephone systems using probability	Apply

Text Book(s):

T1. Thiagarajan Viswananthan, ¯Telecommunication Switching Systems and Networks‖, 2^{nd} Edition, PHI Learning Pvt. Ltd., 2015.

T2. Bellamy John, ¯Digital Telephony‖, 3^{rd} Edition, John Wiley and Sons, 2000.

Reference Book(s):

R1: D N Krishna Kumar, ¯Telecommunication and Switching‖, Sanguine Technical Publishers, Bangalore, 2008.

R2: J.E.Flood, ¯Telecommunication Switching, Traffic and Networks‖, 1^{st} Edition, Pearson Education Ltd., 2011.

R3: Syed R Ali, ¯Digital Switching Systems‖, Mc Graw Hill, 1998.

R4: Behrouz A. Forouzan, ¯Data Communication and Networking‖, 5^{th} Edition, Tata Mc Graw Hill, 2016.

Web References:

1. https://nptel.ac.in/courses/117/104/117104128/
2. https://nptel.ac.in/courses/117/105/117105076/
3. https://nptel.ac.in/courses/106/105/106105082/
4. https://nptel.ac.in/courses/117/104/117104104/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1011	**Course Title: Television and Video Systems**		
Course Category: Professional Elective		**Course Level: Practice**	
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19ECCN1301 - Analog Circuits - I
- 19ECCN1401 - Analog Circuits - II
- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Identify the basic requirements for Television broadcasting system.
2. Categorize various blocks of Monochrome TV Transmitter and Receiver.
3. Differentiate the Monochrome and Colour Television systems.
4. Categorize the standards of Colour Television system.
5. Identify the modules of advanced Television system.

Unit I Fundamentals Of Television 9 Hours

Geometry form and Aspect Ratio - Image Continuity - Number of scanning lines Interlaced scanning -Picture resolution -Kell Factor- Camera tubes: Vidicon - Plumbicon - CCD Image sensors - Monochrome picture tube - Composite video signal - Horizontal and Vertical sync details, Picture signal transmission: positive and negative modulation — VSB transmission and reception

Unit II Monochrome Television Transmitter And Receiver 9 Hours

TV transmitter: Low level IF modulated TV transmitter - Visual exciter - Aural exciter - Diplexer- Monochrome TV receiver: RF tuner - UHF and VHF tuner- Sound inter carrier detection - Vision IF subsystem- video amplifiers requirements - Video amplifier circuits- Sync separation - EHT generation

Unit III Essentials of Colour Television 9 Hours

Compatibility - Colour perception - Three colour theory - Luminance, Hue and Saturation - Colour television cameras - values of luminance and colour difference signals - Colour television display tubes: Delta gun, Precision-in-line and Trinitron colour picture tubes - purity and convergence - automatic degaussing circuit, Colour signal transmission: bandwidth - modulation of colour difference signals - weighting factors - Formation of chrominance signal.

Unit IV Colour TV Systems 9 Hours

NTSC colour TV system: NTSC colour encoder and decoder - limitations of NTSC system , PAL colour TV system: cancellation of phase errors, PAL-D colour system: PAL coder - PAL-D colour receiver - chromo signal amplifier - Ident and colour killer circuits - Colour signal matrixing - merits and demerits of the PAL system, SECAM system: merits and demerits of SECAM system

Unit V Advanced Television Systems 9 Hours

Cable TV - DBS TV - Digital television: Transmission and reception - MAC Signals- DTH - DVB - Flat panel display - LCD, LED and Plasma screen receivers - 3D Stereoscopic TV Techniques -HDTV

Course Outcomes **Cognitive Level**

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

CO1. Identify the basic requirements for Television broadcasting system in terms of scanning process, camera tubes, picture tubes and transmission bandwidth.	Analyze
CO2. Categorize various blocks of Monochrome TV Transmitter and Receiver with their functionalities.	Analyze
CO3. Differentiate the Monochrome and Colour Television systems with their essential requirements.	Analyze
CO4. Categorize the standards of Colour Television system with their appropriate specifications.	Analyze
CO5. Identify the modules of advanced Television system in comparison with fundamental system.	Analyze

Text Book(s):

T1. R.R.Gulati, ¯ Monochrome Television Practice, Principles, Technology and servicing , 3rd Edition, New age International Publisher, 2010

T2. R.R.Gulati, ¯Monochrome and Colour television ¯, New age International Publisher, 2003

Reference Book(s):

R1. A.M Dhake, ¯Television and Video Engineering‖, 2nd Edition, TMH, 2003.

R2. S.P.Bali, " Colour Television, Theory and Practice", TMH, 1994

R3. R.G.Gupta, "Television Engineering and Video systems", 1st Edition, TMH India 2007.

R4. Bernard Grob, "Basic Television Principles and servicing", 2nd Edition, New age International Publisher, 2004

Web References:

1. http://www.ntsc-tv.com/
2. http://dmcitarsi.com/television-transmission/
3. http://www.tech-faq.com/how-television-broadcasting-works.html
4. http://2012books.lardbucket.org/pdfs/mass-communication-media-and-culture/s12-television

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1013	Course Title: Error Control Coding		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Analyze the significance of Error detection/correction methods
2. Analyze the various linear codes
3. Analyze the various Cyclic codes
4. Analyze BCH and RS codes
5. Apply convolutional codes to achieve reliable data transfer

Unit I Coding Theory 9 Hours

Introduction to information theory -Information, Entropy, Mutual information, Shannon Theorems, Channel models, Hamming Distance

Unit II Linear Codes And Block Codes 9 Hours

Definition of Linear Codes, Generator Matrices, The Standard Array, Parity - Check Matrices, Error Syndromes, Error Detection and Correction, Shortened and Extended Linear Codes. Introduction to Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance of Block Codes, Soft - Decision Decoding.

Unit III Cyclic Codes 9 Hours

Definition of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors of XN +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Error Detection and Correction of cyclic codes.

Unit IV BCH and RS Codes **9 Hours**

Review on Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes In Finite Fields, Decoding- Single Error Correction (SEC) and Double Error Correction (DEC), Reed- Solomen Codes.

Unit V Convolution Codes **9 Hours**

Convolution, Encoding Convolutional Codes, Generator Matrices for Convolutional Codes, Generator Polynomials for Convolutional Codes, Graphical Representation of Convolutional Codes, The Viterbi Decoder.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze the Significance of Error detection/correction methods in Data Communication	Analyze
CO2:Analyze the various linear codes for error correction and error detection	Analyze
CO3: Analyze the various Cyclic codes for error correction and error detection	Analyze
CO4: Analyze BCH and RS codes in Data Communication	Analyze
CO5: Apply convolutional codes to achieve reliable data transfer	Apply

Text Book(s):

T1. Moreira Jorge Castineira, Farrell Patrick Guy, ¯Essentials Of Error Control Coding‖, Wiley India, 2013.

T2. Gravano Salvatore, "Introduction to Error Control Codes", Oxford University Press, 1st Edition, 2007.

Reference Book(s):

R1. Ranjan Bose, ¯Information Theory, Coding and Cryptography‖, 2nd Edition, TMH, 2009.

R2. Lin Shu; Costello Daniel J, ¯Error Control Coding : Fundamentals And Applications‖, Pearson, 2011

R3. Sklar Bernard,"Digital Communications - Fundamentals and Applications", Pearson Education-LPE, 2nd Edition, 2009.

R4. Todd K. Moon, ¯Error Correction Coding – Mathematical Methods and Algorithms‖, Wiley India. 2006.

R5. Man Young Rhee, ―Error Correcting Coding Theory‖, McGraw - Hill, 1989.

Web References:

1. https://nptel.ac.in/courses/117/104/117104121/
2. https://nptel.ac.in/courses/117/106/117106031/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1024	Course Title: Advanced Wireless Communication		
Course Category: Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECEN1002 - Wireless Communication

Course Objectives

The course is intended to:

1. Explain the various cellular networks.
2. Analyze the BER for various modulation techniques.
3. Analyze the adaptive modulation techniques.
4. Interpret OFDM and Multi antenna systems.
5. Explain Cognitive radio architecture and relaying techniques.

Unit I Cellular Systems and Standards 9 Hours

Advanced Mobile Phone Systems (AMPS), Global system for Mobile Communication: Frequency Bands and Channels, International Mobile Telecommunications(IMT-2000): Spectrum Allocation – Services provided by 3G cellular systems – Harmonized 3G systems Universal Mobile Telecommunications systems (UMTS): 3G UMTS signal processing - WCDMA - HSPA - HSPA+, Towards 4th G: LTE and LTE advanced.

Unit II Performance of Digital Modulation over Wireless Channels 9 Hours

AWGN Channels: Error probability for BPSK and QPSK - Error probability for MPSK - Error probability for FSK and CPFSK, BER analysis of fading channels: Outage probability - Average probability - Average probability of Error - Moment generating function approach to average error probability - Combined outage and average error probability.

Unit III Adaptive Modulation and Coding 9 Hours

Adaptive transmission system, Adaptive techniques,: Variable - Rate techniques - Variable - error techniques, Variable error probability, Variable Coding techniques, Hybrid techniques, Variable - Rate Variable power MQAM, General M-ary Modulations: Continuous rate adaption - Discrete rate adaption – Average BER target.

Unit IV Multiuser Communication 9 Hours

Orthogonal Frequency Division Multiplexing (OFDM): Principle - Implementation of Transceivers - Frequency-Selective Channels - Channel Estimation: Pilot-Symbol- Based Methods, Peak-to-Average Power Ratio, Inter Carrier Interference, Multiple Access - OFDMA, Multicarrier Code Division Multiple Access,Multiantenna Systems: Smart Antennas - Multiple Input Multiple Output Systems.

Unit V Standardized Wireless Systems 9 Hours

Cognitive Radio: Cognitive Transceiver Architecture - Principles of Interweaving -Spectrum Sensing - Spectrum Management - Spectrum Sharing - Overlay - Ultra Wide Bandwidth System Communications, Relaying: Principle of Relaying -Fundamental Protocols: Decode-and-Forward - Amplify-and-Forward - Compress-and-Forward, Relaying with Multiple, Parallel Relays.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the various cellular networks used in wireless communication.	Understand
CO2.Analyze the BER for various adaptive modulation techniques used in wireless communication	Analyze
CO3. Illustrate adaptive techniques in modulation and coding	Apply
CO4.Interpret OFDM and Multi antenna systems.	Analyze
CO5. Explain Cognitive Radio Architecture and Relaying techniques.	Understand

Text Book(s):

T1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2007.

T2. Andreas F Molisch , "Wireless Communications", John Wiley & Sons, 2010.

Reference Book(s):

R1.Dharma Prakash Agarwal and Qing- Anzeng, "Introduction to Wireless and

R2. Singal T L, "Wireless Communications" Tata McGraw Hill, 2010.

R3. Theodore S Rappaport, "Wireless Communications", Pearson Education, Asia, New Delhi, 2009

.

Web References:

1. http://nptel.ac.in/courses/117104099/
2. http://nptel.ac.in/courses/117102062/2
3. http://web.cs.ucdavis.edu/-liu/2891/Material/book-goldsmith.pdf
4. https://researchpapers4scolars.files.wordpress.com/2015/06/andreas-f-molisch-wireless-conim.pdf

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="5">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4">Total</td><td>100</td></tr>
</table>

Course Code: 19ECEN1025	Course Title: Satellite Communication		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501 - Analog and Digital Communication

Course Objectives

The course is intended to:

1. Describe Satellite orbits and launching.
2. Analyze the components required for space and earth segment.
3. Discover the link power budget
4. Apply various modulation and multiple access techniques
5. Select an appropriate satellite based on the service

Unit I SATELLITE ORBITS AND LAUNCHING 9 Hours

Kepler's three laws of Planetary motion, orbital terms for Earth Satellites, orbital perturbations, Geo stationary orbit: Look Angle determination, limits of visibility, Earth Eclipse of Satellite, Sun transit outages, Launces and launch vehicles

Unit II SPACE SEGMENT AND EARTH SEGMENT 9 Hours

Space Segment: Power Supply – Attitude Control – Spinning Satellite Stabilization -Momentum Wheel Stabilization - Station Keeping - Thermal Control - TT&C Subsystem - Transponders: The wideband receiver, input Demultiplxer, power amplifier – Antenna Subsystem, Receive-Only Home TV Systems: Outdoor Unit – Indoor Unit for Analog TV -Master Antenna TV System – Community Antenna TV System

Unit III SPACE LINK 11 Hours

Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses -Insight on Satellite antennas - Link power budget equation - System noise - Antenna noise - Amplifier noise temperature - Amplifiers in cascade - Noise factor - Noise temperature of absorptive networks – Overall system noise temperature – Carrier to- Noise ratio – Uplink – Block Up Converter (BUC) - Saturation flux density – Input back off – The earth station - HPA – Downlink - Low Noise Block down-converter – Output back off – Satellite TWTA output

Unit IV SATELLITE ACCESS **7 Hours**

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

Unit V SATELLITE APPLICATIONS **9 Hours**

INTELSAT Series, INSAT - VSAT, mobile satellite services: GSM- GPS- INMARSAT-LEO: Beam steering for LEO satellites, MEO, Satellite Navigational System, Direct Broadcast satellites, Direct to home Broadcast, Digital audio broadcast, GRAMSAT, Specialized services: Email -Video conferencing – Internet

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe satellite orbits and launching used in satellite communication	Understand
CO2: Analyze the components required for space and earth segment of satellite communication	Analyze
CO3: Discover the link power budget for satellite communication link	Analyze
CO4: Apply various modulation and multiple access techniques for satellite access	Apply
CO5: Select an appropriate satellite based on the service for the given application	Apply

Text Book(s):

T1. Dennis Roddy, ―Satellite Communications‖, Fourth Edition, McGraw Hill International Editions, 2014.

T2. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson,‗Satellite Communication Systems Engineering', Second Edition,Pearson, 2007

Reference Book(s):

R1. Tri T.Ha, ―Digital satellite communication‖, 2nd Edition, McGraw Hill, New york,1990.

R2. Timothy Pratt, Charles Bostian& Jeremy Allmuti ―Satellite Communications‖, 2nd Edition,John Wiley & Sons (Asia) Pvt Ltd, 2004.

R3. M.Richharia, ―Satellite Communication Systems-Design Principles‖, 2nd Edition,Macmillan/BSPBooks, 2012.

R4. Bruce R.Elbert, ¯The Satellite Communication Applications Hand Book‖, 2nd Edition Artech House Boston, 2003

Web References:

1. http://www.nptelvideos.com/video.php?id=507
2. http://nptel.ac.in/syllabus/117107036/
3. http://nptel.ac.in/courses/106105082/33

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1026	Course Title: Fiber Optic Communication		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Realize construction of optical fibers
2. Analyze the transmission characteristics of optical fibers
3. Describe characteristics of optical sources and its type
4. Construct fiber optic receiver systems
5. Design optical communication systems

Unit I Introduction to Optical Fibers 9 Hours

Evolution of fiber optic system- Element of an Optical Fiber Transmission link- 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 TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER 9 Hours

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion -inter symbol interference and bandwidth-intra model dispersion-material dispersion-waveguide dispersion-polarization mode dispersion-intermodal dispersion-dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile- cutoff wave length-dispersion calculation-mode field diameter

Unit III OPTICAL SOURCES 9 Hours

Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

Unit IV OPTICAL DETECTORS 9 Hours

PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors..

Unit V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9 Hours

System design consideration Point – to -Point link design -Link power budget -rise time budget, WDM -Passive DWDM Components-Elements of optical networks-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Realize basic elements in optical fibers, different modes and configurations.	Understand
CO2: Analyze the transmission characteristics associated with dispersion and polarization techniques.	Analyze
CO3: Describe characteristics of optical sources with their use in optical communication system.	Analyze
CO4: Construct fiber optic receiver systems, measurements and coupling techniques	Analyze
CO5: Design optical communication systems and its networks.	Understand

Text Book(s):

T1. GredKeiser,"Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.

T2. John M.Senior, ―Optical fiber communication‖, Pearson Education, second edition.2007

Reference Book(s):

R1. P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)PrivateLimited, 2016.

R2. Rajiv Ramaswami, ―Optical Networks,A Practical Perspective,Morgan Kaufmann ,3rd Edition-2009

R3. J.Gower, ―Optical Communication System‖, Prentice Hall of India, 2001.

R4.Govind P. Agrawal, ―Fiber-optic communication systems‖, third edition, John Wiley & sons, 2004.

Web References:

1.https://nptel.ac.in/courses/117/107/117107094/

2. https://nptel.ac.in/courses/117/106/117106088/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessmentpattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19ECEN1027</td><td colspan="2">Course Title: OFDM and MIMO Concepts</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week)3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECCN1501-Analog and Digital Communication
- 19MABG1401- Probability and Statistics

Course Objectives

The course is intended to:

1. Explain the concepts of OFDM technique
2. Analyze Orthogonal Frequency Division Multiple Access Techniques
3. Apply the diversity principles
4. Analyze various channel models
5. Analyze the multiuser MIMO model

Unit I INTRODUCTION TO OFDM 9 Hours

Orthogonal Frequency Division Multiplexing(OFDM): Basics, Generation of Subcarriers using IFFT, Guard Time and Cyclic Extension, Windowing, Choice of OFDM Parameters, OFDM Signal Processing, Implementation Complexity of OFDM Versus Single carrier Modulation.

Unit II ORTHOGONAL FREQUENCY DIVISION MULTIPLE ACCESS 9 Hours

Introduction to Multiple Access Techniques, OFDMA, Frequency Hopping OFDMA, Differences between OFDMA and MC-CDMA, OFDMA System Description, Application of OFDM- Digital Radio Broadcasting, IEEE 802.11, HiperLAN/2, MMAC WLAN standard.

Unit III ANTENNA DIVERSITY AND SPACE-TIME CODING TECHNIQUES 9 Hours

Antenna Diversity, Space-Time Coding (STC): Overview- System Model, Pairwise Error ProbabilitySpace-Time Code Design, Space-Time Block Code (STBC)-Alamouti Space-Time Code, Generalization of Space-Time Block Coding, Decoding for Space-Time Block Codes, Space-Time Trellis Code.

Unit IV WIRELESS CHANNEL MODELS 9 Hours

SISO Channel Model: Indoor Channel Models - IEEE 802.11 Channel Model, UWB Channel Model, Outdoor Channel Models-FWGN Model, Frequency-Selective Fading Channel Model, SUI Channel Model, MIMO Channel Models - Statistical MIMO Model - Spatial Correlation,I-METRA MIMO Channel Model.

