GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University, Estd. u/s 3 of UGC Act 1956)

∗VISAKHAPATNAM ∗HYDERABAD ∗BENGALURU∗

Accredited by NAAC with 'A' Grade

REGULATIONS & SYLLABUS

of

Five year Dual Degree (B.Tech. + M.Tech) in Electronics & Communication Engineering

Programme Code : EIREC201001

(W.e.f 2012-13 admitted batch)

Website: www.gitam.edu

Scheme of Integrated Dual Degree Program
B.Tech (ECE) + M.Tech. in chosen specialization
(With effect from 2012-13 Admitted Batch)

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREG101	English	HS	3	60	40	100	3	0	-	3
EIRMT102/ EURMT102	Engg. Mathematics	MT	4	60	40	100	4	0	-	4
EIRPH103E	Engg. Physics - I	BS	4	60	40	100	4	0	-	4
EIRCH104	Chemical Aspects of Engg. Materials	BS	4	60	40	100	4	0	-	4
EIRCS105	Programming with C	BS	3	60	40	100	3	0	-	3
EIRCH106	Environmental Studies	HS	4	60	40	100	4	0	-	4
EIRCH111	Engg. Chemistry Lab	BS	2	-	100	100	-	-	3	3
EIRPH112	**Engg. Physics Lab**	BS	2	-	100	100	-	-	3	3
EIRCS113	**Programming with C Lab**	BE	2	-	100	100	-	-	3	3
Total			**28**	**360**	**540**	**900**	**22**	**0**	**9**	**31**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Syllabus code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC201	Basic Circuit Theory	BE	3	60	40	100	3	1	-	4
EIRMT202/ EURMT 202	Higher Engg. . Mathematics I	MT	3	60	40	100	4	0	-	4
EIRMT203 EURMT203	Higher Engg. Mathematics II	MT	3	60	40	100	4	0	-	4
EIRPH204	Solid State Physics	BS	3	60	40	100	4	0	-	4
EIREC205	Electronic Devices and Circuits	BE	3	60	40	100	3	1	-	4
EIRCS206	Data Structures and Algorithms (DSA)	BE	3	60	40	100	3	0	-	3
EIREC211	Electronic Circuits and Devices Lab	BE	2	-	100	100	-	-	3	3
EIRME212	Engg Graphics Lab	BE	2	-	100	100	-	-	3	3
EIRCS213	Data Structures and Algorithms Lab	BE	2	-	100	100	-	-	3	3
Total			**24**	**360**	**540**	**900**	**21**	**2**	**9**	**32**

Integrated Dual Degree Program B.Tech. (ECE) + M.Tech III Semester

Syllabus code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC301/ EUREC301/ EUREI301/ EUREE301	Advanced Engineering Mathematics	MT	3	60	40	100	3	1	-	4
EIREC302/ EUREC302	Signals and Systems	CE	3	60	40	100	3	1	-	4
EIREC303	Analog Electronic Circuits	CE	3	60	40	100	3	1	-	4
EIREC304	Filters and Wave Shaping Circuits	CE	3	60	40	100	3	1	-	4
EIREC305/ EUREC305	Electrical Machines	BE	3	60	40	100	3	1	-	4
EIREC306/ EUREC306	Electromagnetic Waves and Transmission Lines	CE	4	60	40	100	4	1	-	5
EIREC311	Networks & Electrical Machines Lab	BE	2	-	100	100	-	-	3	3
EIREC312	Analog Electronic Circuits Laboratory	CE	2	-	100	100	-	-	3	3
Total			**23**	**360**	**440**	**800**	**19**	**6**	**6**	**31**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Syllabus code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC401/ EUREC401	Digital Logic Design	CE	3	60	40	100	3	1	-	4
EIREC402	Linear Integrated Circuits	CE	3	60	40	100	3	1	-	4
EIREC403/ EUREC403	Analog Communications	CE	3	60	40	100	3	1	-	4
EIREC404/ EUREC404	Probability Theory and Random Processes	CE	3	60	40	100	3	1	-	4
EIREC405	Antennas and Wave Propagation	CE	3	60	40	100	3	1	-	4
EIREC406/ EUREC406	Control Systems	CE	3	60	40	100	3	1	-	4
EIREC411	Digital Logic Design Lab	CE	2	-	100	100	-	-	3	3
EIREC412	Linear Integrated Circuits Lab	CE	2	-	100	100	-	-	3	3
EIREC413	English Language Lab	HS	2	-	100	100	-	-	3	3
EIREC414	Industrial Tour	IT	Non Credit Audit Course							
Total			**24**	**360**	**540**	**900**	**18**	**6**	**9**	**33**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

Syllabus code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC501/ EUREC501	Microprocessors & Interfacing	CE	3	60	40	100	3	1	-	4
EIREC502/ EUREC502	Digital Communications	CE	3	60	40	100	3	1	-	4
EIREC503	Microwave Engineering	CE	3	60	40	100	3	1	-	4
EIREC504	Digital Signal Processing	CE	3	60	40	100	3	1	-	4
EIREC505	Electronic Measurements and Instrumentation	BE	3	60	40	100	3	1	-	4
EIREC506	Computer Architecture and Organization	CE	3	60	40	100	3	1	-	4
EIREC511	Communication Systems Lab	CE	2	-	100	100	-	-	3	3
EIREC512	Electronic Circuit Simulation Lab	CE	2	-	100	100	-	-	3	3
EIREC513	Advanced Communication Skills Lab	HS	2	-	100	100	-	-	3	3
Total			**24**	**360**	**540**	**900**	**18**	**6**	**9**	**33**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC601/ EUREC601	Radar Engineering	CE	4	60	40	100	3	1	-	4
EIREC602	Telecommunication Systems & Switching Networks	CE	4	60	40	100	3	1	-	4
EIREC603	Satellite Communications	CE	3	60	40	100	3	1	-	4
EIREC604/ EUREC605/ EUREI605	Engg Economics and Management	HS	3	60	40	100	3	1	-	4
EIREC621-624	UG Elective – I	UE	3	60	40	100	3	1	-	4
EIREC631-634	UG Elective – II	UE	3	60	40	100	3	1	-	4
EIREC611	Digital Signal Processing Lab	CE	2	-	100	100	-	-	3	3
EIREC612	Advanced Communication Systems Lab	CE	2	-	100	100	-	-	3	3
EIREC613	Microprocessor Lab	CE	2	-	100	100	-	-	3	3
EIREC614	Personality Development	HS	Non Credit Audit Course							
Total			**26**	**360**	**540**	**900**	**18**	**6**	**9**	**33**

Electives Offered under UG Elective-I	Electives Offered under UG Elective-II
EIREC621 – Operating Systems	EIREC631 – Cellular and Mobile Communications
EIREC622 – Digital Image Processing	EIREC632 – Wireless Communications and Networks
EIREC623 – Speech Processing	EIREC633 – Embedded Systems
EIREC624 – Object Oriented Analysis and Design	EIREC634 – Advanced Communication Systems

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VII Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week #			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC701	Introduction to VLSI Design	CE	4	60	40	100	8	-	-	8
EIRRM702/ EIRVD702/ EIRDS702/ EIRCM702	PG Core –I	PGC	3	60	40	100	7	1	-	8
EIRRM703/ EIRVD703/ EIRDS703/ EIRCM703	PG Core – II	PGC	3	60	40	100	7	1	-	8
EIREC711	**Industrial Training ***	IT	8	50	50	100				
Total			**18**	**230**	**170**	**400**	**22**	**2**	**-**	**24**

* Students shall carry out Internship in any reputed industry / organization for a period of TWELVE WEEKS during May – August in the year.