Unit V MULTIUSER MIMO 9 Hours

Mathematical Model for Multi-User MIMO System, Channel Capacity of Multi-User MIMO System- Capacity of MAC, Capacity of BC,Transmission Methods for Broadcast Channel-Channel Inversion, Block Diagonalization, Dirty Paper Coding (DPC), Tomlinson-HarashimaPrecoding

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
1. Explain the concepts of OFDM technique in Wireless Communication	Understand
2. Analyze Orthogonal Frequency Division Multiple Access Techniques in modern Communication systems	Analyze
3. Apply the diversity principles for Multiuser Communication	Apply
4. Analyze various channel models for Wireless Communication	Analyze
5. Analyze the multiuser MIMO model using different coding schemes	Analyze

Text Book(s):

T1. Nee Richardvan, Prasad Ramjee,‖ OFDM For Wireless Multimedia Communications‗ Artech House, 2000.

T2. Cho Yong Soo et al, ‗MIMO OFDM Wireless Communications with Matlab‖,John Wiley & Sons, 2011

Reference Book(s):

R1.Ramjee Prasad, ‗OFDM for Wireless Communications Systems‖, Universal personal communications, 2004

R2.Mischa Schwartz, ‗Mobile Wireless Communications‖, Cambridge University Press, 2005

R3.Andreas F. Molisch, ‗Wireless Communications‖,2nd Edition, John Wiley and Sons, 2011.

R4.EzioBiglieri, Robert Calder bank, Anthony Constantinides, Andrea Goldsmith, ¯MIMO Wireless Communications‖, Cambridge University Press, 2008.

R5.David Tse and PramodViswanath, ¯Fundamentals of Wireless Communication‖, Cambridge University Press, 2005.

R6.Andrea Goldsmith, ¯Wireless Communication‖, Cambridge University Press, 2005.

Web References:

1. https://ep.jhu.edu/programs-and-courses/525.735-mimo-wireless-communications
2. http://nptel.ac.in/courses/117104115/
3. www.ee.iitm.ac.in/~giri/pdfs/EE6002/book-cho
4. www.keysight.com/upload/cmc_upload/All/20Sept2012Webcast.pd

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19ECEN1001	Course Title: Computer Communication Networks		
Course Category: Professional Elective		Course Level: Introductory	
L:T:P(Hours/Week):3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ITSN2302 - Data Structures and Algorithms - I

Course Objectives

The course is intended to:

1. Compare the layers of OSI model with TCP/IP protocol suite.
2. Illustrate error control techniques in networks.
3. Analyze the network routing algorithms.
4. Apply the congestion control algorithms in Communication networks.
5. Analyze the Application layer services.

Unit I Physical Layer 9 Hours

Data Communications - Network Edge - Network Core - Performance metrics - Networks models: OSI model - TCP / IP protocol suite - Addressing - Transmission Media: Twisted pair, Coaxial Cable - Error detection: Parity Checks, Cyclic Redundancy Check (CRC)

Unit II Data Link Layer 9 Hours

Framing – Flow Control and Error control techniques: Stop and wait – Go back N ARQ – Selective repeat ARQ - sliding window techniques - Multiple Access Techniques: Random access protocol, Controlled access protocol - Ethernet: IEEE 802.3 - Wireless LANS: IEEE802.11.

Unit III Network Layer 9 Hours

Internetworking devices: hub, repeater, bridge, switch, router, Gateway - Basic Internetworking (IP, ARP, DHCP, ICMP), IPV4, IPV6 - Routing: Link State Routing, Distance Vector Routing

Unit IV Transport Layer 9 Hours

Process - to - Process delivery - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion Control -Quality of services (QoS) - Techniques to improve QoS- Integrated Services – Differentiated Services.

Unit V Application Layer 9 Hours

Traditional Applications: Domain Name System (DNS) - E-mail (MIME, SMTP, POP3, IMAP) - WWW – HTTP – SNMP – Telnet.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Compare the layers of OSI model with TCP/IP protocol suite using their functions	Understand
CO2. Illustrate error control techniques in networks using appropriate Protocols	Understand
CO3. Analyze the network routing algorithms using appropriate protocols	Analyze
CO4. Apply the congestion control algorithms in Communication Networks to improve the quality of service	Apply
CO5. Analyze the Application layer services based on its protocols.	Analyze

Text Book(s)

T1. Behrouz A. Forouzan, ―Data communication and Networking‖, 4th edition, Tata McGraw- Hill, 2007

T2. James .F. Kurose & Keith W. Ross, ―Computer Networking: A Top down Approach Featuring the Internet‖, 3rd Edition, Pearson Education, 2007

Reference Book(s):

R1. Andrew S. Tanenbaum, ―Computer Networks‖, Pearson Education, 4th Edition, 2003.

R2. Larry L.Peterson and Peter S. Davie, ―Computer Networks‖ 4th edition, Harcourt Asia Pvt. Ltd, 2007.

R3. Wayne Tomasi, ―Introduction to Data Communication and Networking‖, 1st Edition, Pearson Education, 2007.

R4. William Stallings, ―Data and Computer Communication‖, 8th Edition, Pearson Education, 2007.

Web References:

1. https://nptel.ac.in/courses/106/105/106105183
2. http: // www.cse.iitk.ac.in/users/dheeraj/cs425

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	1	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	2	2	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1004	Course Title: High Speed Networks		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week): 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Pre-requisites

- 19ECEN1001- Computer Communication Networks

Course Objectives

The course is intended to:

1. Describe ATM and Frame relay operation
2. Analyse the queuing models
3. Explain TCP and ATM Congestion Control Techniques
4. Explain the architecture of Integrated and Differentiated Services
5. Identify different protocols for Quality of Service

Unit I Introduction to High Speed Networks 9 Hours

Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

Unit II Congestion and Traffic Management 9 Hours

Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks – Frame Relay Congestion Control

Unit III TCP and ATM Congestion Control 9 Hours

TCP Flow control - TCP Congestion Control – KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Requirements - Attributes -Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management

Unit IV Integrated and Differentiated Services 9 Hours

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.

Unit V Protocols for QoS Support 9 Hours

RSVP - Goals and Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching-Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Describe ATM and Frame relay operation of high speed networks	Understand
CO2. Analyse queuing models for congestion and traffic management using congestion control techniques	Analyze
CO3. Explain TCP and ATM Congestion Control Techniques using algorithms and traffic management techniques	Understand
CO4. Explain the architecture of Integrated and Differentiated Services	Understand
CO5. Identify the different protocols for Quality of Service support for different applications	Understand

Text Book(s)

T1. William Stallings, ¯High Speed Networks and Internet‖, Pearson Education, 2^{nd} Edition, 2002.

T2. Uyless Black: MPLS and Label Switching Networks, Pearson Education, 2^{nd} Edition, 2001

Reference Book(s):

R1 Jean Walrand, Pravin Pratap Varaiya, ¯High performance communication networks‖, 2^{nd} Edition, Jean Harcourt Asia Pvt. Ltd., 2001.

R2 Irvan Pepelnjk, Jim Guichard, Jeff Apcar, ¯MPLS and VPN architecture‖, Cisco Press, Volume I and II, 2003.

R3 Sumit Kasera and Pankaj Sethi, ¯ATM Networks Concepts and Protocols‖, 2nd Edition, Tata McGraw-Hill- New Delhi, 2006.

R4 Rainer Handel, Manfred N.Huber and Stefan Schroder, ¯ATM Networks‖, 3^{rd} Edition, Pearson Education Asia, 2002.

Web References:

1. http://nptel.ac.in/courses/106105081/1
2. http://nptel.ac.in/courses/106105082/30

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1009		Course Title: Wireless Sensor Networks	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. PExplain the basic concepts of WSN and its applications
2. Explain the wireless sensor technology
3. Analyze various Medium access and routing protocols for WSN
4. Analyze various Transport control protocols for WSN
5. Explain the operating system design issues and performance of WSN

Unit I Introduction 9 Hours

Motivation for a Network of Wireless Sensor Nodes: Definitions and Background-Challenges and Constraints-Applications

Unit II Wireless sensor technology 9 Hours

Sensor node technology-sensor taxonomy-WN operating environments-WN trends-Available wireless technologies-MAN/WAN applications

Unit III Medium access control and routing protocols 9 Hours

Medium access control protocols: Fundamentals of MAC protocols-MAC protocols for WSNs, Routing Protocols: Routing challenges-Resource constraints-Routing strategies

Unit IV Transport control protocols 9 Hours

Traditional transport control protocols: TCP- UDP-Mobile IP-Feasibility of using TCP and UDP for WSNs - Existing TCP protocols: CODA,ESRT,RMST,PSFQ,GARUDA

Unit V Operating system and Traffic management 9 Hours

Introduction-Operating system design issues-Introduction to TinyOS, WSN design issues-Performance modeling of WSNs.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Explain the basic concepts of WSN and applications	Understand
CO2. Explain the wireless sensor technology	Understand
CO3. Analyze various Medium access and routing protocols for WSN	Analyze
CO4. Analyze various Transport control protocols for WSN	Analyze
CO5. Explain the operating system design issues and performance of WSN	Understand

Text Book(s)

T1.Kazem Sohraby, Daniel Minoli, Taieb Znati "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley interscience, 2007

T2. Waltenegus Dargie , Christian Poellabauer, ―Fundamentals of Wireless Sensor Networks:
Theory And Practice‖, John Wiley & Sons Publications ,2011

Reference Book(s):

R1.Sabrie Soloman, ―Sensors Handbook" by McGraw Hill publication, 2nd edition, 2009

R2.Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks‖, Elsevier Publications, 2004

R3. Philip Levis, And David Gay "Tiny OS Programming‖ by Cambridge University Press 2009

Web References:

1. https://www.intechopen.com/books/wireless-sensor-networks-technology-and-protocols/overview-of-wireless-sensor-network
2. http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	1	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	1	-
CO3	3	3	2	2	-	-	-	1	-	1	-	1	1	-
CO4	3	3	2	2	-	-	-	1	-	1	-	1	1	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	1	-

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19ECEN1010</td><td colspan="3">Course Title: Cryptography and Network Security</td></tr>
<tr><td colspan="3">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week): 3:0:0</td><td colspan="2">Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19MABG1401 - Probability and Statistics

Course Objectives

The course is intended to:

1. Apply evolutionary encryption and decryption techniques
2. Apply the concept of number theory
3. Analyze the role of MAC functions
4. Explain the various authentication algorithms
5. Identify an appropriate security system

Unit I Introduction to Cryptography 9 Hours

Security goals - Cryptographic attacks - Services and mechanisms - Classical encryption techniques - Block Cipher Design Principles and Modes of Operation - Data Encryption Standard – Triple DES, Advanced Encryption Standard.

Unit II Number Theory and Public Key Cryptography 9 Hours

Introduction to number theory: Prime numbers, Fermat and Euler‘s theorem, testing of primarily, Chinese Remainder theorem, Quadratic Congruence, Exponentiation and logarithm -Public Key Cryptography and RSA – Key management: Diffie-Hellman key Exchange.

Unit III Authentication and Hash Function 9 Hours

Authentication requirements - Authentication functions - Message Authentication Codes - Hash Functions -Security of Hash Functions and MACs - MD5 message Digest Algorithm - Secure Hash Algorithm.

Unit IV Network Security 9 Hours

Authentication Applications: Kerberos - X.509 Authentication Service - Electronic Mail Security – PGP – S/MIME – IP Security – ISAKMP.

Unit V System Level Security 9 Hours

Worms, Viruses, Intrusion Detection System(IDS) - Firewall Design Principles, Case Studies: Single Sign On(SSO),Denial of Service attack(DoS), IP spoofing attack.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Apply known encryption and decryption techniques for network security.	Apply
CO2. Apply the concept of number theory in cryptography.	Apply
CO3. Analyze the role of MAC functions in information security.	Analyze
CO4. Explain the various authentication algorithms for network security.	Understand
CO5. Identify an appropriate security system to provide system level security.	Apply

Text Book(s)

T1. William Stallings, ―Cryptography and Network Security - Principles and Practice‖, Prentice Hall of India, 3rd Edition, 2003

T2. Behrouz A Forouzan, ―Cryptography and Network Security‖, Tata McGraw Hall, 2nd Edition, 2011

Reference Book(s):

R1. Atul Kahate, ―Cryptography and Network Security‖, Tata McGraw-Hill,2003.

R2.Bruce Schneier, ―Applied Cryptography Protocols, Algorithms and Source Code in C‖,

R3. John Wiley and Sons Inc, 2nd edition, 1996

R4. Charles P.Pfleeger, Shari Lawrence Pfleeger, ―Security in Computing‖, 3rd Edition, Pearson Education, 2003

Web References:

1. https://nptel.ac.in/courses/106/105/106105162/
2. https://www.cse.iitk.ac.in/users/braman/cs425/slides/security-overview.pdf

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2
CO1	3	2	1	1	2	-	-	1	-	1	-	2	2	-
CO2	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	2	-	-	1	2	1	-	2	2	-

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1028	**Course Title: Advanced Networking Technologies**		
Course Category: Professional Elective	**Course Level: Mastery**		
L:T:P(Hours/Week):3:0:0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19ECEN1001 - Computer Communication Networks

Course Objectives

The course is intended to:

1. Explain the difference and security issues of IPV6 &IPV4
2. Explain the need for MPLS based VPN
3. Analyze the QOS requirements in multimedia applications
4. Explain the various client layers of Synchronous optical networks
5. Explain the various survivability techniques used in WDM networks

Unit I Internetworking 9 Hours

IPV6-Design Issues-scalability - Addressing – headers – Routing - Auto configuration -IPV4 Vs IPV6, Transition from IPV4 to IPV6 – Interoperability - QOS in IPV6 - Multicast report - ICMPV6 - Security in IPV6

Unit II MPLS and VPN 9 Hours

Virtual private network-Remote access VPN, site-to-site VPN, tunneling and PPP, Security in VPNs, Multiprotocol Label Switching-MPLS operation, Routing in MPLS domains, Tunneling and use of FEC, Traffic engineering, MPLS based VPNs.

Unit III Quality of Service 9 Hours

Application requirements – VOIP - RT video conferencing - Entertainment video - QOS taxonomy - Resource allocation – Scheduling - Queuing disciplines - Integrated Services - Differentiated Services – RSVP

Unit IV Client Layers of the Optical Networks 9 Hours

SONET/SDH- Multiplexing, VCAT and LCAS, SONET/SDH layers, SONET frame structure, SONET/SDH Physical layer, Elements of a SONET/SDH Infrastructure- Optical transport Network – Frame structure , Multiplexing – Generic framing procedure.

Unit V WDM Networks 9 Hours

WDM: Traffic grooming WDM-Network survivability- Survivability techniques or optical WDM networks-Restoration strategies in optical WDM networks

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the difference and security issues of IPV6 &IPV4	Understand
CO2. Explain the need for MPLS based VPN	Understand
CO3. Analyze the QOS requirements in multimedia applications	Analyze
CO4. Explain the various client layers of Synchronous optical networks	Understand
CO5. Explain the various survivability techniques used in WDM networks	Understand

Text Book(s)

T1. Larry L.Peterson, Bruce S.Davie, ―Computer Networks A Systems Approach‖, Fifth edition, Morgan Kaufmann publishers, 2011

T2. Rajiv Ramaswami and Kumar N. Sivarajan, ―Optical Networks: A Practical Perspective‖, Third Edition, Morgan Kaufmann publishers, 2010.

Reference Book(s):

R1. C. Siva Ram Moorthy and Mohan Gurusamy, ―WDM Optical Networks : Concept, Design and Algorithms‖, Prentice Hall of India, Ist Edition, 2002

R2. J.F. Kurose and K.W. Ross, ―Computer Networking- A top down approach Featuring the internet‖, Pearson, 2nd edition, 2003

R3. Hersent Gurleand Petit, ―IP Telephony, packet Pored Multimedia Communication Systems‖, Pearson education, 2003.

R4. Nader F.Mir , ―Computer and Communication Networks‖, Ist edition, Pearson education, 2003.

Web References:

1.http://www.networktutorials.info/networkhowto/what_is_optical_networking.html

2.https://www.cse.iitb.ac.in/~varsha/allpapers/network-misc/mplsvpns.pdf

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	2	-

Assessment pattern

<table>
<tr><th rowspan="5">Continuous Assessment</th><th>Assessment Component</th><th>CO. No.</th><th>Marks</th><th>Total</th></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4">Total</td><td>100</td></tr>
</table>

Course Code: 19ECEN1029	Course Title: Mobile Communication and Networks		
Course Category: Professional Elective		**Course Level: Mastery**	
L:T:P(Hours/Week): 3 : 0 : 0	**Credits: 3**	**Total Contact Hours: 45**	**Max Marks: 100**

Pre-requisites

- 19ECEN1002- Wireless Communication
- 19ECEN1003 - Antennas & Wave Propagation

Course Objectives

The course is intended to:

1. Understand the cellular concepts.
2. Explain the characteristics of signals how they are generated & propagated.
3. Analyze the multiple access techniques suitable for mobile communication.
4. Analyze the antenna characteristics for efficient communication.
5. Analyze the antenna receiver technology in mobile communication.

Unit I Cellular Concepts 9 Hours

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 Signal Characteristics 9 Hours

Signal propagation-Propagation mechanism- reflection, refraction, diffraction andscattering, large scale signal propagation and lognormal shadowing. Fading channels, fading models, power delay profile, average and RMS delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, average fade duration and level crossing rate

Unit III Multiplexing Techniques 9 Hours

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM

Unit IV Antennas for Mobile Communication 9 Hours

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

Unit V Mobile Receiver and Technology 9 Hours

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

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Understand the cellular concepts with respect to technology.	Understand
CO2: Understand the working principles of mobile signals, how they are generated and propagated.	Understand
CO3: Analyze and understand the best sustainable multiple access techniques for effective communication.	Analyze
CO4: Analyze the antenna for mobile communication.	Analyze
CO5: Analyze the antenna receiver technology with characteristics features.	Analyze

Text Book(s)

T1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1998.

T2. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, Second Edition, 2000

Reference Book(s):

R1. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, Second Edition, 1993

R2. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995

R3. VK Garg, Wireless Communication & Networking, The Morgan Kaufmann Series in Networking

Web References:

1. https://nptel.ac.in/courses/117/102/117102062/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	-	3	-
CO2	2	1	-	-	-	-	-	1	-	1	-	-	3	-
CO3	3	3	2	2	-	-	-	1	-	1	-	-	3	-
CO4	3	3	2	2	-	-	-	1	-	1	-	-	3	-
CO5	3	3	2	2	-	-	-	1	-	1	-	-	3	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="5">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4">Total</td><td>100</td></tr>
</table>

Course Code: 19ECEN1030		Course Title: Cognitive Networks	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week):3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites:

- 19ECCN1501 - Analog and Digital Communication

Course Objectives:

The course is intended to:

1. Describe the basics of the Software Defined Radio.
2. Explain the concepts of Software Defined Radio architecture and spectrum management in Software defined Radio.
3. Describe the need for cognitive radio technologies
4. Explain the concept of Cognitive Radio Architecture and their functions
5. Analyze the impact of interference in Cognitive Radio

Unit I Introduction to Software Defined Radio 9 Hours

Need for software defined radio, definition, characteristics and benefits of SDR, design principles of SDR, The ideal Software Radio- The Software Radio Functional Architecture.