\# Hours per week for duration of August 3rd week to end of semester.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIRRM801/ EIRVD801/ EIRDS801/ EIRCM801	PG Core – III	PGC	3	60	40	100	3	1	-	4
EIRVD821-824 EIRDS821-824 EIRRM821-824 EIRCM821-824	PG Elective – I	PGE	3	60	40	100	3	1	-	4
EIRVD831-834 EIRDS831-834 EIRRM831-834 EIRCM831-834	PG Elective – II	PGE	3	60	40	100	3	1	-	4
EIREC811	VHDL Laboratory	CE	2	-	100	100			6	6
EIRRM812/ EIRVD812/ EIRDS812/ EIRCM812	PG Lab – I	PGC	2	-	100	100	-	-	6	6
EIREC813	Project –I	UPW	10	50	50	100	-	-	-	6
Total			**23**	**230**	**370**	**600**	**9**	**3**	**12**	**30**

PG SPECIALIZATION POOLS

- Every student shall select ALL his PG courses only from one of the five below pools based on his merit. Depending on the pool selected by the student he shall be awarded the degree with appropriate specialization (Example: M.Tech (ECE) with specialization in VLSI Design).
- Courses mentioned in the PG Core group are compulsory and student is free to choose any FOUR PG Electives offered by the department
- **The department will offer any TWO of the following pools of PG specialization. Student to choose any one pool of PG specialization based on his merit at the end of VI semester**

Pool-A	**Pool-B**	**Pool-C**	**Pool-D**
VLSI Design	**Digital Systems and Signal Processing**	**RF & Microwave Engineering**	**Communication Systems**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIRRM901/ EIRVD901/ EIRDS901/ EIRCM901	PG Core – IV	PGC	3	60	40	100	3	1	-	4
EIRRM902/ EIRVD902/ EIRDS902/ EIRCM902	PG Core – V	PGC	3	60	40	100	3	1	-	4
EIRVD921-924 EIRDS921-925 EIRRM921-924 EIRCM921-924	PG Elective-III	PGE	3	60	40	100	3	1	-	4
EIRVD931-934 EIRDS931-935 EIRRM931-934 EIRCM931-934	PG Elective – IV	PGE	3	60	40	100	3	1	-	4
EIRVD941-944 EIRDS941-945 EIRRM941-944 EIRCM941-943	PG Elective – V	PGE	3	60	40	100	3	1	-	4
EIRRM911/ EIRVD911/ EIRDS911/ EIRCM911	PG Lab – II	PGC	2	-	100	100	-	-	3	3
EIRRM912/ EIRVD912/ EIRDS912/ EIRCM912	PG Lab – III	PGC	2	-	100	100	-	-	3	3
Total			**19**	**300**	**400**	**700**	**15**	**5**	**6**	**26**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech X Semester

Syllabus Code	**Subject**	Category	Credits	Marks			Hours per week			
				Semester End	Sessionals	Total	L	T	P	Total
EIRRM011/ EIRVD011/ EIRDS011/ EIRCM011	Project – II	PPW	18	50	50	100	-	-	-	-
Total			**18**	**50**	**50**	**100**	**-**	**-**	**-**	**-**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech Programme

List of Core and Elective Courses **(with VLSI Specialization)**

PG Core Courses	
PG Core –I (VII Sem)	EIRVD702 - Analog IC Design
PG Core – II (VII sem)	EIRDS703/ EIRVD703 - Digital System design
PG Core – III (VIII Sem)	EIRVD801- Digital IC Design
PG Core – IV (IX Sem)	EIRVD901- VLSI CAD
PG Core – V (IX Sem)	EIRVD902- Digital Systems Testing and Testability

PG Laboratory Courses	
PG Lab I (VIII Sem)	EIRVD812 - VLSI Design Laboratory
PG Lab II (IX Sem)	EIRVD911- HDL Programming Laboratory
PG Lab III (IX Sem)	EIRVD912 - Advanced VLSI Design Lab

PG Elective Courses	
EIRVD821-824	PG Elective – I
EIRVD831-834	PG Elective – II
EIRVD921-924	PG Elective – III
EIRVD931-934	PG Elective – IV
EIRVD941-944	PG Elective - V

PG Elective -I	
EIRVD821	Semiconductor Devices
EIRVD 822	Operation and Modeling of MOS Transistor
EIRVD823/ EIRRM824	Advanced Digital Signal Processing
EIRVD824	Advanced Computer Organization

PG Elective - II	
EIRVD831	VLSI Technology
EIRVD832	Modeling and Design with HDLs
EUREC835/ EIRVD833/ EIRDS801/ EIRRM834	DSP Processors and Architectures
EIRVD834	Logic Synthesis and Verification

PG Elective -III	
EIRVD921	Analog System Design
EIRVD 922	Active Filter Design
EIRVD923 /EIRDS943	Advanced Computer Architecture
EIRVD924	VLSI Physical Design Automation

PG Elective -IV	
EIRVD931	RF IC Design
EIRVD932	Statistical Digital Signal Processing
EIRVD933	Digital Systems Engineering
EIRVD934	Computer Arithmetic

PG Elective -V	
EIRVD941	Low Power VLSI Design
EIRVD942/ EIRDS941	Advanced Digital IC Design
EIRVD943	VLSI Digital Signal Processing
EIRVD944	Data Converters

Integrated Dual Degree Program B.Tech (ECE) + M.Tech Programme
List of Core and Elective Courses **(with DSSP Specialization)**

PG Core Courses	
PG Core –I (VII Sem)	EIRDS702/EUREC733 - Advanced Digital Signal Processing
PG Core – II (VII sem)	EIRDS703/ EIRVD703- Digital System design
PG Core – III (VIII Sem)	EUREC835/ EIRVD833/ EIRDS801/ EIRRM834 – DSP Processors and Architectures
PG Core – IV (IX Sem)	EIRDS901 - Microcontrollers and Interfacing
PG Core – V (IX Sem)	EIRDS 902- ASIC Design

PG Laboratory Courses	
PG Lab I (VIII Sem)	EIRDS 812 - Digital Systems Design Laboratory
PG Lab II (IX Sem)	EIRDS 911- IC Design Laborotary
PG Lab III (IX Sem)	EIRDS 912- Advanced Digital Systems Laboratory

PG Elective Courses	
EIRDS821-824	PG Elective – I
EIRDS831-834	PG Elective – II
EIRDS921-925	PG Elective – III
EIRDS931-935	PG Elective – IV
EIRDS941-945	PG Elective – V