9 Hours

Unit II SDR Architecture

History of SDR, Basic SDR-hardware architecture, computational processing resources, software architecture, Spectrum management.

9 Hours

Unit III Cognitive Radio Technologies

Introduction: Brief concept of Cognitive Radio-Definition, Function and applications of CRN, Policy challenges: Dynamic spectrum access, Security- Available Technologies for CRs

Unit IV Cognitive Radio Architecture 9 Hours

Functions, components and design rules: AACR Functional component Architecture-Design rules-Flexible functions of component Architecture, Cognition cycle: observe, orient, plan, decide and act phases.

Unit V – Spectrum Awareness **9 Hours**

Interference avoidance problem, cognitive radio role, spectrum sensing, Channel awareness and multiple signals in space, adaptive spectrum implications for Cognitive Radio hardware.

Course Outcomes:	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the basics of the Software defined Radio using its functional architecture.	Understand
CO2: Explain the concepts Software defined radio architecture and spectrum management in Software defined Radio	Understand
CO3: Identify the need for cognitive radio communication technologies	Understand
CO4: Explain the concept of Cognitive Radio Architecture and their functions	Understand
CO5: Analyze the impact of interference in Cognitive Radio	Analyze

Text Book(s):

T1. Bruce A. Fette, ―Cognitive Radio Technology‖, Elsevier, 2009.

T2. Software Radio: A Modern Approach to Radio Engineering by Jeffrey H. Reed Pearson Education, 2002.

Reference Book(s):

R1. Joseph Mitola III, ―Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering‖, John Wiley and Sons Ltd.2000.

R2. Thomas W. Rondeau, Charles W. Bostain,‖Artificial Intelligence in Wireless communication‖, ARTECH HOUSE, 2009.

R3. Markus Dillinger, KambizMadani, Nancy Alonistiotic,‖ Software Defined Radio‖, John Wiley, 2003.

R4. Alexander M. Wyglinski, Maziarnekovee, Y.ThomasHu,‖Cognitive Radio Communication and Networks‖, Elsevier, 2010.

Web References:

1. http://link.springer.com/chapter/10.1007/978-1-4020-5542-3_2

2. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4644051

Course Articulation matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	-	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	-	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	-	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	-	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	-	2	-

Assessment pattern:

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code:19ECEN1012	Course Title: High Speed Electronics		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN2301 - Transmission Lines and Waveguides

Course Objectives

The course is intended to:

1. Explain the concept of transmission line theory
2. Interpret passive and active devices used for low Vs high frequency
3. Analyse the performance of RF amplifiers
4. Explain the function of RF mixer and oscillators
5. Design the CAD tools used for PCB

Unit I Basics, Noise Analysis 9 Hours

Transmission line theory (Basics) cross talk and non-ideal effects-high frequency power delivery-methodologies for design of high speed buses-radiated emissions and minimizing system noise-Noise analysis-Sources, Noise figure, Gain compression-Harmonic distortion-Dynamic range.

Unit II Devices 9 Hours

Passive and active-lumped passive devices(models)-Active(models, low Vs high frequency).

Unit III RF Amplifiers 9 Hours

RF amplifier design-stability-low noise amplifiers-Broad band amplifiers (and Distributed)-cross over distortion-Efficiency-RF power output stages.

Unit IV RF Mixer, Oscillator 9 Hours

Mixers-Up conversion-Down conversion-Conversion gain and spurious response-Oscillators principles-PLL transceiver architectures.

Unit V RF Design Tools 9 Hours

Design tool basics-Design languages-RF IC design flow-RF IC design flow example-simulation examples-Modelling-Printed circuit board and packaging anatomy-CAD tools for PCB design**.**

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1 : Explain the basics of RF circuits and analyse the noise parameters	Understand
CO2: Select the appropriate active and passive models for low Vs high frequency application	Analyze
CO3: Analyse the performance of RF amplifiers	Analyze
CO4: Explain the function of RF mixer and oscillators	Understand
CO5:Design the basic RF tools, simulation and modelling of CAD tools for PCB	Analyze

Text Book(s):

T1. Thomas H.Lee, Design of CMOS Radio frequency Integrated circuits, Cambridge University press, 1998 (2013 reprint) ISBN 9780521639224.

T2. Stephen H.hall, Garrett W.Hall, James A. McCall High Speed Digital System Design: Hand book of Interconnect Theory and Design Practices, Wiley IEEE press, 2000

Reference Book(s):

R1. Chris Bowick, RF Circuit Design, Elsevier, U.S./India, 2007,2nd Edition, ISBN: 9780750685184.

R2. Behzad Razavi, RF Microelectronics, Pearson India, Second Edition, 2014.

R3. Reinhold Ludwig, Gene Bogdanov, RF Circuit Design Theory And Application, Pearson India, Second Edition, 2011

R4. Richard, RF Circuit Design, Wiley Publishers, 2012.

Web References:

1. https://nptel.ac.in/content/syllabus_pdf/117106089.pdf
2. https://nptel.ac.in/courses/117/106/117106089/
3. https://www.youtube.com/playlist?list=PL804EBBC9541F0D5A.
4. https://www.nist.gov/programs-projects/high-speed-electronics

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	-	2	1
CO2	3	3	2	2	-	-	-	1	-	1	-	-	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	-	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	-	2	1
CO5	3	3	2	2	-	-	-	1	-	1	-	-	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1014	Course Title: Biomedical Electronics		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1401 - Analog Circuits- II

Course Objectives

1. Explain the basic concepts of Bio Medical Electronics
2. Categorize the various technique involved in the Electro physical measurements
3. Describe Non-Electrical Biomedical parameter measurement.
4. Illustrate Bio medical imaging techniques
5. Explain the Therapeutic and Prosthetic Devices

Unit I Basic Concepts of Biomedical Electronics 9 Hours

Cells,Tissues, Organs- Structure and Properties. Epithelial tissue,Corrective tissue, cartilage, bone, skin, teeth. Dermal Prosthesis, Facial Prosthesis, Soft tissue replacement, hard tissue replacement, Biocompatibility.

Unit II Electro Physical Measurements 9 Hours

Electrodes: Half Cell Potential, Electrode paste, polarizable and non-polarizable, surface, Depth, needle and micro electrodes and their equivalent circuits. Bio potential amplifiers – Basic Requirements,Medical Preamplifiers. ECG, EEG, EMG – Lead systems and recording methods.

Unit III Non- Electrical Measurements 9 Hours

Measurement of Blood pressure, blood flow, cardiac output and heart sounds, respiratory rate, lung volumes and capacities, Plethysmography, gas volume: measurement of pH of blood, PO2, PCO2.

Unit IV Biomedical Imaging Techniques **9 Hours**

X-Ray and CT Imaging, PET and SPECT Imaging, Magnetic Resonance Imaging, Ultrasonic Imaging, Infra-Red Imaging, Other Imaging Techniques, Application of filtering in medical images: Noise models- Mean Filters – Order Statistics – Adaptive filters and algorithms - Recursive Least Square (RLS) - the Least Mean Square.

Unit V Therapeutic and Prosthetic Devices **9 Hours**

Cardiac Pacemakers : Energy requirements, Methods of stimulation, types : Fixed rate and Demand, Defibrillators : Internal and External : AC defibrillator and Double square Pulse defibrillator, Ventilators, Diathermy, Stimulators, Heart Lung Machine, Dialyzers, Bio sensors, Biomaterials for implantable purposes, its characteristics and testing.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the basic concepts of Bio Medical Electronics	Understand
CO2. Categorize the various techniques involved in the Electro physical measurements using Bio-potential recording methods	Analyze
CO3. Describe Non-Electrical Biomedical parameter measurements	Understand
CO4. Illustrate Bio medical imaging techniques	Understand
CO5. Explain the Therapeutic and Prosthetic Devices	Understand

Text Book(s):

T1. Khandpur R S, ―Handbook of Biomedical Instrumentation ―, 2nd Edition, Tata McGraw-Hill,New Delhi, 2003.

T2. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, 2nd Edition, prentice hall of India, New Delhi, 2004.

T3. Hench L.L. and E.C.Ethridge, ―Biomaterial: an interfacial approach‖, Academic Press, 1982.

Reference Book(s):

R1. Arumugam M., ―Biomedical Instrumentation‖, 2nd Edition, Anuradha Publications,Chennai, 2006.

R2. Joseph J.Carr and John M. Brown, ―Introduction to Biomedical Equipment

Technology,‖ 4^{th} Edition John Wiley and sons, New York, 1997.

R3. Geddes L A and L.E.Baker, ―Principles of Applied Bio-medical Instrumentation―, 3^{rd} Edition, John Wiley and Sons, 1975.

R4. John G. Webster, ―Medical Instrumentation Application and Design‖, 4^{th} Edition, John Wiley and sons, New York, 1998.

R5. Gray E Wnek and Gray L Browlin, ― Encyclopedia of Biomaterials and Biomedical Engineering ―, Marcel Dekker Inc, New York, 2004.

Web References:

1. http://nptel.ac.in/courses/117108037/15
2. http://nptel.ac.in/courses/1021030441

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	3	3	2	2	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1021	Course Title: Advanced Microcontrollers		
Course Category: Professional Elective		**Course Level: Mastery**	
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19ECCN2601 - Microcontroller& its interfacing techniques

Course Objectives

The course is intended to:

1. Select an appropriate microcontroller for an application
2. Discuss the features of MSP430 microcontroller
3. Explain the Architecture of MSP430 Processor
4. Program using PIC 18 Microcontroller
5. Create simple projects using PIC Microcontroller

Unit I Overview of Microcomputer Systems 9 Hours

RISC Verses CISC Processor - Microcontrollers - Types - Selection of Microcontrollers - Architecture (8048) - Resources of Microcontrollers - Applications

Unit II MSP430 microcontroller 9 Hours

The Texas Instruments MSP430: Pin-Out- Functional Block Diagram- Memory- Central Processing Unit- Memory-Mapped Input and Output- Clock Generator- Exceptions: Interrupts and Resets- Watchdog Timer.

Unit III Architecture of the MSP430 Processor 9 Hours

Central Processing Unit- Addressing Modes- Constant Generator and Emulated Instructions- Instruction Set- Examples- Resets- Clock System

Unit IV PIC Microcontroller (PIC18) 9 Hours

PIC Architecture: The WREG Register, File Register, Status Register, Data Format and Directives – PIC Programming in C: Data types and Time delays, I/O Programming, Logic Operations, Data serialization, Program ROM and Data RAM Allocation.

Unit V Applications of PIC Microcontroller-Case study and Projects 9 Hours

Model Train Traffic Light Control using a Hall Effect Sensor, Serial LCD Interfacing, Switch Matrix Key Matrix, Blinking Light and Music, TV IR Remote Control Robot, DC Motor Control Application.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Select an appropriate microcontroller for an application	Understand
CO2. Explain the features of MSP430 microcontroller	Understand
CO3. Explain the Architecture of MSP430 Processor	Understand
CO4. Write an Embedded C Program using PIC 18 Microcontroller	Apply
CO5. Create simple projects using PIC Microcontroller	Apply

Text Book(s):

T1. Raj Kamal, ¯Microcontrollers - Architecture, Programming, Interfacing and System Design‖, Pearson Education, 2007

T2. Muhammad Ali Mazidi , Rolin D. McKinlay , Danny Causey ¯PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18 ¯,Pearson Education,2008

T3. John H. Davies ¯MSP430 Microcontroller Basics‖Elsevier,2008

Reference Book(s):

R1. Daniel Tabak, ¯Advanced Microprocessors‖ McGraw Hill.Inc., 2008.

R2. Myke Predko, ¯Programming and Customizing the PIC Microcontroller‖, Tata McGraw-Hill, 2008

Web References:

1. https://nptel.ac.in/courses/117/104/117104072/

2. https://www.alldatasheet.com/datasheet-pdf/pdf/27250/TI/MSP430.html

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19ECEN1031</td><td colspan="2">Course Title: Introduction to MEMS</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week)3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECSN2201- Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Understand the basic principles of sensors and actuators
2. Explain the basic mechanics in MEMS design
3. Identify electrostatic design and the associated system issues
4. Illustrate the different applications of MEMS
5. Understand the working of optical and RF MEMS

Unit I Introduction to MEMS 9 Hours

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication.

Unit II Mechanics for MEMS Design 9 Hours

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Therm[illegible]hanics - actuators, force and response time, Fracture and thin film mechanics.

Unit III Electro Static Design and System Issues 9 Hours

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators. Electronic Interfaces, Feedback systems, Noise, Circuit and system issues.

Unit IV MEMS Application 9 Hours

Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

Unit V INTRODUCTION TO OPTICAL AND RF MEMS 9 Hours

Optical MEMS, - System design basics - Gaussian optics, matrix operations, resolution. Case studies- MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems -design basics, case study - Capacitive RF MEMS switch, performance issues.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Develop electrical and mechanical model MEMS sensors and actuators	Apply
CO2. Explain mechanics associated with MEMS design.	Understand
CO3. Analyse electrostatic circuits and issues in MEMs	Analyse
CO4. Construct electro mechanical model of MEMS	Apply
CO5. Explain the working concept of optical and RF MEMS	Understand

Text Book(s):

T1. Stephen Santeria, "Microsystems Design", Springer, 2016‖.

T2. Nadim Maluf,"An Introduction to Micro Electro Mechanical System Engineering, Artech House, 2004

Reference Book(s):

R1. Ai Qun Liu, "Photonic MEMS Devices", CRC press Bocaraton, 2009.

R2. Tai Ran Hsu, "MEMS & Micro Systems Design, Manufacture and Nanoscale Engineering", John Wiley, New Jersy, 2008.

Web References:

1. https://nptel.ac.in/courses/117/105/117105082/

2.https://onlinecourses.nptel.ac.in/noc20_ee52/preview

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><th></th><th>Assessment Component</th><th>CO. No.</th><th>Marks</th><th>Total</th></tr>
<tr><td rowspan="4">Continuous Assessment</td><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4">Total</td><td>100</td></tr>
</table>

Course Code: 19ECEN1032		Course Title: Nano Electronics	
Course Category: Professional Elective		**Course Level: Mastery**	
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19PHBC2001- Physics for Electrical Sciences

Course Objectives

The course is intended to:

1. Understand the basic concepts of quantum mechanics
2. Classify the types of harmonic oscillators and its approximations.
3. Explain nano electronic system with more than one degrees of freedom
4. Illustrate the basic concepts of statistical mechanics
5. Explain the applications of nano electronic system.

Unit I Introduction to Quantum Mechanics 9 Hours

Particles, waves, probability amplitudes, schrodinger equation, wave packets solutions, operators, expectation values, eigen functions, piecewise constant potentials.

Unit II Simple Harmonic Oscillators and Approximations 9 Hours

SHM Operators, SHM wave packet solutions, Quantum LC circuit, WKB approximations, variational methods.

Unit III Systems with Two and Many Degrees of Freedom 9 Hours

Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states.

Unit IV Statistical Mechanics 9 Hours

Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors

Unit V Applications 9 Hours

Hydrogen and Helium atoms, electronic states, Atomic force microscope, Nuclear Magnetic Resonance, carbon nanotube properties and applications.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Describe the basic concepts of quantum mechanics.	Understand
CO2. Classify the types of harmonic oscillators and its approximations.	Understand
CO3. Construct the nano electronic system with more than one degrees of freedom.	Apply
CO4. Illustrate the basic concepts of statistical mechanics.	Apply
CO5. Develop a nano electronic system for particular application.	Apply

Text Book(s):

T1. Hagelstein, Peter L., Stephen D. Senturia, and Terry P. Orlando, "Introduction to Applied Quantum and Statistical Physics", New York, NY: Wiley, 2004.

T2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley, 3rd Edition, 2012

Reference Book(s):

R1. Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2000.

R2. Neil Gershenfeld, "The Physics of Information Technology", Cambridge University Press, 2000.

Web References:

1. https://nptel.ac.in/courses/117/108/117108047/
2. https://nptel.ac.in/courses/118/104/118104008/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="5">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4">Total</td><td>100</td></tr>
</table>

<table>
<tr><td colspan="2">Course Code: 19ECEN1015</td><td colspan="2">Course Title: Wavelets and Its Applications</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECCN1402- Signals and Systems
- 19ECCN2501- Digital Signal Processing

Course Objectives

The course is intended to:

1. Understand the need for wavelet transform
2. Analyze the multirate system
3. Understand the concept of continuous time wavelet transform
4. Analyze the relationship between the filter bank and wavelet
5. Understand the application of wavelets

Unit I Fundamentals And Fourier Analysis 9 Hours

Vector Spaces – Properties- Dot Product – Basis – Dimension, Orthogonality and Orthonormality - Relationship Between Vectors and Signals - Signal Spaces - Concept of Convergence. Fourier basis & Fourier Transform - Need for Time-Frequency Analysis - Heisenberg‟s Uncertainty principle - Short time Fourier transform (STFT) - short comings of STFT- Need for Wavelets

Unit II Introduction To Multirate Systems 9 Hours

Decimation and Interpolation in Time domain - Decimation and Interpolation in Frequency domain – Multi rate systems for a rational factor.

Unit III CWT And Multi Resolution Analysis 9 Hours

Wavelet basis - Continuous time Wavelet Transform (CWT) - need for scaling function - Multi Resolution Analysis - important wavelets: Haar- Mexican hat- Meyer- Shannon- Daubachies.

Unit IV Filter Banks And DWT **9 Hours**

Two channel filter bank - Perfect Reconstruction (PR) condition - relationship between filter banks and wavelet basis - DWT - Filter banks for Daubachies wavelet function

Unit V Wavelets Applications **9 Hours**

Wavelet denoising- Speckel removal-Edge detection and noise removal- Image fusion-object detection- discrete wavelet multitone modulation- Image compression

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Understand the need for wavelet transform through time-frequency analysis	Understand
CO2. Analyze the multirate system for rational factor.	Analyze
CO3. Understand the concept of continuous time wavelet transform and mutiresolution analysis	Understand
CO4. Analyze the relationship between the filter bank and wavelet from perfect reconstruction condition	Analyze
CO5. Understand the application of wavelets through various example applications	Understand

Text Book(s):

T1. K.P.Soman , K.I. Ramachandran, N.G. Rasmi,‖Insight Into Wavelets: From Theory to Practice‖ PHI Learning Private Limited, 3rd Edition, 2010

T2. Rao R M and A S Bopardikar, Wavelet Transforms -Introduction to theory and Applications, Pearson Education, Asia, 2000.

Reference Book(s):

R1. Stephane G Mallat, A Wavelet Tour of Signal Processing:The sponse way‖ Academic Press, Third edition, 2008

R2. Wavelets and Sub band Coding, M. Vetterli and J. Kovacevic, Prentice Hall, 1995.

R3. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.

R4. C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.

R5. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	3	3	-
CO2	3	3	2	2	-	-	-	1	-	1	-	3	3	-
CO3	2	1	-	-	-	-	-	1	-	1	-	3	3	-
CO4	3	3	2	2	-	-	-	1	-	1	-	3	3	-
CO5	2	1	-	-	-	-	-	1	-	1	-	3	3	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1016	Course Title: Digital Image and Video Processing		
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1402- Signals and Systems
- 19ECCN2501- Digital Signal Processing

Course Objectives

The course is intended to:

1. Analyze the digital images in frequency domain.
2. Analyze the given Digital Image by applying various filtering techniques.
3. Select the techniques for segmenting digital images.
4. Apply the various compression schemes
5. Analyze the video signals and different video coding standards

Unit I Digital Image Fundamentals 9 Hours

Elements of digital image processing systems, Digital Camera, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, Color image fundamentals - RGB, YUV, HSI models, Image sampling, Quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. 2D transforms - DFT, DCT and KLT

Unit II Image Enhancements And Filtering 9 Hours

Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, frequency domain filters – low-pass and high-pass.

Unit III Image Segmentation 9 Hours

Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Unit IV Image Compression **9 Hours**

Redundancy-inter-pixel and psycho-visual; Lossless compression - predictive, entropy; Lossy compression- predictive and transform coding; Still image compression standards - JPEG

Unit V Fundamentals of Video Coding **9 Hours**

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 a video encoder and decoder; Video coding standards – MPEG and H.26X.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Analyze the digital images in frequency domain by applying 2D transforms	Apply
CO2: Analyze the given Digital Image by applying various filtering techniques in both spatial and frequency domains.	Apply
CO2: Select the appropriate techniques for segmenting digital images.	Apply
CO3: Apply the various compression schemes for the given image.	Apply
CO4: Analyze the video signals and different video coding standards	Apply

Text Book(s):

T1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008

T2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India 2nd edition 2004

T3. Murat Tekalp , Digital Video Processing, Prentice Hall, 2nd edition 2015

T4. Jack Keith, Video Demystified Third Edition, Penram International, 2010

Reference Book(s):

R1. Dr. Jayaraman, S., Essakirajan, S., and Veerakumar, T., ―Digital Image Processing‖, Tata McGraw Hill, New Delhi, 2012

R2. David Salomon, ―Data Compression - The Complete Reference‖, 3rd edition, Springer Verlag New york, 2004.

R3. William K-Pratt, ―Digital Image Processing‖, 4th edition, John Wiley and Sons, 2007.

R4. Kenneth R.Castleman, ―Digital Image Processing‖, Pearson Education, 1996.

Web References:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/104/117104020/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1017	Course Title: Speech and Audio Processing		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN2501- Digital Signal Processing

Course Objectives

The course is intended to:

1. Describe the mechanism of speech production
2. Discuss the time domain parameters of speech signal
3. Explain various frequency domain techniques used for speech signal processing
4. Explain various speech coding techniques
5. Describe the concepts of perceptual audio coding

Unit I Speech Signal Modelling 9 Hours

Mechanism of speech production - Categorization of speech sounds - Discrete time modeling of speech production: Vocal tract, Radiation, Excitation, The complete model - Human Auditory System

Unit II Time Domain methods for Speech Processing 9 Hours

Time domain parameters of speech: Short-time Energy and Average Magnitude, Short-time Average Zero-Crossing Rate – Speech vs. Silence discrimination using Energy and Zero-Crossings – Short-time Autocorrelation function – Pitch period estimation using the autocorrelation function

Unit III Frequency Domain methods for Speech Processing 9 Hours

Short-Time Fourier Transform - Analysis and Synthesis - Homomorphic Filtering - Cepstrum of voiced and unvoiced – Pitch Detection – Formant Estimation

Unit IV Speech Coding **9 Hours**

Scalar Quantization - Vector Quantization - Subband Coding - Sinusoidal Coding - Linear Predictive Coding (LPC) - Mixed Excitation LPC (MELP) - Code-Exciited Linear Prediction (CELP) – Acoustics: Echo, Reverberation – Echo Cancellation

Unit V Audio Coding **9 Hours**

Transparent Audio Coding - Perceptual Masking - Noise Shaping: subband analysis, temporal noise shaping - Example coding schemes: MPEG-1 Audio layers I and II, MPEG-1 Audio Layer III (mp3), MPEG-2 AAC

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Describe the mechanism of speech production and auditory perception	Understand
CO2. Analyze speech signals using time domain parameters for voiced and unvoiced signal classification	Understand
CO3. Explain various frequency domain techniques used for processing and extracting information from speech signals	Understand
CO4. Explain the different coding techniques used for speech signals	Understand
CO5. Describe the concepts of perceptual audio coding for lossy compression of audio signals	Understand

Text Book(s):

T1. R.Rabiner and R.W.Schafer, ―Digital Processing of Speech signals‖, Pearson Education - India, New Delhi, 2010

T2. Thomas.F.Quatieri, ―Discrete-Time Signal Processing‖, Pearson Education - India, New Delhi, 2011.

T3. Ben Gold, Nelson Morgan and Dan Ellis, ―Speech and Audio Signal Processing: Processing and Perception of Speech and Music‖, 2nd Edition, John Wiley & Sons, 2011.

Reference Book(s):

R1. Wai C. Chu, ―Speech Coding Algorithms - Foundation and Evolution of Standardized Coder‖, John Wiley & Sons, 2003

R2. J.L.Flanagan, ―Speech Analysis, Synthesis and Perception‖, Springer-Verlag, 1972

R3. E.S.Gopi, ―Digital Speech Processing using Matlab‖, Springer, 2014

Web References:

1. https://nptel.ac.in/courses/117/105/117105081/
2. https://web.ece.ucsb.edu/Faculty/Rabiner/ece259/speech%20course.html

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td>Course Code: 19ECEN1018</td><td colspan="3">Course Title: Information Theory and Coding</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours:45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECCN1501- Analog and Digital Communication

Course Objectives

The course is intended to:

1. Understand the basics of Information theory
2. Learn the principles of information coding
3. Discuss about the different statistical and dictionary based coding techniques
4. Explain the concepts of linear block codes for error detection and correction
5. Describe the notion of convolutional codes

Unit I Concepts of Information Theory 9 Hours

Introduction to Information theory – Self Information – Entropy – Conditional Entropy – Characteristics of Entropy function - Mutual Information -Information rate - Channel capacity - Redundancy and Efficiency of channels - Binary symmetric channel - Binary asymmetric channel

Unit II Source Coding 9 Hours

Encoding techniques – Purpose of encoding – Instantaneous codes – Kraft's Inequality – Coding efficiency and redundancy – Source coding theorem

Unit III Statistical and Dictionary Based Coding 9 Hours

Statistical Methods - Shannon-Fano Algorithm, Run-length coding, Huffman algorithm, Arithmetic coding; Dictionary Methods - Static and Adaptive Dictionary - LZ77, LZ78, LZW algorithms

Unit IV Codes for Error Detection and Correction 9 Hours

Parity check coding – Linear block codes -Error detecting and correcting capabilities – Generator and Parity check matrices - Hamming codes - Encoding and Decoding of cyclic codes

Unit V Convolutional Codes 9 Hours

Introduction to convolutional codes - Encoding - State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes – Viterbi algorithm

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Understand the basic concepts of information theory related to data	Understand
CO2. Explain the principles of source coding techniques for message signals	Understand
CO3. Apply statistical and dictionary based coding to compress text data	Apply
CO4. Apply Linear block codes for error detection and correction	Apply
CO5. Apply convolutional codes for encoding and decoding of message signals	Apply

Text Book(s):

T1. Simon Haykin and Michael Moher, ―Communication systems‖ John Wiley & Sons, Fourth Edition, 2000

T2. Khalid Sayood, ―Introduction to Data Compression‖, Morgam Kaufmann, Fourth Edition, 2012

T3.Thomas M. Cover, Joy. A. Thomas, ―Elements of Information Theory‖, John Wiley & Sons, Second Edition, 2006

Reference Book(s):

R1. Ranjan Bose, ―Information Theory, Coding and Cryptography‖, McGraw Hill, 3rd Edition, 2016

R2. David Salomon, ―Data Compression: The Complete Reference‖, Springer,4th Edition, 2007

R3. Gravano Salvatore, ―Introduction to Error Control Codes, Oxford University Press, 2001

Web References:

1. https://nptel.ac.in/courses/108/102/108102117/
2. https://nptel.ac.in/courses/117/101/117101053/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1033	Course Title: Adaptive Signal Processing		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1402-Signals and Systems
- 19ECCN2501-Digital Signal Processing

Course Objectives

The course is intended to:

1. Illustrate the basic concepts of adaptive systems
2. Illustrate the concept of optimal Wiener filtering
3. Explain the design of LMS Filters for adaptive systems
4. Explain the concepts of vector space framework
5. Explain the design of RLS Filters for adaptive systems

Unit I Introduction to Adaptive Filters 9 Hours

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 Wiener Filtering 9 Hours

Optimal FIR (Wiener) filter-Applications: Linear Prediction, Noise Cancellation - Lattice Representation for FIR Wiener Filter. IIR Wiener Filter – Non causal IIR Wiener Filter – Causal IIR Wiener Filter.

Unit III LMS Filters 9 Hours

Method of steepest descent- extension to complex valued signals-The LMS algorithm (real, complex)- convergence analysis- weight errorcorrelation matrix-excess mean square error and misadjustment - Variants of the LMS algorithm-Normalized LMS algorithm- Block LMS and FFT based realization.

Unit IV Vector Space Framework for Optimal Filtering 9 Hours

Signal space concepts - Introduction to finite dimensional vector space theory- Gram Schmidt orthogonalization-concepts of orthogonal projection- orthogonal decomposition of vector spaces Vector space of random variables-correlation as inner product-forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit V RLS Lattice Filters 9 Hours

Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Illustrate the basic concepts of adaptive systems using random process and random variables	Apply
CO2. Analyze optimal Wiener filtering design for adaptive systems	Analyze
CO3. Analyze LMS algorithm design for signal processing applications	Analyze
CO4. Analyze Vector space framework for optimal filtering	Analyze
CO5. Analyze RLS Lattice Filters design for adaptive systems	Analyze

Text Book(s):

T1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986

T2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

T3. Monson H Hayes, ―Statistical Digital Signal Processing and Modelling‖, Wiley, 2004

Reference Book(s):

R1. Todd K. Moon, Wynn C. Stirling, ―Mathematical Methods and Algorithms for Signal Processing‖ Prentice Hall, First edition, 1999.

R2. John. R. Triechler, C. Richard Johnson (Jr), Michael. G. Larimore, ¯Theory and Design of Adaptive Filters‖, Prentice Hall India Private Limited, 2004

R3. Bernard Widrow and Samuel. D. Stearns, ¯Adaptive Signal Processing‖, Pearson Education, 2001.

Web References:

1.https://nptel.ac.in/courses/117/105/117105075/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	2	-
CO2	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO3	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO4	3	3	2	2	-	-	-	1	-	1	-	1	2	-
CO5	3	3	2	2	-	-	-	1	-	1	-	1	2	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code: 19ECEN1019	Course Title: Computer Architecture		
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN2601 - Microcontroller and its Interfacing Techniques

Course Objectives

The course is intended to:

1. Identify the various modules of computer system.
2. Design high speed Arithmetic unit.
3. Design basic processing unit using the concept of pipelining.
4. Classify various memories used in computer system.
5. Classify various i/o devices used in computer system.

UNIT I Basic Structure Of Computers 9 Hours

Functional units- Basic Operational Concepts, Bus Structures, Memory locations and addresses – Memory operations – Instruction and instruction sequencing – addressing modes – assembly language – Basic I/O operations, Stacks and queues

UNIT II Arithmetic Unit Design 9 Hours

Addition and subtraction of signed numbers – Design of fast adders – multiplication of positive numbers- signed operand multiplication and fast multiplication – Integer division, Floating point numbers and operations.

UNIT III Basic Processing Unit 9 Hours

Fundamental concepts – Execution of a complete Instruction – Multiple bus organization – Hardwired control – micro programmed control. Basic concepts in pipelining.

UNIT IV **Memory System** **9 Hours**

Basic concepts - semiconductor RAMs, ROMs - Speed, size and cost - cache memories - Performance consideration - Virtual memory- Memory Management requirements, Secondary storage.

UNIT V **I/O Organization** **9 Hours**

Computer peripherals- Input and output devices, serial communication links; Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, and USB);

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Identify the various modules of the computer system.	Apply
CO2. Design high speed Arithmetic unit that can perform various arithmetic Operations.	Apply
CO3. Identify the basic blocks of processing unit with reference to the concept of pipelining.	Apply
CO4. Classify various memories used in computer system based on their function.	Apply
CO5. Classify the various i/o peripherals based on the data transfer modes.	Apply

Text Book(s):

T1. Carl Hamacher, Safwat Zaky, Zvonko Vranesic, ―Computer Organization, Tata McGraw-Hill Education Pvt. Ltd, 5th Edition 2011.

T2. William Stallings, ―Computer Organization and Architecture‖ - Designing for Performance 8th Edition Pearson Education, 2010.

Reference Book(s):

R1. David A. Patterson and John L. Hennessey, ―Computer organization and design‖, Morgan Kauffman, 2014.

R2. Vincent P. Heuring, Harry F. Jordan, ―Computer System Architecture‖, 2nd Edition, Pearson Education, 2005.

R3. Govindarajalu B, ―Computer Architecture and Organization, Design Principles and Applications‖, Second edition, Tata McGraw Hill, New Delhi, 2010.

R4. AharonYadin, ― Computer Systems Architecture‖, Chapman and Hall/CRC, 2016

Web References:

1. http://nptel.ac.in/courses/106102062/
2. https://www.cis.upenn.edu/~milom/cis501-Fall11/lectures/00_intro.pdf
3. https://inspirit.net.in/books/academic/Computer%20Organisation%20and%20Architecture%208e%20by%20William%20Stallings.pdf
4. http://www.nptelvideos.in/2012/11/computer-architecture.html
5. http://www.learnerstv.com/Free-Computer-Science-Video-lectures-ltv086-Page1.html

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO2	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO3	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO4	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO5	3	2	1	1	-	-	-	1	-	1	-	1	1	3

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><td rowspan="5">Continuous Assessment</td><td>Assessment Component</td><td>CO. No.</td><td>Marks</td><td>Total</td></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

<table>
<tr><td>Course Code: 19ECEN1020</td><td colspan="3">Course Title: CMOS Analog IC Design</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Practice</td></tr>
<tr><td>L:T:P(Hours/Week)3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECSN2201- Electric Circuits and Electron Devices
- 19ECCN1302- Digital Principles and System Design

Course Objectives

The course is intended to:

1. Explain the concept of CMOS Technology and Analog MOSFET models.
2. Explain the basic MOSFET based analog circuits.
3. Explain the design of differential amplifier and Op-amp circuit.
4. Explain the design of dynamic analog and various nonlinear circuits
5. Explain the design of various data conversion architectures.

UNIT I Introduction to CMOS Technologies and Analog MOSFET Models 9 Hours

MOSFET- Structure, MOSFET Capacitances, Threshold Voltage , IV Characteristics , SPICE modeling, DC equations , Short Channel MOSFET . MOS Passive Elements – Capacitors and Resistors, Temperature and Voltage dependence of Capacitors and Resistors. ANALOG MOSFET MODELS - Low frequency model, High frequency model, Temperature effects, Noise in MOSFET.

UNIT Ii Analog MOS Modeling 9 Hours

Current Mirror,Current sources, Self-biasing techniques, Voltage dividers, Common Source and Common Drain and Common Gate amplifiers, Band gap voltage references, Beta multiplier based references.

UNIT III Differential Amplifiers and OPAMP Design 9 Hours

Differential Amplifier – Source coupled pair, Source cross coupled pair, Cascode load, Wide swing differential amplifiers. Operational Amplifiers - Basic CMOS Op-amp, Fully differential Op-amp, Operational Trans-conductance amplifier.

UNIT IV Dynamic Analog and Non Linear Circuits 9 Hours

Dynamic Analog Circuits – MOSFET switch, Switched capacitor circuit. Non Linear Analog Circuits – CMOS comparator, Analog multiplier, Level shifting circuit, Challenges in analog design.

UNIT V Mixed Signal Circuits 9 Hours

Data Conversion Fundamentals - Analog Vs Discrete time signal, Converting analog to digital signal - Sample and hold circuit, Data Conversion Architectures – DAC, ADC.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Explain the concept of CMOS Technology and Analog MOSFET models.	Understand
CO2. Explain the MOSFET based basic analog circuits.	Understand
CO3. Explain the design of differential amplifier and Op-amp circuits.	Understand
CO4. Explain the design of dynamic analog and various nonlinear circuits.	Understand
CO5. Explain the design of various data conversion architectures.	Understand

Text Book(s):

T1. Sedra and Smith,‖MicroelectronicCircuits‖,Oxford University Press, Seventh Edition,2015.

T2. Jacob Baker.R., Li.H.W., and Boyce.D.E., CMOS Circuit Design ,Layoutand Simulation, Prentice-Hall of India,1998.

T3. BehzadRazavi,‖Design of Analog CMOS Integrated Circuits‖,Tata McGraw Hill,Second Edition, 2015

Reference Book(s):

R1. Paul R. Gray and Meyer.R.G., Analysis and design of Analog Integrated circuits, John Wiley and Sons inc., USA, 3rd Edition, 1993.

R2. David. A. Johns and Martin. K., Analog Integrated Circuit Design, Wiley, 1997.

R3. MalcomR.Haskard, LanC.May, ―Analog VLSI Design - NMOS and CMOS ", Prentice Hall, 1998

R4. Jose E.France, YannisTsividis, ―Design of Analog-Digital VLSI Circuits for Telecommunication and signal Processing ", Prentice Hall, 1994.

R5. Randall L Geiger, Phillip E. Allen, Noel K.Strader, ―VLSI Design Techniques for Analog

and Digital Circuits ", McGraw Hill International Company, 1990.