PG Elective -I	
EIRDS821	Linear Algebra and Random Processes
EIRDS 822/ EIRCM832	Estimation and Detection Theory
EIRDS823/ EIRRM833/ EIRCM801	Communication Networks
EIRDS824	Digital VLSI Design

PG Elective - II	
EIRDS831	Digital Signal Compression
EIRDS832	Modeling and Design with HDLs
EIRDS833	Multirate Systems and Time Frequency Analysis
EIRDS834	Analog IC Design

PG Elective -III	
EIRDS921	Data structures and algorithms
EIRDS922	Advanced Microprocessors
EIRDS923	Analog System Design
EIRDS924	Digital Speech Processing
EIRDS925	Embedded Software Design

PG Elective -IV	
EIRDS931	Biomedical Signal Processing
EIRDS 932/ EIRRM944	Radar Signal Processing
EIRDS933	Image and Video Processing
EIRDS934	Multidimensional Signal Processing
EIRDS935	Digital Control Systems

PG Elective -V	
EIRDS941/ EIRVD942	Advanced Digital IC Design
EIRDS 942	Array Signal Processing
EIRVD923 /EIRDS943	Advanced Computer Architecture
EIRDS944	Linear and Nonlinear Optimization
EIRDS945	SONAR signal processing

Integrated Dual Degree Program B.Tech (ECE) + M.Tech Programme

List of Core and Elective Courses **(with RFME Specialization)**

PG Core Courses	
PG Core –I (VII Sem)	EIRRM702/EPRRM101 - Advanced Electromagnetics
PG Core – II (VII sem)	EIRRM703/EPRRM102 - RF Components and IC Design
PG Core – III (VIII Sem)	EIRRM801 - Antenna Analysis & Design
PG Core – IV (IX Sem)	EIRRM901 - Computational Techniques in Electromagnetics
PG Core – V (IX Sem)	EIRRM902 - Microwave Devices and Integrated Circuits

PG Laboratory Courses	
PG Lab I (VIII Sem)	EIRRM812 - Antennas Laboratory
PG Lab II (IX Sem)	EIRRM911 - Microwave Measurements Laboratory
PG Lab III (IX Sem)	EIRRM912 - MIC Design Lab

PG Elective Courses	
EIRRM821-824	PG Elective – I
EIRRM831-834	PG Elective – II
EIRRM921-924	PG Elective – III
EIRRM931-934	PG Elective – IV
EIRRM941-944	PG Elective - V

PG Elective -I	
EIRRM821/ EUREC832	Microwave Networks
EIRRM 822	Microwave Measurements
EIRRM823	EMI & EMC Techniques
EIRVD823/ EIRRM824/	Advanced Digital Signal Processing

PG Elective - II	
EIRRM831	Advanced Microprocessors
EIRRM 832	Fiber Optic Communications
EIRDS823/ EIRRM833/EIRCM801	Communication Networks
EUREC835/EIRVD833/ EIRDS801/ EIRRM834	DSP Processors and Architecture

PG Elective -III	
EIRRM921	Global Positioning Systems
EIRRM 922	Phased Array Antennas
EIRRM923	Photonic Networks and Switching
EIRRM924	Radar Signature Analysis and Imaging

PG Elective -IV	
EIRRM931	Smart Antennas for Mobile Communication
EIRRM 932	Antennas and Propagation for Wireless Communication Systems
EIRRM933	RF Receiver Design and Wireless applications
EIRRM934	RF and Microwave MEMs

PG Elective -V	
EIRRM941	Wireless Channels and UWB Radio
EIRRM942	Computer Communication Networks
EIRRM943	Multimedia Communication Technology
EIRRM944/ EIRDS932	Radar signal processing

Integrated Dual Degree Program B.Tech (ECE) + M.Tech Programme

List of Core and Elective Courses **(with Communication Systems Specialization)**

PG Core Courses	
PG Core –I (VII Sem)	EIRCM702 - Information Theory
PG Core – II (VII sem)	EIRCM 703 - Modern Digital Communication Techniques
PG Core – III (VIII Sem)	EIRCM 801/ EIRDS823/ EIRRM833 - Communication Networks
PG Core – IV (IX Sem)	EIRCM 901 - Optical Communications
PG Core – V (IX Sem)	EIRCM 902 – Wireless Communications

PG Laboratory Courses	
PG Lab I (VIII Sem)	EIRCM 812 - Communication Engineering Laboratory
PG Lab II (IX Sem)	EIRCM 911 – Network Design and Simulation Laboratory
PG Lab III (IX Sem)	EIRCM 912 - Modern Communication Engineering Laboratory

PG Elective Courses	
EIRCM821-824	PG Elective – I
EIRCM831-834	PG Elective – II
EIRCM921-924	PG Elective – III
EIRCM931-934	PG Elective – IV
EIRCM941-943	PG Elective - V

PG Elective -I	
EIRCM821	Random Processes
EIRCM 822	Multicarrier Communications
EIRCM823	Multi-rate Signal processing
EIRCM824	Stochastic Processes and Queuing Theory

PG Elective - II	
EIRCM831	Simulation of Communication Systems and Networks
EIRCM832/ EIRDS822	Estimation and Detection Theory
EIRCM833	Multimedia Compression Techniques
EIRCM834	Soft Computing

PG Elective -III	
EIRCM921	Markov Modeling & Queuing Theory
EIRCM922	Global Tracking and Positioning Systems
EIRCM923	Spread Spectrum & CDMA Systems
EIRCM924	Advances in Fiber Optics and Photonics

PG Elective -IV	
EIRCM931	Network Management
EIRCM932	High Speed Switching Architecture
EIRCM933	Communication Network Security
EIRCM934	Space Time Coding & MIMO Systems

PG Elective -V	
EIRCM941	Spectrum Analysis
EIRCM942	Wavelet Transforms and Its Applications
EIRCM943	Network Routing Algorithms and protocols

For students opting out after VIII semester with B Tech (ECE) degree*

* 1. The student can opt out with **B. Tech. (ECE) degree** by submitting his option request to the department head before the closure of instruction of **VI semester**.

2. The scheme of instruction and detailed syllabus of all courses of I – VI semesters are in common with that of 5 year Integrated program.

VII Semester

Syllabus Code	Subject	Category	Credits	Marks			Hours per week #			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIREC701	Introduction to VLSI Design	CE	4	60	40	100	8	-	-	8
EIRVD702/ EIRRM702/ EIRCS702	Advanced Elective –I	AE	3	60	40	100	7	1	-	8
EIRRM703/ EIRVD703/ EIRCS703	Advanced Elective - II	AE	3	60	40	100	7	1	-	8
EIREC711	**Industrial Training ***	IT	8	50	50	100				
Total			**18**	**230**	**170**	**400**	**22**	**2**	**-**	**24**

* Students shall carry out Internship in any reputed industry / organization for a period of TWELVE WEEKS during May – August in the year.

Hours per week for duration of August 3rd week to end of semester.

VIII Semester

Syllabus Code	Subject	Category	Credits	Marks			Hours per week			
				Semester End Exam	Sessionals	Total	L	T	P	Total
EIRVD801/ EIRDS801/ EIRCS801	Advanced Elective – III	AE	3	60	40	100	3	1	-	4
EIRVD821/ EIRVD824/ EIRRM832	Advanced Elective – IV	AE	3	60	40	100	3	1	-	4
EIRVD831/ EIRVD823/ EIRRM821	Advanced Elective – V	AE	3	60	40	100	3	1	-	4
EIREC811	VHDL Laboratory	CE	2	-	100	100			6	6
EIREC812	Microwave Engineering Laboratory	CE	3	-	100	100	-	-	6	6
EIREC813	Project	PW	10	50	50	100	-	-	-	6
Total			**24**	**230**	**370**	**600**	**9**	**3**	**12**	**30**

Courses offered under Advanced Elective – I - V

Advanced Elective – I (VII Semester)	EIRVD702 Analog IC Design	EIRDS702 Advanced Digital Signal Processing	EIRCS702 Information Theory
Advanced Elective – II (VII Semester)	EIRVD703 Digital System design	EIRRM703 RF Components and IC Design	EIRCS703 Modern Digital Communication Techniques
Advanced Elective – III (VIII Semester)	EIRVD801 Digital IC Design	EIRDS801 DSP Processors and Architectures	EIRCS801 Communication Networks
Advanced Elective – IV (VIII Semester)	EIRVD821 Semiconductor Devices	EIRVD824 Advanced Computer Organization	EIRRM832 Fiber Optic Communications
Advanced Elective – V (VIII Semester)	EIRVD831 VLSI Technology	EIRRM821 Microwave Networks	EIRDS901 Microcontrollers and Interfacing

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

English

Code: **EIREG101** Category: **HS**
Credits: **3** No. of hours: **4 per week**
Department: **Humanities**

Topics Covered
Tenses
Concord
Error Analysis
Single Sentence Definitions
Paragraph Writing
Essay Writing
Dialogue Writing
Reading Comprehension
Note Making
Precis Writing
Features of Abstract
Characteristics of Technical Paper
Notices
Memo
Minutes of the Meeting
Letter Writing (Letter of Enquiry, Permission, Regret, Reconciliation, Complaint)
Drafting Curriculum vitae
Resume and Covering Letter
Job Application

Engineering Mathematics

Code:	**EIRMT102/EURMT 102**	Category:	**MT**
Credits:	**4**	No. of hours:	**4 per week**
Department:	**Engg. Maths**		

The objective of the course is to impart knowledge in Basic concepts of Mathematics relevant to Engineering applications.

UNIT-I: First order Differential Equations

Formation – Variables seperable – Homogeneous, non Homogeneous, Linear and Bernoulli equations. Exact equations - Applications of first order differential equations – Orthogonal Trajectories, Newton's law of cooling, law of natural growth and decay.

UNIT-II: Higher order Differential Equations

Complete solutions - Rules for finding complementary function - Inverse operator - Rules for finding particular integral - Method of variation of parameters - Cauchy's and Legendre's linear equations - Simultaneous linear equations with constant coefficients - Applications of linear differential equations to Oscillatory Electrical circuits L-C, LCR – Circuits - Electromechanical Analogy.

UNIT-III: Mean Value Theorems

Rolle's, Lagrange's and Cauchy's mean value theorems. Taylor's and Maclaurin's theorems and applications (without proofs).

UNIT-IV: Infinite Series

Definitions of convergence, divergence and oscillation of a series - General properties of series - Series of positive terms - Comparison tests - Integral test - D' Alembert's Ratio test - Raabe's test - Cauchy's root test - Alternating series - Leibnitz's rule - Power series - Convergence of exponential, Logarithmic and binomial series (without proofs).

UNIT-V: Linear Algebra

Rank of a Matrix – Elementary Transformations – Echelon form - Normal form (self study). Consistency of Linear system of equations $A X = B$ and $A X = 0$. Eigen Values and Eigen Vectors – Properties of eigen values(without proofs) – Cayley – Hamilton theorem (Statement only without proof) – Finding inverse and powers of a square matrix using Cayley – Hamiton theorem – Reduction to diagonal form – Quadratic form - Reduction of Quadratic form into canonical form – Nature of quadratic forms.

Text Books Prescribed:

1. Higher Engineering Mathematics, Dr.B.S Grewal. Khanna Publishers.

References :

1. Advanced Engineering Mathematics by Erwin Kreyszig.Wiley Eastern Pvt. Ltd.
2. Textbook of Engineering Mathematics by N.P.Bali. Laxmi Publications (P) Ltd.
3. Higher Engineering Mathematics by Dr.M.K.Venkata Raman. National Pub.Co.
4. Calculus and Analytic Geometry by Thomas / Finney Sixth edition -Narosa Publishing House

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester
Engineering Physics-I

Code:	**EIRPH103E**	Category:	**BS**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**Engg. Physics**		

The aim of the course is to impart knowledge in basic concepts of Physics relevant to Engineering applications.

UNIT – I

THERMODYNAMICS: Heat and Work - First Law of Thermodynamics and Applications - Reversible and Irreversible Processes - Carnot's Cycle and Efficiency - Second Law of Thermodynamics - Carnot's Theorem - Entropy - Entropy in Reversible and Irreversible Processes - Entropy and Second Law - Entropy and Disorder - Third Law of Thermodynamics.

UNIT – II

ELECTROMAGNETIC OSCILLATIONS AND ALTERNATING CURRENTS: Energy Stored In a Capacitor and an Inductor - LC Oscillations (Qualitative and Quantitative) - Analogy to Mechanical Motion-Damped Oscillations - Damped Oscillations in an RLC Circuit-Alternating Current (Including Equations for Voltages and Currents) - Fundamental Definitions - (Cycle, Time period, Frequency, Amplitude, Phase, Phase Difference, Root Mean Square (RMS) value, Average Value, Form Factor, Quality Factor, Power in Alternating Current Circuits) - Forced Oscillations and Resonance - The Series RLC Circuit.

ELECTROMAGNETIC WAVES: Induced Magnetic Fields - Displacement Current - Maxwell's Equations - Traveling Waves and Maxwell's Equations - The Poynting Vector - Light and the Electromagnetic Spectrum.

UNIT – III

ULTRASONICS: Introduction - Production of Ultrasonics by Magnetostriction and Piezo-electric Effects - Detection and Applications of Ultrasonics.

INTERFERENCE: Introduction - Interference in Thin Films - Wedge Shaped Film - Newton's Rings - Lloyd's Mirror - Michelson's Interferometer and Applications.

UNIT – IV

DIFFRACTION: Introduction - Differences between Fresnel and Fraunhofer Diffractions - Single Slit Diffraction (Qualitative and Quantitative Treatment) - Differences between Interference and Diffraction - Gratings and Spectra-Multiple Slits - Diffraction Grating - X-ray Diffraction - Bragg's Law.