Web References:

1. http://nptel.ac.in/courses/117101105/
2. http://www.nptel.ac.in/syllabus/117101006/
3. http://www.siliconmentor.com/analog-vlsi-design/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO2	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO3	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO4	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO5	2	1	-	-	-	-	-	1	-	1	-	1	1	2

High-3; Medium-2;Low-1

Assessment pattern

<table>
<tr><th rowspan="5">Continuous Assessment</th><th>Assessment Component</th><th>CO. No.</th><th>Marks</th><th>Total</th></tr>
<tr><td>CCET I</td><td>1,2</td><td>50</td><td rowspan="3">30</td></tr>
<tr><td>CCET II</td><td>3,4</td><td>50</td></tr>
<tr><td>CCET III</td><td>5</td><td>50</td></tr>
<tr><td>Tutorials / Quiz / Assignments</td><td>1,2,3,4,5</td><td>30</td><td>10</td></tr>
<tr><td>End Semester Examination</td><td>ESE</td><td>1,2,3,4,5</td><td>100</td><td>60</td></tr>
<tr><td colspan="4" align="right">Total</td><td>100</td></tr>
</table>

Course Code: 19ECEN1022	Course Title: Low Power VLSI Design		
Course Category: Professional Elective		**Course Level: Mastery**	
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19ECSN2201- Electric Circuits and Electron devices
- 19ECCN1302- Digital Principles and System Design
- 19ECCN1601- VLSI System Design

Course Objectives

The course is intended to:

1. Explain the sources of power dissipation in MOSFETs and its effects.
2. Discuss the circuit and logic level low power design techniques
3. Explain the power reduction design techniques in clock networks and buses
4. Explain the techniques involved in low power memory design
5. Explain the concepts of software design for low power

Unit I Introduction to Low Power Dissipation 9 Hours

Need for low power VLSI chips, Physics of power dissipation in CMOS devices, Sources of power dissipation in Digital Integrated circuits, Basic principles of low power design-probabilistic power analysis-random logic signal-probability and frequency-power analysis techniques - signal entropy

Unit II Circuit and Logic Level Low Power Design Techniques 9 Hours

Circuit: transistor and gate sizing - pin ordering - network restructuring and reorganization - adjustable threshold voltages – Logic: signal gating - logic encoding, Pre-computation logic

Unit III Special Low Power VLSI Design Techniques 9 Hours

Power reduction in clock networks -single driver Vs distributed buffers, zero skew Vs tolerable skew, chip and package co-design of clock network, CMOS floating node - low power bus - delay balancing, Switching activity reduction - parallel architecture with voltage reduction - operator reduction -Adiabatic computation

Unit IV Low Power Memory Design **9 Hours**

Basics of SRAM- Memory cell – Pre-charge and equalization circuit. Sense amplifier-Output latch - Low power SRAM technologies - types of DRAM – Basics of DRAM - Cell refresh circuit – HVG – BBG – BVG – RVG -VDC

Unit V Software Design and Power Estimation **9 Hours**

Low power circuit design style -Software power estimation - Co-design for low power

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Understand the effect of MOS device parameters on various sources of power dissipation.	Understand
CO2. Understand low power design techniques at the circuit and logic level	Understand
CO3. Explain the various power reduction methods in clock networks and buses.	Understand
CO4. Apply the techniques in low power memory design	Apply
CO5. Apply the concepts of software design for low power	Apply

Text Book(s):

T1. Gary Yeap ―Practical Low Power Digital VLSI Design‖, Springer US, Kluwer AcademicPublishers,2002

T2. Kiat-Seng Yeo, Kaushik Roy, ―Low Voltage Low Power VLSI Subsystems‖, Tata Mc-Graw Hill,2009.

T3. Kaushik Roy, Sharat C. Prasad, ―Low power CMOS VLSI circuit design‖, Wiley IntersciencePublications",1987.

Reference Book(s):

R1. Rabaey, Pedram, ―Low power design methodologies‖ Kluwer Academic, 1997.

R2. Chandrasekaran, A.P., Broadersen.R.W, ―Low Power Digital CMOS VLSI Design‖, Kluwer 1995.

R3. DimitriosSoudris, Christians Pignet, Costas Goutis, ―Designing CMOS Circuits for Low Power‖, Kluwer, 2002

R4. AbdelatifBelaouar, Mohamed.I.Elmasry, ―Low power digital VLSI design‖, Kluwer, 1995

R5. James B.Kulo, Shih-Chia Lin, ―Low voltage SOI CMOS VLSI devices and Circuits‖, John Wiley and sons, inc. 2001.

Web References:

1. nptel.ac.in/courses/106105034/12
2. www.nptelvideos.com/course.php?id=422
3. http://www.youtube.com/watch?v=ruclwamT-Ro&list

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO2	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO3	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO4	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO5	3	2	1	1	-	-	-	1	-	1	-	1	1	3

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1023	Course Title : Digital System Design and Verification		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1302- Digital Principles and System Design
- 19ECCN1601- VLSI System Design

Course Objectives

The course is intended to:

1. Apply different design methodologies to design digital circuits.
2. Classify the different modelling techniques used in digital circuit design.
3. Apply various techniques and tools to verify the functionality and timing issues.
4. Use high level modelling to design digital circuits.
5. Apply test benches and simulation environment to verify the functionality and timing issues

Unit I Introduction to Verilog HDL **9 Hours**

Introduction to Verilog HDL, Abstraction levels, Digital circuit design with Verilog HDL, Need for verification, Simulation and synthesis, 4 state logic: Top, down, Bottom and up design methodology..

Unit II Circuit Design Using Verilog HDL **9 Hours**

Gate level modeling – Introduction, Design of gate primitives, Basic digital design at gate level; Dataflow modeling – Introduction, assignment statements, simple digital circuit design using assignments, Test bench; Behavioral modeling - Introduction, Procedural blocks, blocking and non-blocking assignments, simple digital circuit design at behavioral level; FSM design

Unit III Verification Technologies and Tools **9 Hours**

Importance of Verification - Reconvergence Model - The Human Factor - Formal and Functional Verification Approaches - Timing Verification - Testing Versus Verification - Design and Verification Reuse - Linting - Simulation - Third Party Models - Verification Intellectual Property - Waveform Viewers - Code Coverage - Functional Coverage - Issue Tracking – Metrics - Role of the Verification Plan - Levels of Verification - Verification Strategies

Unit IV High-Level Modeling 9 Hours

High-Level Versus RTL Thinking - Structure of High-Level Code - Data Abstraction - Object-Oriented Programming - Parallel Simulation Engine - Race Conditions

Unit V Architecting Testbenches and Simulation Management 9 Hours

Stimulus and Response -Transaction-Level Interface - Self-Checking Test benches - Directed Stimulus - Random Stimulus - Managing Simulations – Regression

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply different design methodologies to design digital circuits using Verilog HDL.	Apply
CO2: Utilize different modelling to design digital circuits with Verilog HDL	Apply
CO3: Analyze the functionality and timing issues in digital circuits using various technology and tools.	Analyze
CO4: Utilize high level modeling to design digital circuits	Apply
CO5: Analyze the functionality and timing issues in digital circuit models using test benches and simulation environment	Analyze

Text Book(s):

T1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.

T2. Zainalabdien Navabi, Verliog Digital System Design,TMH, 2nd Edition.

T3. Chris Spear, Greg Tumbush, "System Verilog for Verification - A Guide to Learning the Testbench Language Features" Springer, 2012.

Reference Book(s):

R1. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.

R2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.

R3. Andreas Meyer, ―Principles of Functional Verification‖, Newnes, 2003.

R4. Janick Bergeron, ―Writing Test Benches Using System Verilog‖, Springer, 2009.

R5. Kropf T, ―Introduction to Formal Hardware Verification‖, Springer Verlag, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc17_cs21/preview
2. https://nptel.ac.in/syllabus/syllabus.php?subjectId=117106092

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO2	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO3	3	2	2	2	-	-	-	1	-	1	-	1	1	3
CO4	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO5	3	2	2	2	-	-	-	1	-	1	-	1	1	3

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECEN1034	**Course Title: Testing of VLSI Circuits**		
Course Category: Professional Elective		**Course Level: Practice**	
L:T:P(Hours/Week)3:0:0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- 19ECCN1302 - Digital Principles and System Design
- 19ECCN1601 - VLSI System Design

Course Objectives

The course is intended to:

1. Identify the faults in the digital circuits
2. Create Test Patterns for combinational logic circuit
3. Create Test Patterns for sequential logic circuit
4. Explain the different testability techniques for Testing.
5. Explain various BIST Architecture and test algorithms

UNIT I Testing and Logic Simulation 9 Hours

Introduction to testing - Faults in Digital Circuits - Modeling of faults - Logical Fault Models - Fault detection and redundancy - Fault equivalence and fault Location - Fault dominance - Logic simulation - Types of simulation - Delay models - Gate Level Event - driven simulation.

UNIT II Test Generation for Combinational Circuits 9 Hours

Test generation for combinational logic circuits - Testable combinational logic circuit design.

UNIT III Test Generation for Sequential Circuits 9 Hours

Test generation for sequential circuits - design of testable sequential Logic circuits.

UNIT IV Design for Testability 9 Hours

Design for Testability - Ad-hoc design - generic scan-based design - classical scan-based design – system level DFT approaches.

UNIT V Self-Test and Test Algorithms 9 Hours

Built-In-Self-Test - test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test Algorithms - Test generation for Embedded RAMs

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Identify the faults in digital the circuits	Understand
CO2: Apply test pattern for combinational logic circuit.	Apply
CO3: Apply test pattern for sequential logic circuit.	Apply
CO4: Explain the different testability techniques for testing.	Understand
CO5: Explain various BIST Architecture and test algorithms.	Understand

Text Books:

1. M.Abramovici, M.A.Breuer and A.D. Friedman, ―Digital systems and Testable Design‖,Jaico Publishing House, 2002.
2. P.K. Lala, ―Digital Circuit Testing and Testability‖, Academic Press, 2002.

Reference Books:

R1.M.L.Bushnell and V.D.Agrawal, ―Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits‖, Kluwer Academic Publishers, 2002.

R2.A.L.Crouch, ―Design Test for Digital IC‘s and Embedded Core Systems‖, Prentice Hall International, 2002.

R3.Robert J., Jr. Feugate, Steven M. McIntyre," Introduction to VLSI Testing" Prentice Hall International, 1988.

R4.Angela Krstic and Kwang-Ting Cheng,―Delay fault testing for VLSI Circuits‖, KluwerAcademic Publishers, 1998.

R5.Mike Tien and Chien Lee, ―High-Level Test Synthesis of Digital VLSI Circuits‖, Artech House, Inc., 1997.

Web References:

1. http://onlinelibrary.wiley.com/doi/10.1002/0471457787.fmatter/pdf
2. http://nptel.ac.in/courses/106103016/30
3. www.cs.colostate.edu/~malaiya/530/08/resources.html

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO2	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO3	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO4	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO5	2	1	-	-	-	-	-	1	-	1	-	1	1	2

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code: 19ECEN1035		Course Title: ASIC Design	
Course Category: Professional Elective		Course Level: Practice	
L:T:P(Hours/Week)3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- 19ECCN1302 - Digital Principles and System Design
- 19ECCN1601- VLSI System Design

Course Objectives

The course is intended to:

1. Explain the different types of ASICs and logic cells used in ASIC design
2. Explain the architecture of various programmable logic cells
3. Explain the various interconnects in programmable logic cells and design software.
4. Develop a digital circuit using HDL.
5. Explain the various functional blocks in an ASIC.

UNIT I Introduction To ASICs 9 Hours

Types of ASICs - Design flow – CMOS transistors- CMOS Design rules -Combinational logic Cell - Sequential logic cell - Transistor as Resistor - Transistor parasitic capacitance – Library cell design.

UNIT II Programmable ASIC s, Logic Cells And I/O Cells 9 Hours

Anti-fuse - Static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA, Xilinx I/O blocks -Altera MAX 5000 - Altera FLEX.

UNIT IIIC **ASIC interconnect and design software 9 Hours**

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 - Altera FLEX -Design systems - Logic Synthesis - Half gate ASIC -Low level design language - PLA tools

UNIT IV Logic Synthesis 9 Hours

A logic synthesis example: Arithmetic and MUX units in Veriog HDL, FSM synthesis in Verilog, Memory synthesis in Verilog.

UNIT V Floor Planning, Placement and Routing 9 Hours

Floor planning, Placement, Routing- Global routing-detailed routing- special routing- Parasitic extraction, LVS, DRC and GDS Extraction.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the different types of ASICs and logic cells used in ASIC design.	Understand
CO2: Explain the architecture of various programmable logic cells	Understand
CO3: Analyse the various interconnects in programmable logic cells and design software	Understand
CO4: Apply a digital circuit using HDL.	Apply
CO5: Explain the various functional blocks in an ASIC	Understand

Text Books:

T1. Michael John Sebastian Smith, "Application Specific Integrated Circuits‖ Pearson education, 2008.

T2. Norman G. Einspruch, "Application Specific Integrated Circuit (ASIC)Technology‖, Academic Press, 2012.

Reference Books:

R1. Morris Mano.M, ¯Digital Design‖, 3rd edition, Pearson Education India, 2013.

R2. Douglas L. Perry, ¯VHDL: Programming by Example‖ McGraw Hill Education, thedition,2002.

Web References:

1. www.vlsi.wpi.edu/cds/explanations/lvs.html
2. http://www.eng.auburn.edu/
3. http://www.geoffknagge.com/fyp/index.shtml#asic

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO2	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO3	2	1	-	-	-	-	-	1	-	1	-	1	1	2
CO4	3	2	1	1	-	-	-	1	-	1	-	1	1	3
CO5	2	1	-	-	-	-	-	1	-	1	-	1	1	2

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19CSEC1001	Course Title: Programming Using JAVA		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites The student should have undergone the course(s):

- 19CSSC2001 - C Programming
- 19ITSN2302 - Data Structures and Algorithms-I

Course Objectives

The course is intended to:

1. Describe the distinct properties and features of Java.
2. Implement name spaces, concurrency and handle exceptional conditions.
3. Employ Java standard library functions.
4. Apply Java utility, input/output functions and file manipulators.
5. Develop Java applications using user interfaces and database connectivity.

Unit I Introduction **9 Hours**

Overview of Java – Data types, operators, control flows -Class fundamentals, objects and constructors -Method overloading- argument passing, Returning objects, recursion – Method Overriding and Dynamic Method dispatch- Abstract class.

Unit II Packages, Exceptions and Threads **9 Hours**

Packages and access protection – Interfaces and extending interfaces – Exception fundamentals and types - Try, catch, throw, throws and finally; Chained Exceptions - Thread model, Creating threads and thread priorities - Synchronization -Inter thread communication.

Unit III Java Utilities **9 Hours**

String Handling -String Buffer class and functions – Library Functions – Math – Process – Clone – System Functions.

Unit IV Collections and I/O Streams **9 Hours**

Collections - Classes and Interfaces - Iterators and User defined collections - String Tokenizer – Java I/O classes and Interfaces - Streams – Byte Streams - Character Streams – File concepts.

Unit V Exploring Swing 9 Hours

Java Swing - Features -Components and Containers - Event handling - Exploring Swing - Menus – Java Database Connectivity.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the distinct properties and features of Java.	Understand
CO2: Implement name spaces, concurrency and handle exceptional conditions inprograms.	Apply
CO3: Employ Java standard library functions for solving complex problems.	Apply
CO4: Apply Java utility, input/output functions and file manipulators	Apply
CO5: Develop Java applications using user interfaces and database connectivity	Apply

Text Book(s):

T1. Herbert Schildt, ―Java the Complete Reference‖, Mcgraw Hill Education Ninth Edition, 2014

T2. Mahmoud Parsian, ―JDBC Metada, MySQL and Oracle Recipes: A Problem-Solution Approach‖, Apress Publications, 2006

Reference Book(s):

R1. Bart Baesens, Aimee Backiel, SeppeVandenBrocke, ―Beginning JavaProgramming: The Object Oriented Approach‖, John Wiley & Sons, 2015.

R2. Daniel Liang, ―Introduction to Java Programming, Comprehensive Version‖, Pearson Education, 9^{th} Edition, 2014.

R3. James M Slack, Programming and Problem solving with JAVA, ThomsonLearning, 2002.

R4. C Thomas Wu, An Introduction to Object Oriented programming with Java, Tata McGrawHill, 2005.

R5. Cay S. Horstmann and Gary Cornell, ―Core Java: Volume I – Fundamentals‖, 8^{th} Edition, Sun Microsystems Press, 2008.

Web References:

1. https://docs.oracle.com/javase/tutorial/java/index.html
2. http://javabeginnerstutorial.com/core-java/

3. http://www.w3schools.in/java/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	1	1	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	1	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">**Course Code: 19CSEC1002**</td><td colspan="2">**Course Title: Data Mining and Analytics**</td></tr>
<tr><td colspan="2">**Course Category: Professional Elective**</td><td colspan="2">**Course Level: Mastery**</td></tr>
<tr><td>**L:T:P(Hours/Week)**
3: 0: 0</td><td>**Credits:3**</td><td>**Total Contact Hours:45**</td><td>**Max Marks:100**</td></tr>
</table>

Pre-requisites: The student should have undergone the course(s):

- 19CSSC2001 - C Programming
- 19ITSN2302 - Data Structures and Algorithms-I

Course Objectives

The course is intended to:

1. Select the appropriate pre-processing technique.
2. Relate the techniques of association rule.
3. Evaluate the classification algorithms.
4. Apply the clustering algorithms.
5. Analyze the requirements for a big data analytics.

Unit I Data Preprocessing 9 Hours

Data Mining Overview - Data Objects and Attribute Types - Data Visualization. Data Pre-processing: Data Cleaning - Data Integration - Data Reduction - Data Transformation and Data Discretization.

Unit II Association 9 Hours

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods -Basic Concepts – Frequent Item set Mining Methods – Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map – Pattern Mining in Multilevel, Multidimensional Space.

Unit III Classification 9 Hours

Basic Concepts: Decision Tree Induction - Bayes Classification Methods - Rule Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy.

Unit IV Clustering 9 Hours

Cluster Analysis: Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering.

Unit V Introduction To Big Data 9 Hours

Introduction to Big Data: Classification of Digital Data - Characteristics, Evolution and Definition of Big data - Challenges with Big Data - Traditional Business Intelligence (BI) vs Big Data - The Big Data Technology Landscape: Hadoop. Introduction to Hadoop: Hadoop Overview - Hadoop Distributors - Hadoop Distributed File System.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1. Choose the appropriate pre-processing technique to solve the given problem.	Apply
CO 2. Apply the techniques of association rule to real world data	Apply
CO 3. Evaluate the classification algorithms with respect to their accuracy.	Apply
CO 4. Apply the clustering algorithms to group the real world data.	Apply
CO 5. Analyze the requirements for a big data analytics system for the organization.	Apply

Text Book(s):

T1. Jiawei Han, MichelineKamber, Jian Pei, ―Data Mining: Concepts and Techniques‖, 3rd Edition, Elsevier, 2012.