POLARISATION: Introduction - Double Refraction - Negative Crystals and Positive Crystals - Nicol's Prism - Quarter Wave Plate and Half Wave Plate - Production and Detection of Circularly and Elliptically Polarised Lights.

UNIT – V

LASERS: Introduction - Spontaneous and Stimulated Emissions - Population Inversion – Ruby Laser - He-Ne Laser - Semiconductor Laser – Applications.

FIBRE OPTICS: Introduction - Optical Paths in Fibre - Optical Fibre and Total Internal Reflection - Acceptance Angle and Cone of a Fibre - Fibre Optics in Communications - Applications.

Prescribed Books :

1. Physics Part I & II by Resnick, Halliday, Krane. John Wiley & Sons.
2. A Text Book of Engg. Physics by Kshirsagar & Avadhanulu. S.Chand and Co.

Reference Books:

1. Heat, Thermodynamics, and Statistical Physics Agarwal, Singhal, Satya Prakash. Pragati Prakashan, Meerut.
2. Engineering Physics by R.K.Gaur and S.L.Gupta. Dhanpat Rai & Sons, Delhi.
3. Engineering Physics by P.K.Palani samy. Scitech Publications (India) Pvt Ltd., Chennai
4. The Feynman Lectures on Physics by Addison-Wesley.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Chemical Aspects of Engg. Materials

Code: EIRCH104 Category: BS
Credits: 4 No. of hours: 4 per week
Department: Engg. Chemistry

UNIT-I: ELECTROCHEMISTRY & CORROSION AND ITS CONTROL: Electrode Potential – Determination of Single Electrode Potential-Reference Electrodes – Hydrogen and Calomel Electrodes. Electrochemical Series and its Applications. Primary Cell–Dry or Leclanche Cell, Secondary Cell – Lead acid storage Cell – Definition of Corrosion, Theories of Corrosion –Dry Corrosion and Electro Chemical Corrosion Factors Affecting Corrosion- Nature of the Metal and Nature of the Environment. Prevention of Corrosion: Metallic Coatings –Galvanising and Tinning, Anodized Coatings, Cathodic Protection- Inhibitors, Organic Coatings-Paints –Characteristics, Constituents and their functions, Varnishes.

UNIT-II: SOLID STATE CHEMISTRY-I: Introduction, classification, laws of crystallography, crystallographic systems, space lattice, types of lattices, Brags Equation, Neutron Diffraction, Born- Haber cycle, cohesive energy Ionic crystal. Properties of solids, Rhedogical plastic flow and elastic its glass transition temperature – Liquid Crystals properties and applications.

UNIT-III: SOLID STATE CHEMISTRY – II: Defects in solids-point defects- linear defect-Frenkel & Schotkey defect (Mathematical derivations). Band theory of solids semiconductors– Extrinsic & Intrinsic non stochiometric, organicsemiconductors, zone refining, -applications in the purification of semiconductor materials and preparation of ultrapure compounds. preparation of single crystals of Si & Ge (Czochralski crystal pullingmethod) doping, Elementary ideas of integrated circuits.

UNIT-IV: ENGINERING MATERIAL SCIENCE: Properties of Aluminium, Iron, Titanium Selective ferrous – non-ferrous alloys: Composition and applications of cast iron, steels, heat resisting steels, stainless steel, brass, bronze, aluminium alloys and titanium alloys. Refractories:– Classification - criteria of a good refractory. Preparation and properties of silica, magnesite and silicon carbide refractories - clay bond, silica nitride bond and self bond in silicon carbide.

UNIT-V: HIGHPOLYMERS&COMPOSITE MATERIALS: Types of Polymerization– Mechanism of addition polymerization-Moulding constituents. Differences between Thermo Plastic and Thermosetting Resins. Preparation and Properties of Polyethylene, PVC, Polystyrene, Polyamides (Nylon-6:6), Polycarbonates and Bakelite - Engineering applications of Plastics. Composite materials: Introduction –constituents of composites-types of composites-Processing of fibre reinforced composites.

Text Books :

1. Engineering Chemistry by C. Jain and M. Jain. Dhanapat Rai & Sons, Delhi.
2. Engineering Chemistry by B.K.Sharma, Krishna Prakashan, Meerut.
3. A Textbook of Engineering Chemistry by Sashi Chawla, Dhanapath Rai & Sons, Delhi.
4. Chemistry of Engg materials by Jain &Jain, Dhanapath Rai & Sons, Delhi.
5. Physical chemistry by Laidler
6. Physical chemistry by Azaroch

Reference Books :

1. A Textbook of Engineering Chemistry, S.S.Dara,S.Chand & Co. New Delhi.
2. Material Science and Engineering, V.Raghavan. ,Prentice-Hall India Ltd.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester
Programming with C

Code:	**EIRCS105**	Category: **BS**	
Credits:	**3**	No. of hours:	**3 per week**
Department: **CSE**			

UNIT – I

Introduction to Computer and Basics of 'C' :
Anatomy of a Digital Computer Memory Units: RAM, ROM, Types of RAM, Auxiliary Memory introduction only - Definition and functions of Operating Systems.Introduction to C, Historical Development of C, Features of C, Character Set, Constants, Variables, Data Types and Keywords, Operators, Operator – Precedence and Associativity, Typecasting, Basic I/O functions.

UNIT – II

CONTROL STRUCTURES: The if statement, if-else statement, Nested if-elses, Switch Statement, Break Statement, Continue statement, go to statement. Loops: for loop, while loop, do-while loop, simple examples algorithms and flowcharts.

UNIT – III

FUNCTIONS: Need of functions, Function Parameters, Passing Values between Functions, Calling Convention, Function Declaration and Prototypes, Calling Function by Value and by Reference, Recursion. Introduction to **Pointers:** Basic Pointer Notation,

Storage classes: Automatic, Register, Static and external storage classes.

UNIT – IV

ARRAYS AND STRINGS:

Introduction to Arrays, Initialization of Array, Passing Array Elements to a Function, Pointers and Arrays, Two dimensional Array.

Strings: What are Strings, Arrays of Strings and Standard Library String Functions.

UNIT – V

STRUCTURES & UNIONS:

What is a Structure, Declaration of Structure Members and Structure Variables, How Structure Elements are Stored, Initialization of Structure, Nested Structure, Array of Structures, Union, Difference between Union & Structures. **Files:** Introduction, File Structure, File handling functions, File Types, Unbuffered and Buffered Files, Error Handling.

Text Books:

1. Fundamentals of Information Technology, Alexis Leon, Mathews Leon.Vikar Publications. (Chapters : 3, 6, 7 and 11 only for Unit – I).
2. Programming With C, K R Venugopal, Sudeep R Prasad. Tata McGraw Hill.
3. The C Programming Language by Kernighan and Ritchie, Prentice Hall Publications

Reference Books:

1. Introduction to Computers by Peter Norton. Tata McGraw Hill.
2. Let us C, Yashwant Kanetkar by BPB Publications.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Environmental Studies

Code:	**EIRCH106**	Category:	**HS**
Credits:	**4**	No. of hours:	**4 per week**
Department:	**Engg. Chemistry**		

1. **The Multidisciplinary nature of environmental studies** – Definition, scope and importance, need for public awareness. **Natural Resources**: Renewable and non-renewable resources. Natural resources and associated problems – Forest Resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: world food problems, changes caused by agricultural and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. Land resources: Land as a resources, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life styles.
2. **Ecosystems**: Concept of an ecosystem. Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystems, Grassland ecosystems, desert ecosystems. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). **Biodiversity and its conservation**: Introduction: Definition: genetic, species of ecosystem diversity. Bio-geographical classification of India. Value of Biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hotspots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

3. **Environmental Pollution:** Definition, Causes, effects and control measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies, Disaster Management: floods, earthquakes, cyclones and landslides.

4. **Social Issues and the environment**: From unsustainable to sustainable development. Urban problems related to energy, Water conservation, rain water harvesting and watershed management. Resettlement and rehabilitation of people, its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

5. **Human Population and the Environment**: Population growth, variation among nations, Population explosion – Family welfare programme. Environment and human health. Human rights, Value education, HIV / AIDS, Women and Child welfare, Role of information technology in environment and human health. Case Studies. **Unit – VI: Field Work**: Visit to local area to document environmental assets-river / forest / grassland/ hill/mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, Insects, birds. Study of simple ecosystems – pond, river, hill slopes, etc.

Text Book:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha. Published by – University Grants Commission, Universities Press, India.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Engineering Chemistry Laboratory

Code:	**EIRCH111**	Category: **BS**	
Credits:	**2**	No. of hours:	**3 per week**
Department:	Engg. Chemistry		

The objective of the Laboratory Practicals is to make the student to acquire the basic concepts in Engineering Chemistry.

1. Calibration of Volumetric Apparatus.
2. Determination of sodium carbonate in soda ash.
3. Estimation of Iron as Ferrous Iron in an Ore Sample.
4. Estimation of copper (II) present in a brass sample (iodometric method)
5. Determination of Viscosity of a Liquid.
6. Determination of Surface Tension of a Liquid.
7. Determination of Mohr's Salt by potentiometric method.
8. Determination of Strength of an acid by pH metric method.
9. Conduct metric titration of mixture of weak and strong acid with sodium Hydroxide.
10. Determination of calcium hardness and magnesium hardness of water Sample.
11. Colorimetry a) Estimation of Manganese b) Estimation of Iron

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Engineering Physics Laboratory

Code:	**EIRPH112**	Category:	**BS**
Credits:	**2**	No. of hours:	**3 per week**
Department:	**Engg. Physics**		

The main aim of the course is to acquaint the students with basic concepts in Engineering Physics using the following illustrative list of experiments.

1. J – by Callender and Barne's Method.
2. Thermal Conductivity of a Bad Conductor – Lee's Method.
3. Magnetic Field Along the Axis of a Circular Coil Carrying Current – Stewart and Gee's Galvanometer.
4. Hall Effect- Measurement of Hall Coefficient.
5. Carey Foster's Bridge – Laws of Resistance and Specific Resistance.
6. Calibration of Low Range Voltmeter – Potentiometer Bridge Circuit.
7. Thickness of a Paper Strip- Wedge Method.
8. Newton's Rings – Radius of Curvature of a Plano Convex Lens.
9. Diffraction Grating – Normal Incidence.
10. Determination of Refractive Indices (o and e) of a Bi-Refringent Material (Prism).
11. Cauchy's Constants – Using a Spectrometer.
12. Dispersive Power of a Prism – Using a Spectrometer.
13. Determination of Rydberg Constant.
14. LASER – Diffraction.
15. Determination of Band Gap in a Semiconductor.
16. Optical Fibres – Numerical Aperture and Loss of Signal.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech I Semester

Programming with C Laboratory

Code:	**EIRCS113**	Category:	**BE**
Credits:	**2**	No. of hours:	**3 per week**
Department:	CSE		

1. Write a program to read the coordinates of a triangle and find the area. Check whether the given points form a triangle or a straight line.
2. Write a program to find the roots of a quadratic equation.
3. Write a program to check whether the given number is prime or not.
4. Write a program to print the Pascal triangle.
5. Using switch-case statement, write a C program that takes two operands and one operator from the user, performs the operation and then prints the answer. (consider operators +,-,/,* and %).
6. Write a program to print Fibonacci series up to a given number.
7. Write a function to find the value of nCr.
8. Write a program to implement binary search.
9. Write a function to swap to numbers by using call by reference.
10. Write a program to delete redundant elements in a given set of values.
11. Write a program to find maximum element of a given array
12. Write a program to arrange the elements in a ascending order.
13. Write a program for addition, multiplication of two given matrices of order M x N.
14. Write a program to check whether the given square matrix is symmetric or not.
15. Write a program to count the no. of words and no. of each vowel in a given sentence.
16. Write a function to sort the given list of names in dictionary order. (use string handling functions)
17. Write a program to read N student records having fields (sno, sname, sex, cgpa) and sort them by CGPA.
18. Write a C program to obtain the product of two matrices A of size (3X3) and B of size (3X2). The resultant matrix C is to be printed out along with A and B. Assume suitable values for A & B.
19. Write C procedures to add, subtract, multiply and divide two complex numbers (x+iy) and (a+ib). Also write the main program that uses these procedures.
20. Write a C program to extract a portion of a character string and print the extracted string. Assume that m characters are extracted starting with the nth character.
21. Write C program using FOR statement to find the following from a given set of 20 integers. i) Total number of even integers. ii) Total number of odd integers. iii) Sum of all even integers. iv) Sum of all odd integers.
22. Write a function that will scan a character string passed as an argument and covert all lower case characters into their upper case equivalents.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

BASIC CIRCUIT THEORY

Code:	**EIREC201**	Category:	**BE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

Unit-I

Charge, Current, Voltage and Power, Voltage and Current sources, Ohms law. Voltage and Current Laws: Nodes, Paths, Loops, Branches. Krichoff's Current Law, Kirchoffs Voltage Law, Single Loop Circuit, Single Node Pair Circuit, Seies and Parallel connected independent sources. Resistors in series and parallel. Voltage and Current Division. Basic Nodal and Mesh Analysis: Nodal Analysis, Super Node, Mesh Analysis, Super Mesh, Nodal vs Mesh Analysis comparison. Useful Circuit Analysis Techniques: Linearity and Superposition, Source Transformations, Thevenins and Nortons equivalent circuits, Maximum Power Transfer. Delta – Wye conversion

Unit – II

Capacitors and Inductors: Capacitor, Inductor, Inductance and Capacitance combinations. Consequences of Linearity. Basic RL and RC Circuits: Source free RL circuits, Properties of the exponential response. Source Free RC Circuit, The unit step function, driven RL circuits. Natural and Forced Response. Driven RC Circuits. The RLC Circuit: The source free parallel circuits. The overdamped parallel RLC circuit. Critical Damping. The Underdamped parallel RLC circuit. The source free series RLC circuit. Complete response of the RLC circuit. The lossless LC circuit

Unit – III

Sinusoidal Steady-State Analysis: Characteristics of sinusoids, forced response to sinusoidal functions, the complex forcing function. The Phasor, Phasor relationships for R, L and C. Impedance, Admittance, Nodal and Mesh analysis. Phasor diagrams. AC Circuit Power Analysis: Instantaneous Power, Average Power, Effective values of current and voltage. Apparent power and power factor, complex power.