T2. SeemaAcharya, SubhashiniChellappan, ―Big Data and Analytics‖, 1st Edition, Wiley India, 2015.

Reference Book(s):

R1. Jure Leskovec, AnandRajaraman, Jeffery David Ullman, ―Mining of Massive Datasets‖, 2nd Edition, Cambridge University Press, 2014.

R2. Ian H.Witten, Eibe Frank, Mark A.Hall, ―Data Mining: Practical Machine Learning Tools and Techniques‖, 3rd Edition, Elsevier, 2011

R3. EMC Education Services, ―Data Science and Big Data Analytics‖, Wiley, 2015

R4. DT Editorial Services, ―Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)‖, Dream tech

R5. G. K. Gupta, ¯Introduction to Data Mining with Case Studies‖, Eastern Economy Edition, Prentice Hall of India, 2006

Web References:

1. http://hanj.cs.illinois.edu/bk3/bk3_slidesindex.html
2. http://www.mmds.org/
3. http://www.kdnuggets.com/tutorials/index.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	1	1	-	2	2	-

High-3; Medium-2;Low-1

Assessmentpattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19CSEC1003	Course Title: Software Testing		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

The student should have undergone the course(s):

- 19CSSC2001 - C Programming
- 19ITSN2302 - Data Structures and Algorithms-I

Course Objectives

The course is intended to:

1. Describe the software testing principles and its characteristics.
2. Choose the appropriate testing for software development.
3. Design Test cases suitable for a software development in various domains.
4. Justify the importance of planning, documenting and validating the test plan.
5. Illustrate the need for automatic testing tools.

Unit I Testing Fundamentals 9 Hours

Introduction to testing as Engineering Activity -Testing Fundamentals: Basic Definitions- Testing principles-Tester‘s role -Defects, Hypotheses and Tests.

Unit II Levels of Testing 9 Hours

The need for levels of Testing- Unit Test: Functions, Procedures, Classes, and Methods as Units- Unit Test: The Need for Preparation- Unit Test Planning- Designing the Unit Tests- Running the Unit Tests and Recording Results- Integration Test: Goals- Integration Strategies for Procedures and Functions- Integration Strategies for Classes- Designing Integration Tests- Integration Test Planning- System Test: The Different Types- Regression Testing- Alpha, Beta, and Acceptance Tests.

Unit III Designing Test Cases 9 Hours

Test case design strategies-Using Black Box approach to Test Case design-Random Testing - Equivalence class partitioning -Boundary value Analysis-Cause effect testing and state transition testing-Error Guessing - Using White Box Approach to Test case design - Test Adequacy Criteria -Coverage and Control Flow Graphs - Covering Code Logic - Paths - Additional test design approaches- code complexity testing - Evaluating Test Adequacy Criteria.

Unit IV Test Management 9 Hours

Test Planning: Preparing a plan - scope management - deciding test strategy - responsibilities -resource requirements - test deliverables -testing tasks - Test management: standards - infrastructure management- People management - product release - Test Process - Test Reporting.

Unit V Test Automation 9 Hours

Test Automation - Terms - Skills required - Scope of automation- Design and Architecture for Automation - Process Model - Selecting Test tools - automation for extreme Programming- Test Metrics and Measurements.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the software testing principles and its characteristics.	Understand
CO2:Choose the appropriate testing during the phases of software development.	Apply
CO3:Design Test cases suitable for a software development in various domains.	Apply
CO4:Justify the importance of planning, documenting and validating the test plan.	Apply
CO5:Illustrate the need for automatic testing tools.	Apply

Text Book(s):

T1. Ilene Burnstein,‖Practical Software Testing: A Process-Oriented Approach‖, Springer International Edition, 2013.

T2. Srinivasan Desikan and Gopalaswamy Ramesh, ―Software Testing - Principles and Practices‖, Pearson Education, 2006.

Reference Book(s):

R1. Ron Patton, ―Software Testing‖, Sams Publishing, Pearson Education, 2nd Edition, 2009

R2. Boris Bezier, ―Software Testing Techniques‖,Dreamtech,2nd Edition, Reprint 2009

R3. Aditya P. Mathur, ―Foundations of Software Testing: Fundamental Algorithms and Techniques‖,Pearson Education, 2008

R4. Edward Kit,‖ Software Testing in the Real World – Improving the Process‖, Pearson Education, 1995.

R5. RenuRajani, Pradeep Oak, ―Software Testing – Effective Methods, Tools and Techniques‖, Tata McGraw Hill, 2004.

Web References:

1. http://nptel.ac.in/courses/106105150/
2. Lecturehttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-00-introduction-to-computer-science-and-programming-fall-2008/video-lectures/lecture-11/
3. http://www.testingtools.com/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	1	1	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	1	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19CSEC1004	Course Title: Data Base Management System Concepts		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites: The student should have undergone the course(s):

- 19CSSC2001 - C Programming
- 19ITSN2302 - Data Structures and Algorithms-I

Course Objectives

The course is intended to:

1. Construct the Entity Relationship Model.
2. Convert ER diagram to relational database schema.
3. Relate the normalization technique to obtain the relational database design.
4. Choose a query evaluation and optimization technique.
5. Execute the online transactions and control concurrency.

Unit I An Overview of Database Systems 9 Hours

Introduction – Database system applications, Database versus file systems, View of data, Data models, Database languages, Database users and administrators, Database system structure, Entity – Relationship Model – Basic concepts, Constraints, Keys, Design issues, ER diagram, Weak entity sets, Design of an ER database schema.

Unit II Data Models 9 Hours

Relational model - Structure of relational databases – The relational algebra -Tuple relational calculus, Domain relational calculus, SQL – Background, Basic structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Joined relations, DDL, Embedded SQL, Dynamic SQL, Integrity and security – Domain constraints, Referential integrity, Assertions, Triggers.

Unit III Relational Databases Design 9 Hours

Relational database design – First normal form, Second normal form - Pitfalls in relational database design, Functional dependencies, Decomposition, Desirable properties of decomposition, BCNF, Third normal form, Fourth normal form.

Unit IV Indexing and Querying 9 Hours

Indexing and hashing – Basic concepts, Ordered indices, B+ tree index files, B tree index files – Static hashing, Dynamic hashing, Comparison of ordered indexing and hashing, Multiple key access - Query Processing – Overview, Measures of query cost, Selection operation, Sorting, Join operation - Query Optimization – Overview, Estimating statistics of expression results, Transformation of relational expressions

Unit V Transaction and Concurrency Control 9 Hours

Transactions – Transaction concept, Transaction state, Implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Testing for serializability - Concurrency control – Lock based protocols, Timestamp based protocols, Validation based protocols, Multiple granularity, Multiversion schemes.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Construct the Entity Relationship Model for obtaining the structure of a database	Apply
CO2. Convert ER diagram to relational database schema	Apply
CO3. Apply the normalization technique to obtain the relational database design.	Apply
CO4. Select a query evaluation and optimization technique for a given query.	Apply
CO5. Implement online transactions and control concurrency	Apply

Text Book(s):

T1. Silberschatz, Korth, Sudarshan, ―Database System Concepts‖, 6th Edition, McGrawHill International Edition, New Delhi 2010

T2. Date C.J., Kannan A, Swaminathan S, ―An introduction to database systems‖, 8th Edition, Pearson Education, New Delhi, 2009.

Reference Book(s):

R1. Elmasri, R., Navathe, S.B., ―Fundamentals of database systems‖, 6th Edition, Pearson Education, New Delhi, 2010.

R2. Raghu Ramakrishnan, Johannes Gehrke. ―Database Management Systems‖, 3rd Edition, McGrawHill International Edition, New Delhi 2007.

R3. Bipin C Desai, ―An Introduction to Database Systems‖, Eleventh Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.

R4. Bipin C Desai, ―An Introduction to Database Systems‖, 11th Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.

R5. JefreyD.Ulman and Jenifer Widom, ―A First Course in Database Systems‖, 3rd Edition, Prentice-Hall, New Delhi, 2007.

R6. C.J.Date, A.Kannan and S.Swamynathan, ―An Introduction to Database Systems‖, 8th Edition, Pearson Education, 2006.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/
3. www.nptelvideos.in/2012/11/database-management-system.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO2	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO3	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO4	3	2	1	1	1	-	-	1	1	1	-	2	2	-
CO5	3	2	1	1	1	-	-	1	1	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td>Course Code: 19ECCN1036</td><td colspan="3">Course Title: Industrial Electronics</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours:45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ECSN2201 - Electric Circuits and Electron devices

Course Objectives

The course is intended to:

1. Explain various power switching devices.
2. Compute the performance parameters.
3. Identify a DC-DC converter.
4. Explain the operation of inverters and harmonic reduction.
5. Describe the operation of AC voltage controller and cyclo converter.

Unit I Power Switches 9 Hours

Power Diode: reverse recovery characteristics, types

SCR: Two transistor model, turn-on methods, communication techniques, dynamic behavior, types, series and parallel connection, UJT trigger circuit, protection circuits: over voltage and over current and snubber circuits, losses and cooling – TRIAC & GTO: Construction, dynamic behavior and driver circuit.

MOSFET & IGBT: Construction, dynamic behavior and driver circuit.

Unit II Controlled Rectifiers 9 Hours

Controlled Rectifiers: 1 pulse, 2 pulse, 3 pulse and 6 pulse converters with R and RL loads, dual converter, performance parameters, estimation of average load voltage and effect of source impedance.

Unit III DC Converters 9 Hours

Choppers: Principle of step-up and step-down operation, Time ratio control and current limit control, types, forced commutation techniques (voltage, current and load).

Switching regulators: Operation of Buck, Boost and Buck-boost regulators.

Unit IV Inverters 9 Hours

Inverter: single-phase half and full bridge, Three-phase six steps VSI and CSI, Control: voltage control of single phase inverter, output AC voltage control and harmonic reduction.

Unit V AC-AC Converter 9 Hours

AC Voltage controller: types of control - on-off, Phase angle control and sequence control, Single phase: with R and RL loads, Three phase: Star and delta connected loads.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Outline the overview of Power semiconductor devices their dynamic characteristics.	Understand
CO2.	Compute the performance parameters of controlled rectifiers.	Understand
CO3.	Identify a DC-DC converter for a given application	Understand
CO4.	Explain the modulation techniques of PWM inverter and harmonic reduction methods	Understand
CO5.	Describe the operation of AC voltage controller and cyclo converter.	Understand

Text Book(s):

T1. Muhammad H. Rashid, ¯Power Electronics: Circuits, Devices and Applications‖, Pearson Eduaction, 3^{rd} Edition (reprint),2011.

T2. P.S.Bimbhra, ¯Power Electronics‖, Khanna Publishers, 3^{rd} Edition, 2004.

Reference Book(s):

R1. Ned Mohan, T.M.Undeland, W.P.Robbins, ¯Power Electronics: Converters, Applications and Design‖, John Wiley and Sons, 3^{rd} Edition reprint), 2009.

R2. Joseph Vithayathil, ¯Power Electronics: Principles and Applications‖, tata McGraw-Hill, New Delhi,2010.

R3. M.D.Singh and K.B.Khanchandani,‖Power Electronics‖, Tata McGraw Hills Publishing Company Limited, 2^{nd} Edition, 2006.

R4. Philip T

Web References:

1. http://nptel.ac.in/courses/117106093/
2. http://www.vlsi-expert.com/p/vlsi-basic.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code: 19EEEC1001	Course Title: Industrial Automation (Common to EC & EE)		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites:

- 19ECCN1302 - Digital Principles and System Design
- 19ECCN1502 - Control Systems

Course Objectives

The course is intended to:

1. Justify the need for automation in industry
2. Describe the architecture and types of PLC used in industry automation
3. Develop the PLC based control logic program according to their application
4. Explain industry networking Protocols and SCADA programming
5. Explain the applications of DCS in various power plants

Unit I Introduction to Factory Automation **9 Hours**

History and developments in industrial automation- Vertical integration of industrial automation- Building blocks in Automation: Processing systems, Multi microprocessor systems, LAN, analog and digital I/O modules, remote terminal unit

Unit II Programmable Logic Controllers **9 Hours**

PLC an Overview- Parts and Architecture of PLC- Principles of Operation - I /O Specifications - Memory types-Programming devices- PLC vs Computers, PLC size and Applications, Advantages of PLC, selection of PLC

Unit III Programming of PLC **9 Hours**

Program scan - PLC Programming Languages-Simple process control programs using Relay Ladder Logic - Programming Timers : On delay timer, OFF delay timer- Programming counters: Up and Down counter – PLC arithmetic functions -Program Control Instructions-Math Instructions-data transfer operations-Data comparison instructions

Unit IV Industry Networking and SCADA 9 Hours

PLC Networking- Networking standards & IEEE Standard - Protocols - Field bus - Process bus and Ethernet .SCADA-Channel scanning-conversion to engineering units- data processing – Distributed SCADA systems- HMI introduction

Unit V Distributed Control System and Applications 9 Hours

DCS: Evolution - Different architectures - local control unit - Operator interface - Displays - Engineering interface. **Applications:** Thermal power plant-cement plant-water treatment plant-Solar, windmill substation automation.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Justify the need for automation in industry	Understand
CO2. Describe the architecture and types of PLC used in industry automation	Understand
CO3. Develop the PLC based control logic program according to their application	Apply
CO4. Explain industry networking Protocols and SCADA programming	Understand
CO5. Explain the applications of DCS in various power plants	Understand

Text Book(s):

T1. Frank D Petruzella ―Programmable Logic Controllers", McGraw Hill Education India Private Limited, 4th Edition, 2016.

T2. Bolton.W, ―Mechatronics‖, Pearson Education, 4th Edition,2014.

Reference Book(s):

R1.John W Webb & Ronald A Reis, ―Programmable logic controllers: Principles and Applications‖, Prentice Hall India, 5th edition, 2006

R2.Dobrivojie Popovic, Vijay P. Bhatkar, ―Distributed Computer Control for Industrial Automation‖, MarcelDekkar Inc., New York, 1st edition, 2011.

R3. Krishna Kant, ‗Computer based Industrial Control', Prentice Hall of India, 2nd edition, 2010 .

R4. Rajesh Mehra and Vikrant Vij, ―PLCs& SCADA- Theory and Practice‖,Laxmi Publications, 1st edition, 2016.

Web References:

1. http://www.fieldbus.org
2. www.nptel.ac.in/downloads/108105063/
3. http://nptel.ac.in/courses/108105062/18

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td colspan="2">Course Code: 19EEEC1002</td><td colspan="3">Course Title: Automotive Electronics
(Common to EC & EE)</td></tr>
<tr><td>Course Category: Professional Elective</td><td colspan="4">Course Level: Mastery</td></tr>
<tr><td colspan="2">L:T:P(Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours:45</td><td>Max Marks:100</td></tr>
</table>

Prerequisites:

- Electron devices
- Microprocessor and Microcontroller

Course Objectives

The course is intended to:

1. Inculcate knowledge of mechanical system in automotive systems.
2. Understand the electronic system in automobiles.
3. Know the X-by-wire concepts in automobiles.
4. Understand the embedded system applications in automobiles.
5. Disseminate the knowledge of communication protocols used in automobiles.

Unit I Automotive Mechanical Systems 9 Hours

Vehicle Systems: Power Train System (Air System, Fuel System (Carburettor& Diesel Fuel Injection, Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)), Transmission System (Front, Rear & 4 wheel Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering).

Unit II Electronics in Automotive Systems 9 Hours

Performance (Speed, Power, and Torque), Control (Emission, Fuel Economy, Drivability, and Safety) & Legislation (Environmental legislation for pollution & Safety Norms). Overview of Chassis subsystem (ABS, TCS, & ESP) – Comfort and safety subsystems (Night Vision, Airbags, Seatbelt Tensioners, Cruise Control-Lane-departure-warning, Parking).

Unit III Drive by Wire 9 Hours

Challenges and opportunities of X-by-wire: system & design requirements, steer-by-wire, brake-by-wire, suspension-by wire, gas-by-wire, power-by-wire, shift by wire- Future of Automotive Electronics

Unit IV Embedded System in Automotive Applications 9 Hours

Gasoline / Diesel systems Sensors – Nox sensor, Knock Sensor, MAP Sensor, Oxygen sensor, Throttle Position Sensor- Actuators - Idle speed control valves, Exhaust gas recirculation valves Thermal actuators - Body electronics – Body electronics domain- Central locking and electric windows, Climatic Control - On-Board Diagnostics (OBD). Introduction to electric vehicles- Types of electric vehicles.

Unit V Vehicle Communication Protocols 9 Hours

SPI, I2C, USB communication protocols - Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000. Introduction to AUTOSAR

Course Outcomes	
At the end of the course students will be able to:	**Cognitive Level**
CO1. Explain the mechanical systems of automobiles	Understand
CO2. Describe the electronic system in automobiles	Understand
CO3. Summarize the X-by-wire concepts in automobile	Understand
CO4. Outline the embedded system applications in automobiles	Understand
CO5. Explain the different communication protocols in embedded system for automobile	Understand

Text Books

1. Robert Bosch GmbH, "Bosch Automotive Handbook", 10th Edition, Wiley Publishers, 2019
2. William B. Ribbens, ¯Understanding Automotive Electronics‖, 7th Edition, SAMS/Elsevier Publishing, 2012

Reference Books

1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, Springer Vieweg, Wiesbaden 2014
2. Knowles.D, Automotive Electronic and Computer Controlled Ignition Systems, Reston Pub Co,1990

3. Denton.T , Automobile Electrical and Electronic Systems: Automotive Technology: Vehicle Maintenance and Repair, 2012
4. JoergSchaeuffele, Thomas Zurawka - Automotive Software Engineering - Principles, Processes, Methods and Tools, SAE, 2016

Web References

1. www.austincc.edu/autotech
2. www.austincc.edu
3. https://acconline.austincc.edu/webapps/portal/frameset.jsp

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO5	2	1	-	-	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2; Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19EEEC1003	Course Title: Virtual Instrumentation (Common to EC & EE)		
Course Category: Professional Elective		**Course Level: Mastery**	
L:T:P(Hours/Week) 3: 0: 0	**Credits:3**	**Total Contact Hours:45**	**Max Marks:100**

Pre-requisites:

- 19CSSC2001 - C Programming

Course Objectives

The course is intended to:

6. Discuss the importance of virtual instrumentation.
7. Develop virtual instruments.
8. Apply the concept of Arrays, Strings and File I/O tasks.
9. Select suitable Data acquisition system interfaces.
10. Examine DAQ hardware's and LabVIEW.

Unit I Graphical System Design 9 Hours

Graphical System Design Model – Virtual Instrumentation – Virtual Instrument and Traditional Instrument – Hardware and software in virtual instrumentation – Virtual instrumentation for test, control and Design – Conventional and Graphical programming.