Unit – IV

Magnetically Coupled Circuits: Mutual Inductance, Energy considerations, The Linear transformer, Ideal transformer. Complex Frequency and The Laplace Transform: Complex frequency, The damped sinusoidal forcing function. Definition of Laplace transform, Laplace transforms of simple time functions. Inverse transform techniques and Circuit Analysis in the s-Domain: Z(s) and Y(s). Node and Mesh analysis in the s-Domain.

Unit – V

Frequency Response: Poles, Zeros and Transfer functions, Convolution, The complex frequency plane. Parallel resonance, More about parallel resonance. Series resonance. Other resonant forms. Scaling. Bode diagrams, Filters. Two port networks: One port networks, admittance parameters, some equivalent networks, impedance parameters, hybrid parameters and transmission parameters.

Text Books:

1. William H. Hayt Jr. and Jack E. Kemmerly, 'Engineering Circuit Analysis', 7th Edition, McGraw Hill Publications, 2007
2. Vanvalkenburg M.E, 'Network Analysis', Prentice Hall India Publications
3. Basic Engineering Circuit Analysis, 9th Edition, Wiley Publications.

Reference Books

1. 'Network Theory', .Sudhakar & Syammohan, TMH
2. Ryder, J.D. 'Networks, lines and fields' , Prentice Hall, 2nd Ed,1991
3. Networks and Transmission lines, T. Anil Kumar, Pearson Education

HIGHER ENGINEERING MATHEMATICS - I

Code:	**EIRMT202/EURMT202**	Category:	**MT**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**Engg. Maths**		

UNIT-I: Partial Differentiation-1

Introduction to Partial differentiation - Total derivative - Differentiation of implicit functions - Geometrical interpretation - Tangent plane and normal to a surface - Change of variables - Jacobians.

UNIT-II: Partial differentiation-2

Taylor's theorem for functions of two variables. Total differential - Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral sign, Leibnitz's Rule.

UNIT-III: Fourier Series

Euler's formulae - Conditions for a Fourier expansion - Functions having points of discontinuity - Change of interval - Odd and even functions - Expansions of odd or even periodic functions - Half range series and practical Harmonic Analysis.

UNIT-IV: Partial differential equations

Formation of partial differential equations - Solutions of a partial differential equation - Equations solvable by direct integration - Linear equations of the first order - Non-linear equations of the first order - Homogeneous linear equations with constant coefficients - Rules for finding the complementary function - Rules for finding the particular integral.

UNIT-V: Applications of Partial Differential Equations

Method of separation of variables – partial differential equations – wave equation – one dimensional heat flow – two-dimensional heat flow-solution of Laplace equation –Laplace equation in polar co-ordinates.

Text Books:

1. Higher Engineering Mathematics by .B.S Grewal, Khanna Publishers.

References :

1. Advanced Engineering Mathematics by Erwin Kreyszig.Wiley Eastern Pvt. Ltd.
2. Textbook of Engineering Mathematics by N.P.Bali.Laxmi Publications (P) Ltd.
3. Higher Engineering Mathematics by M.K.Venkata Raman. National Pub. Co.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

HIGHER ENGINEERING MATHEMATICS - II

Code:	**EIRMT203/EURMT203**	Category:	**MT**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**Engg. Maths**		

UNIT-I: Multiple Integrals-I

Double integrals- Change of order of integration, Double integrals in Polar coordinates- Areas enclosed by plane curves,

UNIT-II: Multiple Integrals-II

Triple integrals - Volume of solids - Change of variables - Area of a curved surface. Beta and Gamma functions – Properties - Relation between beta and gamma functions – Dirichlet's integrals of type I and type II.

UNIT-III: Vector Differentiation

Scalar and vector fields - Gradient, Divergence and Curl - Directional derivative – Identities - Irrotational and Solenoidal fields.

UNIT-IV: Vector Integration

Line, Surface and Volume integrals - Green's theorem in the plane - Stoke's and Gauss divergence theorems - Introduction of orthogonal curvilinear co-ordinates, Cylindrical co-ordinates and Spherical polar co-ordinates (self study)

UNIT-V: Laplace transforms

Transforms of elementary functions - Properties of Laplace transforms - Existence conditions - Inverse transforms - Transforms of derivatives and integrals - Multiplication by t^n - Division by t - Convolution theorem. Applications to ordinary differential equations and simultaneous linear equations with constant coefficients - Unit step function - Unit impulse function - Periodic functions.

Text Book:

1. Higher Engineering Mathematics by B.S Grewal, Khanna Publishers.

References :

1. Advanced Engineering Mathematics by Erwin Kreyszig. Wiley Eastern Pvt. Ltd.
2. Textbook of Engineering Mathematics by N.P.Bali. Laxmi Publications (P) Ltd.
3. Higher Engineering Mathematics by M.K.Venkata Raman. National Pub.Co.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Solid State Physics

Code:	**EIRPH204**	Category:	**BS**
Credits:	**3**	No. of hours:	**4 per week**

Department: **Engg. Physics**

The aim of the course is to impart knowledge in basic concepts of physics relevant to engineering applications.

UNIT – I

DIELECTRIC PROPERTIES: Introduction - Fundamental Definitions - Local Field - Claussius-Mossotti Relation - Different Types of Electric Polarizations (electronic, ionic, and dipolar polarizations) - Frequency and Temperature Effects on Polarization - Dielectric Loss - Dielectric Breakdown - Determination of Dielectric Constant - Properties and Different Types of Insulating Materials - Ferroelectric Materials - Spontaneous Polarization in $BaTiO_3$ - Electrets.

UNIT-II

MAGNETIC PROPERTIES: Introduction - Fundamental Definitions - Different Types of Magnetic Materials - Weiss Theory of Ferromagnetism - Domain Theory of Ferromagnetism - Hysteresis - Hard and Soft Magnetic Materials - Ferrites - Microwave Applications - Magnetic Bubbles.

UNIT – III

MODERN PHYSICS (QUANTUM PHYSICS): Matter Waves - Heisenberg's Uncertainty Principle - Schrodinger's Time Independent Wave Equation - Physical Significance of Wave Function (ψ) - Application to a Particle in a one Dimensional Box (Infinite Potential Well) - Free Electron Theory of Metals - Band Theory of Solids (qualitative) -Distinction between Metals, Insulators and Semiconductors - Elementary Concepts of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (No Derivation).