Unit II Labview Basics I 9 Hours

Front Panel and Block Diagram - Tools, Controls and Functions palette. Modular programming – SubVI. Structures – FOR, WHILE Loops, Case, Sequence, event structures, Formula node.

Unit III Labview Basics Ii 9 Hours

Arrays, Clusters, Strings, File I/O, Time and Dialog controls, Waveform chart, Graph, XY Graph and operations Report generation, Web Publishing tool.

Unit IV Data Acquisition System 9 Hours

Instrument control: GPIB - VISA - Instrument drivers - Serial Port communication. Data Acquisition: Review of Transducers and signal conditioning, DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration.

Unit V Labview Applications 9 Hours

LabVIEW RT, Process control applications, Physical applications, Speed control, Data visualization, Imaging and Sound. Level, flow, temperature process, biomedical application - Pulse rate

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1.Discuss the importance of virtual instrumentation using Lab view	Understand
CO2.Develop virtual instruments using LabVIEW graphical programming tools	Understand
CO3. Apply the concept of Arrays, Strings and File I/O tasks in Data Acquisition	Apply
CO4. Select suitable Data acquisition system interfaces based on the Requirement	Apply
CO5.Examine DAQ hardware‘s and LabVIEW in various real time Environments	Apply

Text Book(s):

T1. Jovitha Jerome, ‗Virtual Instrumentation using LabVIEW‘ PHI Learning Private Limited, New Delhi, 2nd Printing, 2011

T2. Gary W Johnson, Richard Jennings, ‗LabVIEW Graphical Programming‘ 4th Edition, McGraw Hill, 2006

Reference Book(s):

R1. Sanjay Gupta, Joseph John, ‗Virtual Instrumentation using LabVIEW‘ Tata McGraw Hill, 5th Reprint, 2010

R2. Robert H Bishop. ‗Learning with LabVIEW 2009‘ Pearson Education, 2010

Web References:

4. http://www.av.it.pt/conftele2009/Papers/125.pdf
5. https://www.researchgate.net/publication/3420671_What_is_virtual_
6. http://www.ni.com/pdf/manuals/374629c.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	2	2	-
CO3	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19EEEC1005	Course Title: Industrial Safety		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Impart knowledge on safety engineering fundamentals and safety management practices
2. Expose the basic concepts of chemical hazards
3. Explain industrial health hazards and environmental control for protection
4. Identify and prevent chemical, environmental mechanical, fire hazardthrough analysis
5. Apply proper safety techniques on safety engineering and management

Unit I Introduction 9 Hours

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure

Unit II Chemical Hazards 9 Hours

Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

Unit III Environmental Control 9 Hours

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection

Unit IV Hazard Analysis 9 Hours

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

Unit V - Safety Regualtions 9 Hours

Explosions – Disaster management – catastrophe control, hazard control, Safety education and training - Factories Act, Safety regulations Product safety – case studies

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Understand safety engineering fundamentals and safety management practices	Understand
CO2. Understand the basic concepts of chemical hazards	Understand
CO3. Summarize industrial health hazards and environmental control for protection	Apply
CO4. Identify and prevent hazards through analysis	Apply
CO5. Apply proper safety techniques on safety engineering and management	Understand

Text Book(s):

T1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003

T2. Fordham Cooper, W., Electrical Safety Engineering, Butterworth and Company, London, 1986

Reference Book(s):

R1. Safety Manual, “EDEL Engineering Consultancy”, 2000.

R2. Indian Electricity Act and Rules, Government of India.

R3. Power Engineers – Handbook of TNEB, Chennai, 1989.

R4. David L.Goetsch, “Occupational Safety and Health for Technologists”, 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005.

Web References:

1.https://nptel.ac.in/courses/110/105/110105094/

2.http://ccc.chem.pitt.edu/wipf/Web/HCH.pdf

3.https://www.preventionweb.net/publications/view/61941

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	-	-	2	1	2	-	2	1	1
CO2	1	1	1	1	1	-	-	2	1	2	-	2	1	1
CO3	2	1	1	1	1	-	-	2	1	2	-	2	1	1
CO4	2	1	1	1	1	-	-	2	1	2	-	2	1	1
CO5	1	1	1	1	1	-	-	2	1	2	-	2	1	1

High-3; Medium-2;Low-1

Assessmentpattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

<table>
<tr><td>Course Code: 19MEEC1014</td><td colspan="3">Course Title: Engineering Economics and Cost Analysis
(Common to AU,ME,EC EE &EI)</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P (Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max. Marks:100</td></tr>
</table>

Prerequisites: The student should have undergone the course(s):

- Manufacturing Technology

Course Objective: The course is intended to

1. Calculate the breakeven point.
2. Application of interest formula.
3. Comparison of economic alternatives.
4. Replacement analysis of equipment.
5. Calculate depreciation of an equipment.

UNIT I Introduction to Economics 8 Hours

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

UNIT II Value Engineering 10 Hours

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications -Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

UNIT III Cash Flow Management 9 Hours

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV Replacement and Maintenance Analysis 9 Hours

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V Depreciation 9 Hours

Depreciation- Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case study

Course Outcomes At the end of this course, students will be able to:	Cognitive Level
CO1. Categorize different cost and calculate the breakeven point for a given business situation	Understand
CO2. Apply different interest formulae and their application in decision making process.	Understand
CO3. Evaluate present value, future value and annual worth analysis on one or more economic alternatives.	Understand
CO4. Determine the economic value of an asset and develop a better replacement policy for given equipment.	Understand
CO5. Evaluate the depreciation of equipment per period.	Understand

Text Book(s):

T1. Panneerselvam R, ―Engineering Economics‖, Prentice Hall of India Ltd, New Delhi, 2014

T2. Chan S.Park, ―Contemporary Engineering Economics‖, Prentice Hall of India, 2016.

Reference(s):

R1. Donald.G. Newman, Jerome.P.Lavelle, ―Engineering Economics and analysis‖ Engg. Press, Texas, 2010.

R2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, ―Engineering Economy‖, Macmillan, New York, 2010.

Web References:

1. https://en.wikipedia.org/wiki/Engineering_economics
2. https://en.wikipedia.org/wiki/Cost%E2%80%93benefit_analysis

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	3	1	-	-
CO2	2	1	-	-	-	-	-	1	-	1	3	1	-	-
CO3	2	1	-	-	-	-	-	1	-	1	3	1	-	-
CO4	2	1	-	-	-	-	-	1	-	1	3	1	-	-
CO5	2	1	-	-	-	-	-	1	-	1	3	1	-	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	Retest	1,2,3,4	50	
	CCET 3	5	50	
	Tutorial	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				**100**

<table>
<tr><td colspan="2">Course Code: 19MEEC1015</td><td colspan="3">Course Title: Principles of Management
(Common to ME,MC EC,EE & EI)</td></tr>
<tr><td colspan="3">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P (Hours/Week) 3: 0: 0</td><td colspan="2">Credits:3</td><td>Total Contact Hours: 45</td><td>Max. Marks:100</td></tr>
</table>

Prerequisites: The student should have undergone the course(s):

- Nil

Course Objectives: The course is intended to:

1. Describe the role of managers.
2. Explain the significance of planning, decision making and strategies for international business.
3. Explain the significance of organizing the tasks.
4. Explain the motivational theories.
5. Explain the control techniques.

UNIT I Overview of Management 9 Hours

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II Planning 9 Hours

Nature and Purpose planning - Planning process - Types of plans - Objectives - Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision -Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III Organizing 9 Hours

Nature and purpose of organizing - Organization structure - Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV Directing 9 Hours

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity

UNIT V Controlling 9 Hours

Process of controlling - Types of control - Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control - Quality Control - Planning operations.

Course Outcomes **At the end of this course, students will be able to:**	**Cognitive Level**
CO1.Describe the role of managers with reference to an organization context and business.	Understand
CO2.Explain the significance of planning, decision making and strategies for international business to accomplish the organizational goal.	Understand
CO3.Explain the significance of organizing the tasks to accomplish the organizational goal.	Understand
CO4.Explain the motivational theories to increase the productivity and retention rate of employees.	Understand
CO5.Explain the control techniques such as budgetary, maintenance, quality to accomplish the organizational goal.	Understand

Text Book(s):

T1.Stephen P. Robbins, Rolf Bergman and Mary Coulter, ―Management, Prentice Hall of India, 8th edition, 2017.

T2.Charles W.L Hill, Steven L McShane, ―Principles of Management‖, Mcgraw Hill Education, 2008.

Reference(s):

R1. Hellriegel, Slocum & Jackson, ―Management – A Competency Based Approach‖, Thomson South Western, 10th edition, 2007.

R2. Harold Koontz, Heinz Weihrich and mark V Cannice, ―Management – A global & Entrepreneurial Perspective‖, Tata McGraw Hill, 12th edition, 2007.

R3. Andrew J. Dubrin, ―Essentials of Management‖, Thomson Southwestern, 7th edition, 2007.

Web References:

1. http://www.managementstudyguide.com/all-subjects.htm

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	2	1	2	2
CO2	2	1	-	-	-	-	-	1	-	1	2	1	2	2
CO3	2	1	-	-	-	-	-	1	-	1	2	1	2	2
CO4	2	1	-	-	-	-	-	1	-	1	2	1	2	2
CO5	2	1	-	-	-	-	-	1	-	1	2	1	2	2

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	Retest	1,2,3,4	50	
	CCET 3	5	50	
	Tutorial	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

<table>
<tr><td colspan="2">Course Code: 19EEEN1045</td><td colspan="2">Course Title: Disaster Management (Common to EC,EE & EI)</td></tr>
<tr><td colspan="2">Course Category: Professional Elective</td><td colspan="2">Course Level: Mastery</td></tr>
<tr><td>L:T:P(Hours/Week) 3: 0: 0</td><td>Credits:3</td><td>Total Contact Hours: 45</td><td>Max Marks:100</td></tr>
</table>

Pre-requisites

- 19ENHG2101- Communication Skills-I
- 19ENHG2201- Communication Skills-II

Course Objectives

The course is intended to:

1. Distinguish the natural and manmade disasters.
2. Explain the environment hazards and level of toxicology.
3. Analyze the causes and effects of Earthquake and Tsunami formation.
4. Analyze the causes and effects of Cyclone formation.
5. Describe about modern technological tools in disaster management.

Unit I Introduction 9 Hours

Disaster- Disaster management- Disaster prevention and preparedness measures-Types of Disaster - Causal factor of Disaster - Natural, Manmade, creeping disaster-Disaster in the Indian context various measures - Disaster related policy goals - United Nations Development Program (UNDP) - United Nations Disaster Relief Organization (UNDRO) - Govt. of India.

Unit II Environmental Disaster 9 Hours

Environmental hazards - Typology - Assessment and response - the strategies- the scale of disaster - Vulnerability - Disaster trends - Paradigms towards a balanced view - Chemical hazards and Toxicology - Biological hazards -Hazard caused by world climate change – Risk analysis – other technological disasters.

Unit III Earthquake and Tsunami 9 Hours

Earthquake - Causes of earthquake - Earthquake scales - Measures of earth -quake -

Magnitude and Intensity - Earthquake Recurrence hazard assessment -Seismic zoning - Earthquake disaster mitigation - Component research focus -Forecasting techniques and Risk analysis - Tsunami - Causes of Tsunami -Effects of Tsunami - Tsunami warning system - Tsunami warning system in India - International status of Tsunami warning and communication system -Tsunami warning centers - Pacific Tsunami Warning Center (PTWC) - Pacific Tsunami Warning System (PTWS) components - Institutional arrangements and design criteria for Tsunami mitigation.

Unit IV Cyclone 9 Hours

Tropical cyclone - Warning system - Protection of buildings from cyclones - Precaution before and during cyclones - Tropical cyclone warning strategy in India - Cyclone related problems - aerial survey - Management strategy - risk reduction by public awareness and education.

Unit V Application of Technology In Disaster Management 9Hours

Hazard map - Multi hazard mapping - Application of satellites in Disaster Management - Application of remote sensing in forecasting and disaster relief -Use of digital image processing in disaster management - GIS in disaster management - Spatial data - GIS data base design - Convention mapping concepts and Coordinate system - Methods of spatial Interpolation in GIS.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1:Distinguish the natural and manmade disasters	Understand
CO2:Explain the environment hazards and level of toxicology	Understand
CO3:Analyze the causes and effects of Earthquake and Tsunami formation	Apply
CO4:Analyze the causes and effects of Cyclone formation	Apply
CO5:Describe about modern technological tools in disaster management	Understand

Text Book(s):

T1. Pardeep Sahni, Madhavimalalgoda and Ariyabandu, ―Disaster risk reduction in south Asia‖, PHI

T2. AmitaSinhal, ¯Understanding earthquake disasters‖ TMH, 2010.

Reference Book(s):

R1. PardeepSahni, AlkaDhameja and Uma medury, ¯Disaster mitigation: Experiences and reflections‖, PHI

R2.Jeff Groman, ¯The atlas of Natural Disasters‖, Friedman/Fairfax publishing, 2002

R3.Jaikrishna and Chandrasekar, Elements of Earthquake Engineering.

Web References:

1. www.nptel.ac.in

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	2	-	-	1	-	1	-	-
CO2	2	1	-	-	-	2	2	-	-	1	-	1	-	-
CO3	3	2	1	1	-	2	2	-	-	1	-	1	-	-
CO4	3	2	1	1	-	2	2	-	-	1	-	1	-	-
CO5	2	1	-	-	-	2	2	-	-	1	-	1	-	-

High-3; Medium-2;Low-1

Assessment Pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

OPEN ELECTIVE (OE)

Course Code: 19ECOC1001		Course Title: In Vehicle Networking	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

Nil

Course Objectives

The course is intended to:

1. Explain the fundamental concepts and architecture of in-vehicle networking
2. Develop the in-vehicle networking using Controlled Area Network
3. Demonstrate the Flexray protocol for in-vehicle networking
4. Model the Local Interconnect Network (LIN) for vehicular networking
5. Design the model of Media Oriented System Transport in-vehicle networking

Unit I Introduction To In-Vehicle Networking **9 Hours**

Introduction to Computer Networks - Network Topologies - Types of Networks: Local Area Networks, Wide Area Networks - Vehicle network Architecture - Vehicle network.

Unit II Control Area Network **9 Hours**

Layered Architecture - ISO 11898 Architecture - CAN Physical Layer- CAN transceiver – CAN working example.

Unit III Flex Ray **9 Hours**

Flex ray Architecture - topologies: Multi-drop Bus, star and hybrid - node operation - frames and signals – Applications.

Unit IV Local Interconnect Network **9 Hours**

Introduction: Transmit & receive data through LIN network- The power management in LIN network - LIN Versus CAN.

Unit V - Media Oriented System Transport **9 Hours**

MOST in ISO-OSI reference model - Types - Topology - MOST physical layer - Frames and signals – Functioning and synchronization.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the fundamental concepts and architecture of in-vehicle networking.	Understand
CO2: Develop the in-vehicle networking using Controlled Area Network.	Understand
CO3: Demonstrate the Flexray protocol for in-vehicle networking.	Understand
CO4: Model the Local Interconnect Network (LIN) for vehicular networking.	Understand
CO5: Design the model of Media Oriented System Transport in-vehicle networking.	Understand

Text Book(s):

T1. Kirsten Matheus, Thomas Königseder., Automotive Ethernet, Cambridge University Press, UK, 1st Edition 2015.

T2. DominiqueParet.Multiplexed Networks for Embedded Systems: CAN, LIN, FlexRay, Safe-by-Wire, John Wiley & Sons Ltd. 1st Edition 2007.

T3. ChristophSommer, Falko Dressler., Vehicular Networking, Cambridge University Press, UK, 1st Edition 2015.

Reference Book(s):

R1. Marc Emmelmann, Bernd Bochow, Christopher Kellum.,Vehicular Networking: Automotive Applications and Beyond, John Wiley &Sons Ltd, 1st Edition 2010.

R2. Hannes Hartenstein, Kenneth Laberteaux.,VANET: Vehicular Applications and Inter-Networking Technologies, John Wiley & Sons Ltd, 1st Edition 2010.

R3. Stephan Olariu, Michele C. Weigle, Vehicular Networks: From Theory to Practice, CRC Press, USA, 1st Edition 2009.

Web References:

1. https://www.elprocus.com/controller-area-network-can/
2. https://www.embitel.com/product-engineering-2/automotive/in-vehicle-networking
3. https://www.globaledgesoft.com/blog-posts/in-vehicle-networking-at-a-glance/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECOC1002		Course Title: Consumer Electronics	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

Nil

Course Objectives

The course is intended to:

1. Understand the concept of basic electronic devices.
2. Explain the construction and working of audio & video system.
3. Illustrate the working functions of home appliances
4. Explain the communication devices used for information exchange.
5. Understand product safety, compliance standards and techniques.

Unit I Electronics Fundamentals **9 Hours**

Semiconductor Devices: Diodes, Transistors, Logic Gates, Integrated Circuits- Moorse Law, ADC, DAC, Introduction about Microcontroller, Microcontrollers in consumer electronics.

Unit II Entertainment Electronics **9 Hours**

Audio systems: Construction and working principle of : Microphone, Loud speaker, stereo, 2.1 home theatre, 5.1 home theatre Display systems: Graphic Displays: CRT, LCD, LED Video Players : DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

Unit III Home Appliances **9 Hours**

Home Enablement Systems: RFID Home, Lighting control, Washing Machines, Kitchen Electronics: Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart floor, Smart locks.

Unit IV Communication Systems **9 Hours**

Cordless Telephones, Fax Machines, PDAs- Tablets, Smart Phones and Smart Watches. Video Conferencing Systems- Web/IP Camera, Internet Enabled Systems, GPS and Tracking Systems.

Unit V - Safety & Liability Issues **9 Hours**

Product Compliance: Product safety and liability issues; standards related to electrical safety and fire hazards, EMI/EMC requirements, design techniques for ESD, RF interference and immunity, line current harmonics and mains voltage surge.

Course Outcomes **Cognitive Level**

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

CO1: Explain the concept of basic electronic devices.	Understand
CO2: Explain the construction and working of audio & video system.	Understand
CO3: Illustrate the working functions of home appliances.	Understand
CO4: Summarize the communication devices used for information exchange.	Understand
CO5: Identify different product safety, compliance standards and techniques associated with electronic products.	Understand

Text Book(s):

T1. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.

T2. Philp Hoff "Consumer Electronics for Engineers" - Cambridge University Press.1998.

Reference Book(s):

R1. Bali S P, Consumer Electronics, Pearson, 2007.Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

R2. Jordan Frith, " Smartphones as Locative Media ", Wiley. 2014.

R3. Douglas Kinney, A Beginners Guide to Consumer Electronics Repair: Hand Book and Tutorial, iUniverse, 2006.

R4. Sridhar Canumalla, PuligandlaViswanadham, Portable Consumer Electronics Packaging, Materials, and Reliability, PennWell, 2010.Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design By OmeshTickoo, Ravi Iyer 2016

Web References:

1. https://blog.epicvila.com/home-appliances-working-conditions/
2. https://www.mediacollege.com/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECOC1003		Course Title: Internet Of Everything	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

Nil

Course Objectives

The course is intended to:

1. To impart knowledge on Internet of Things (IoT), which relates to the study of sensors, actuators, and controllers, among other Things
2. To understand IoT value chain structure (device, data cloud), application areas and technologies involved
3. To understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
4. To learn how to use software programs to perform varying and complex tasks
5. To Expand upon the knowledge learned and apply it to solve real world problems

Unit I Introduction 9 Hours

Internet of Things Promises-Definition- Scope-Sensors for IoT Applications-Structure of IoT-IoT Map Device

Unit II Seven Generations of IOT Sensors 9 Hours

Industrial sensors - Description & Characteristics-First Generation - Description & Characteristics-Advanced Generation - Description & Characteristics-Integrated IoT Sensors - Description & Characteristics

Unit III Technological Analysis 9 Hours

Wireless Sensor Structure-Energy Storage Module-Power Management Module-RFModule-Sensing Module

Unit IV The World of the Future – Internet of Everything **9 Hours**

Overview of Mobile and Wearable Computing, Augmented Reality, and Internet of Things. The fundamental axes of the Wearables + IoT + AR space - Free-roaming AR: Wearable Computing, Wireless, Sensing, and Meta sensing with light bulbs.

Unit V - Future and Perspectives **9 Hours**

Internet of Everything - The Future and perspectives - Challenges- Examples for sensor, actuator, control circuits with applications.

Course Outcomes **Cognitive Level**

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

CO1: Explain the basic concepts on Internet of Things (IoT)	Understand
CO2: State IoT value chain structure	Understand
CO3: Describe about IoT sensors and technology challenges in it	Understand
CO4: Illustrate software techniques for performing varying and complex tasks	Understand
CO5: Explain the knowledge for solving real world problems	Understand

Text Book(s):

T1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Développement Copyrights ,2014

T2. Editors OvidiuVermesan Peter Friess,'Internet of Things - From Research and Innovation to Market Deployment', River Publishers, 2014

Reference Book(s):

R1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

R2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

R3. Woodrow Barfield, Fundamentals of Wearable Computers and Augmented Reality, Second Edition – 2015.

R4. OmeshTickoo, Ravi Iyer Making, Sense of Sensors: End-to-End Algorithms and Infrastructure Design – 2016.

R5. ¯Practical Electronics for Inventors, Third Edition,‖ by Paul ScherzandSimon Monk. 2016

Web References:

1. https://www.open.edu/openlearn/science-maths-technology/internet-everything

2. https://onlinecourses.nptel.ac.in/noc21_cs17

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO2	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO3	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO4	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO5	2	1	-	-	-	-	-	1	1	1	-	-	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECOC1004	Course Title : Data Science Using Hadoop With R		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Describe the significance of Big Data.
2. Solve the basic Analysis problem.
3. Explain the YARN architecture, configuration and containers.
4. Use suitable data types for basic operations.
5. Choose an appropriate plot for visualizing the data.

UNIT I Introduction To Big Data 9 Hours

Data science process - roles, stages in data science project, What is Big Data-types of data-elements of big data-big data analytics. Exploring the big data stack-big data applications.

UNIT II Hadoop Eco System 9 Hours

Hadoop ecosystem-Hadoop Distributed File System-Map Reduce framework techniques to optimize MapReduce jobs-uses of Map Reduce.

UNIT III Hadoop Yarn Architecture 9 Hours

YARN Architecture-working of YARN-YARN schedulers-backward compatibility with YARN-YARN configurations-YARN commands-YARN containers.

UNIT IV Introduction to R **9 Hours**

Basic features of R-data types in R-reading data sets-reading and combining numeric, text-reading multiple data values from large values-reading data from R Studio-exporting data from R.

UNIT V Manipulating and Processing Data In R **9 Hours**

Creating data subset-merging datasets in R-sorting data-melting-casting-matrices-data frames-functions-arguments in functions-built-in functions in R-plots-RHadoop-integration of R and Hadooptext mining in RHadoop.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the significance of Big Data	Understand
CO2: Solve the basic Analysis problem using Map and reduce	Apply
CO3: Explain the YARN architecture, configuration and containers	Understand
CO4: Identify suitable data types for basic operations on data	Apply
CO5: Choose an appropriate plot for visualizing the data.	Apply

Text Books:

T1. Black Book, ¯BIG DATA, DT Editorial Services, Dream tech press, Edition:2016.

T2. Norman Matloff, ¯The Art of R Programming: A Tour of Statistical Software Design‖, No Starch Press, USA, 2011

Reference Books

R1. Jimmy Lin and Chris Dyer, ¯Data Intensive Text Processing using Map Reduce, Morgan and Claypool Publishers, USA, 2010.

R2. Nina Zumel, John Mount, ¯Practical Data Science with R‖, Manning Publications, 2014.

R3. ArvindSathi, ¯Big Data Analytics: Disruptive Technologies for changing the game(paperback), Mc Press, 2012.

R4. Dirk deRoos, ¯HadoopFor Dummies‖, John Wiley & Sons, 2014.

Web References:

1. https://www.datascience.com/resources#.learn-data-science
2. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction
3. http://lintool.github.io/MapReduceAlgorithms/ed1n.html
4. https://www.tutorialspoint.com/r/r_overview.htm

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO2	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO4	3	2	1	1	-	-	-	1	-	1	-	2	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	2	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECOC1005	Course Title: Artificial Intelligence		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Identify a suitable Artificial Intelligence methods
2. Explain the knowledge representation
3. Explain the various reasoning techniques
4. Interpret the concepts of planning and machine learning
5. Explain the concepts of typical expert systems and its architectures

Unit Introduction To Artificial Intelligence 9 Hours

Introduction to AI - Problem formulation, Problem Definition - Production systems,Control strategies, Search strategies. Problem characteristics, Production system characteristics, – Heuristic search - Depth first and Breath first, Generate and test, Hill Climbing, Best first search, Search in Game playing.

Unit II Representation Of Knowledge 9 Hours

Knowledge representation issues: representation and mapping, approaches, issues Knowledge representation using Predicate logic- Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using Rules – Logic programming, Forward vs Backward knowledge, Matching

Unit III Reasoning 9 Hours

Introduction to Non-monotonic reasoning -Logics - Implementation issues - Implementation: depth-first search - Statistical reasoning - Probability and Bayes theorem - Bayesian networks – Dempster –Shafer theory – Fuzzy logic

Unit IV Knowledge Acquisition and Machine Learning 9 Hours

Knowledge Acquisition process - Meta knowledge - Components of planning system - Understanding - Learning - Rote learning - Explanation based Learning - Inductive Learning - Natural language processing.

Unit V Expert Systems 9 Hours

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition -Meta knowledge, Heuristics. Typical expert systems - MYCIN,DART, XOON, Expert systems shells. AI for robotics.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify a suitable Artificial Intelligence methods for solving the given problems	Understand
CO2: Explain the knowledge representation using various logics and rule based systems	Understand
CO3: Explain the knowledge using various reasoning techniques	Understand
CO4: Interpret the concepts of planning and machine learning	Understand
CO5: Explain the concepts of typical expert systems and its architectures	Understand

Text Book(s):

T1. Kevin Night and Elaine Rich, Nair B., ―Artificial Intelligence (SIE), McGraw Hill- 2008.

T2. R.B.Mishra, ―Artificial Intelligence PHI learning private ltd, 2011.

Reference Book(s):

R1. Peter Jackson, ―Introduction to Expert Systems‖, 3rd Edition, Pearson Education, 2007.

R2. Stuart Russel and Peter Norvig ―AI – A Modern Approach‖, 2nd Edition, Pearson Education 2007.

R3. Deepak Khemani ―Artificial Intelligence‖, Tata McGraw Hill Education 2013.

R4. N.P.Padhy, ―Artificial Intelligence and Intelligent systems‖ Oxford University press, 4th Edition, 2008

Web References:

1. http://nptel.ac.in/courses/106105077/

2. https://in.udacity.com/course/intro-to-artificial-intelligence--cs271

3. https://www.tutorialspoint.com/artificial_intelligence/index.htm

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO2	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO3	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO4	2	1	-	-	-	-	-	1	1	1	-	-	-	-
CO5	2	1	-	-	-	-	-	1	1	1	-	-	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19ECOC1006	**Course Title: Machine Vision System**		
Course Category: Open Elective		**Course Level: Mastery**	
L:T:P(Hours/Week)3: 0: 0	**Credits:3**	**Total Contact Hours: 45**	**Max Marks:100**

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Describe the fundamental concepts in machine vision systems
2. Explain the concepts of image acquisition
3. Practice the algorithms for machine vision
4. Illustrate the pattern recognition algorithms
5. Apply the machine vision algorithms for real time applications

Unit Introduction to Machine Vision 9 Hours

The nature of vision - tasks for a vision system – The image: representations and properties - mathematical and physical background - Data structures for image analysis - Basic Image Filtering Operations

Unit II Image Acquisition and Conversion 9 Hours

Illumination - Electromagnetic Radiation - Types of Light Sources - Interaction of Light and Matter - Lenses - Pinhole Cameras - Gaussian Optics – Depth of Field – Tele centric Lenses - Lens Aberrations - Cameras : CCD Sensors CMOS Sensors - Color Cameras - Sensor Sizes - Camera-Computer Interfaces - Image Acquisition Modes - Camera Calibration - Camera Models for Area Scan Cameras - Camera Model for Line Scan Cameras - Calibration Process - Accuracy of the Camera Parameters.

Unit III Machine Vision Algorithms 9 Hours

Image Enhancement - Gray Value Transformations - Image Smoothing - Thresholding - Extraction of Connected Components - Feature Extraction - Morphology - Edge Extraction – Image Segmentation - Segmentation and Fitting of Geometric Primitives

Unit IV Pattern Recognition 9 Hours

Template Matching Gray-Value-Based Template Matching - Template Matching with Rotations and Scalings - Optical Character Recognition- Classifiers: parametric classifiers – non parametric classifiers - nearest neighbor- neural networks

Unit V Machine Vision Applications 9 Hours

Reading of Serial Numbers - Inspection of Saw Blades - Inspection of Ball Grid Arrays (BGA) - Surface Inspection - Inspection of Punched Sheets - Pose Verification of Resistors.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the fundamental concepts in machine vision systems by studying the fundamental concepts of image representation and its properties	Understand
CO2: Explain the concepts of image acquisition using various cameras and its interfacing techniques	Understand
CO3: Practice the algorithms for machine vision using image segmentation, Edge extraction and morphological operations	Understand
CO4: Illustrate the pattern recognition algorithms like template matching and classifiers	Understand
CO5: Apply the machine vision algorithms for real time applications for inspection, reading and measuring applications	Apply

Text Book(s):

T1. Carsten Steger, Markus Ulrich, and Christian Wiedemann "Machine Vision Algorithms and Applications‖ Wiley-VCH; 1st Edition, 2007.

T2. E.R.Davies, ―Machine Vision: Theory, Algorithms, Practicalities‖ Elsevier, Technology & Engineering , 2004.

T3. Alexander Hornberg, ―Handbook of Machine Vision‖ John Wiley & Sons, (2007).

Reference Book(s):

R1. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973

R2. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992.

R3. Nellazuech, ‗Understanding & applying machine vision Marceldekker Inc.2000.

R4. E. R. DAVIES, Computer and Machine Vision: Theory, Algorithms, Practicalities, Academic Press(2012).

R5. Harley R. Myler, ―Fundamentals of Machine Vision‖, SPIE Press, (1999).

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2
3. https://nptel.ac.in/syllabus/111104092/

Course Articulation matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	2	-
CO5	3	2	1	1	-	-	-	1	-	1	-	1	2	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code:19ECOC1007		Course Title: Soft Computing	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Explain the basics of Soft computing and Fuzzy theory.
2. Apply the fuzzy theory for problem solving.
3. Explain the supervised learning of neural networks.
4. Explain the concepts of fuzzy and neural networks.
5. Apply Genetic algorithms for optimizing a problem.
6.

UNIT I Introduction to Soft Computing 9 Hours

Introduction to Soft computing – Soft computing techniques – Types of Problems: Classification, Functional Approximation, Optimization - Modelling the problems. Introduction to classical set and fuzzy set- Classical relation and fuzzy relation – Fuzzy arithmetic - Fuzzy measures

UNIT II Application Of Fuzzy Sets 9 Hours

Fuzzy Membership function - Fuzzy Rule base and reasoning - Fuzzy Inference System - Defuzzification - Fuzzy Decision making - Fuzzy based clustering

UNIT III Artificial Neural Networks 9 Hours

Introduction to Artificial Neural Networks (ANN) - Models and Terminologies of ANN - Hebb Network -Learning methods: Supervised and unsupervised learning. Supervised learning networks: Perceptrons - Adaline - Back propagation network - Radial basis function network.

UNIT IV Unsupervised Learning Networks and Neuro-fuzzy systems 9 Hours

Unsupervised Learning Networks: Kohonen self-organizing network - Learning Vector quantization - Counter Propagation networks. Introduction to hybrid systems - Architecture of Adaptive Neuro Fuzzy Inference System (ANFIS) - Hybrid learning algorithm

UNIT V Optimization 9 Hours

Introduction to optimization – principles of optimization – Duality principle – Classification of optimization problems - Traditional optimization methods and its drawbacks – Evolutionary concepts in optimization: Genetic Algorithm (GA) - Simple GA – Binary coded GA – Limitations of Binary coded GA

Course Outcomes	**Cognitive Level**
At the end of the course students will be able to:	
CO1: Explain the basics of soft computing and Fuzzy theory	Understand
CO2:Apply the fuzzy theory for problem solving	Apply
CO3:Explain the supervised learning of neural networks	Understand
CO4:Summarize the concepts of fuzzy and neural networks	Understand
CO5:Apply Genetic algorithms for optimizing a problem	Apply

Text Books:

T1. Sivanandam.S.N, Deepa.S.N, ―Principles of soft computing‖,2nd Edition, Wiley India Pvt Limited, 2011.

T2. Jyh - Shing Roger Jang, Cheun Tsai Sun, Eiji - Mizutani, ―Neuro fuzzy and Soft computing‖, Prentice Hall, 1997.

Reference Books:

R1. Dilip Kumar Prathiar, ―Soft Computing‖ Narosa Publishing House Pvt Ltd, 2008

R2. Anupam - shukla, RituTiwari, Rahul Kala, ―Real life applications of Soft computing‖, CRC press, 2010.

R3. Aliev,R.A, Aliev,R.R, ¯Soft Computing and its Application‖, World ScientificPublishing Co. Pvt. Ltd., 2001.
R4. Mehrotra.K, Mohan.C.K, Ranka.S, ¯Elements of Artificial Neural Networks‖, The MIT Press, 2nd Edition, 2000.
R5. Ronald R.Yager, Lofti - Zadeh, ¯An Introduction to fuzzy logic applications in intelligent Systems‖, Kluwer Academic, 1992.

Web References:

1. http://www.myreaders.info/html/soft_computing.html
2. https://www.tutorialspoint.com/artificial_intelligence/
3. http://www.soft-computing.de/def.html
4. http://nptel.ac.in/courses/106106046/41

Course Articulation matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	1	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	1	-	1	-	1	-	-

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
			Total	100

Course Code: 19CSEC6701	Course Title: Professional Readiness for Innovation, Employability and Entrepreneurship (common to CSE, IT & ECE)		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 0: 0: 6	Credits:3	Total Contact Hours: 96	Max. Marks:100

OBJECTIVES:

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skillsof the students.

This course is a four months immersive program to keep up with the industry demand and to havecritical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. **This is an EEC category course offered as an elective, under the type,“Experiential Project Based Learning”.**

Highlights of this course:

- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approachesand methodologies.
- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

OUTCOMES:

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

- Upskill in emerging technologies and apply to real industry-level use cases
- Understand agile development process
- Develop career readiness competencies, Team Skills / Leadership qualities

- Develop Time management, Project management skills and Communication Skills
- Use Critical Thinking for Innovative Problem Solving
- Develop entrepreneurship skills to independently work on products

The course will involve 40-50 hours of technical training, and 40-50 hours of project development.The activities involved in the project along with duration are given in Table 1.

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & businessdomains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluationmetrics	1
	TOTAL	**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY ANDENTREPRENEURSHIP			
Technical Skills		**Soft Skills**	
Criteria	**Weightage**	**Criteria**	**Weightage**
Project Design using DesignThinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis usingCritical Thinking	10	Attendance and Punctuality	5
Project Planning using AgileMethodologies	5	Project Documentation	5
Technology Stack (APIs, tools,Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product /Application	5		
Technical Training & Assignments	5		
Total	70	Total	30
Total Weightage			100
Passing Requirement			50
Continuous Assessment Only			

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	3	3	3	3	3	3	3	3	3
CO2	1	1	1	1	1	3	3	3	3	3	3	3	3	3
CO3	2	2	2	2	2	3	3	3	3	3	3	3	3	3
CO4	2	2	2	2	2	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3	3	3	3	3	3	3	3	3
CO6	2	2	2	2	2	3	3	3	3	3	3	3	3	3

High-3; Medium-2; Low-1

Course Code: 19ECPN6801	Course Title: PROJECT		
Course Category: Project		**Course Level: Practice**	
L:T:P (Hours/Week) 0: 0: 16	**Credits:8**	**Total Contact Hours:240**	**Max. Marks:100**

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Identify the problem statement by doing literature survey
2. Develop a novel solution for the problem statement and design a software/hardware prototype based on the solution.
3. Demonstrate time management by following a proper time line to execute the project
4. Effectively communicate the results of projects in a written and oral format

The objective of Project is to enable the student to take up investigative study in the broad field of Electronics and Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation forthe student(s) in R&D work. The assignments normally included as given below:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Oral Presentation before a departmental committee.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Define problem statement in the opted domain by doing literature survey	Apply

CO2: Develop a novel solution for the identified problem statement with the help of engineering knowledge.	Apply
CO3: Manage time by following a proper planning to execute the project.	Apply
CO4: Design a hardware/software prototype based on the solution developed for the problem	Create
CO5: Demonstrate the results by making presentations and preparing reports	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	3	3	3	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO3	-	-	-	-	-	3	-	3	3	-	3	3	-	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO5	3	3	-	-	3	3	3	3	3	3	-	3	3	3

High-3; Medium-2; Low-1