UNIT – IV

SEMICONDUCTORS: Introduction - Intrinsic and Extrinsic Semiconductors - Carrier Concentration in Intrinsic Semiconductors - Carrier Concentration in n-Type Semiconductors - Carrier Concentration in p-Type Semiconductors - Hall Effect and Applications -Variation of Carrier Concentration with Temperature - Conductivity of Extrinsic Semiconductor - PN Junction - Forward Bias - Reverse Bias -VI Characteristics of a PN Junction - Fundamentals of LED, LCD - Photovoltaic Cell (Solar Cell).

UNIT – V

SUPERCONDUCTIVITY: Introduction - BCS Theory - Meissner Effect - Properties of Superconductors - Type-I and Type-II Superconductors - High T_c Superconductors - Applications.

NANOSCIENCE: History – Definition - Size Dependent Properties (Qualitative): Mechanical and Electrical - Growth Techniques: Top Down (PVD, Ball Milling) - Bottom Up (Sol-Gel and Co-Precipitation) - Applications.

Prescribed Books :

1. Physics Part I & II by Resnick, Halliday, Krane. John Wiley & Sons.
2. Solid State Physics by P.K. Palanisamy. Scitech Publications (India) Pvt. Ltd, Chennai.
3. A TextBook of Engg.Physics by Kshirsagar & Avadhanulu. S.Chand and Co.
4. Introduction to Nano Technology Charles P. Poole, Frank J. Owens.Wiley

Reference Books:

1. Engineering Physics by R.K.Gaur and S.L.Gupta. Dhanpat Rai & Sons, Delhi.
2. Solid State Physics by S. O. Pillai. New age International (P) Limited, New Delhi.
3. Materials Science by M. Arumugam. Anuradha Agencies, Kumbhakonam.
4. Modern Physics by Arthur Beiser. Tata Mc Graw-Hill.
5. The Feynman Lectures on Physics. Addison-Wesley.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

ELECTRONIC DEVICES AND CIRCUITS

Code: **EIREC205** Category: **BE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit I: Introduction to Electronics

Introduction, Signals, Frequency Spectrum of Signals, Analog and Digital Signals, Amplifiers, Circuit Models for Amplifiers, Frequency Response of Amplifiers, Digital Logic Inverters.

Unit II: Diodes

The Ideal Diode, Terminal Characteristics of Junction Diodes, Modeling the Diode Forward Characteristic, Operation in the Reverse Breakdown Region--Zener Diodes, Rectifier Circuits, Limiting and Clamping Circuits, Physical Operation of Diodes, Special Diode Types.

Unit III: MOS Field-Effect Transistors

Device Structure and Physical Operation, Current -Voltage Characteristics, MOSFET Circuits at DC, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small-Signal Operation and Models, Single-Stage MOS Amplifiers, The MOSFET Internal Capacitances and High-Frequency Model, Frequency Response of the CS Amplifier, The Depletion-Type MOSFET.

Unit IV: Bipolar Junction Transistors

Device Structure and Physical Operation, Current-Voltage Characteristics, The BJT as an Amplifier and as a Switch, BJT Circuits at DC, Biasing in BJT Amplifier Circuits, Small-Signal Operation and Models, Single-Stage BJT Amplifiers, The BJT Internal Capacitances and High-Frequency Model, Frequency Response of the Common-Emitter Amplifier.

Unit V: Operational Amplifiers

The Ideal Op Amp, The Inverting Configuration, The Non-inverting Configuration, Difference Amplifiers, Effect of Finite Open-Loop Gain and Bandwidth on Circuit Performance, Large-Signal Operation of Op Amps, DC Imperfections.

Text Book:

1. Microelectronic Circuits by Sedra / Smith, Fifth edition, Oxford University Press, 2006.

Reference Books:

1. Fundamentals of Microelectronics by Behzad Razavi, Wiley Publications, 200.
2. Integrated Electronics Analog and Digital Circuits, Jacob Millman and Christos C. Halkias, McGraw Hill.
3. Electronic Devices and Circuits – RL Boylestad & Louis Nashelsky, Pearson Education.
4. Electronic Devices & Circuits, Dharma Raj Cheruku & B T Krishna, 2nd edition, Pearson Education, 2008.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Data Structures and Algorithms

Code:	**EIRCS206**	Category:	**BE**
Credits:	**3**	No. of hours:	**3 per week**
Department: **CSE**			

UNIT – I

Data representation: introduction, linear lists, formula based representation, indirect addressing, simulating pointers, comparisons and applications. Arrays, matrices, special and sparse matrices, single linked list, double linked list, circular linked list. , Basics of time complexity

UNIT – II

Stacks: definitions, operations and applications, array and linked representation of stacks. Queues: definitions and operations. Array and linked representation of queues. Applications.

UNIT – III

Trees: definitions and properties, representation of binary trees, operations. Binary tree traversal. AVL trees and operations on AVL trees, B+ trees, operations on B+ trees and applications.

UNIT – IV

Searching & Sorting: merge sort, quick sort, selection sort, heap sort. Complexity analysis. Sequential search, binary search. Various types of hashing.

UNIT – V

Graphs: definitions and representation of graphs. Graph search methods. Applications. Applications, Spanning Tree, Minimum Spanning Tree, Prim's Algorithm, Kruskal's Algorithm.

Text Books:

1. Data Structures. Algorithms and Applications in C++**,** S.Sahani, Tata Mc-Graw Hill.
2. Date Strctures using C and C++, Yedidyah Langsam, MosheJ Augenstein Aaron M. Tenenbaum, Publisher: Prentice Hall India
3. C and Data Structures by E. Balaguruswamy
4. Data Structures – Schaums Outline Series

Reference Books:

1. An Introduction to data structures with applications – Trembly & Sorenson.
2. Data Structures and Algorithms, Aho, Ullman, Hopcroft, Addison Wesley Publications
3. Data Structures and Algorithm Analysis using C 2/e by Allen Weiss, Pearson Education, 1997
4. C The Complete Reference by Herbert Schildt
5. Sartaz Sahani McGraw – HillS.K. Srivatsava, Deepli Srivatsava. BPB Publications.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Electronic Devices and Circuits Laboratory

Code:	**EIREC211**	Category:	**BE**
Credits:	**2**	No. of hours:	**3 per week**
Department: **ECE**			

- Breadboard practice.
- Soldering practice.
- Study of CRO.

1. V-I characteristics of a PN junction diode, Zener Diode & LED.
2. Zener diode Regulator.
3. Half wave Rectifier with and without capacitor filter.
4. Full wave Rectifier with and without capacitor filter.
5. Bridge Rectifier with and without capacitor filter.
6. Clipping and Clamping Circuits using Diodes
7. Input and Output Characteristics of BJT Transistor
8. Characteristics of CB Configuration
9. Characteristics of CE Configuration
10. Analysis of Emitter Follower
11. Input and Output Characteristics of NMOS and PMOS Transistor
12. Input and Output Characteristics of Bipolar Amplifier
13. Input and Output Characteristics of MOS Amplifier

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Engineering Graphics Lab

Code:	**EIRME212**	Category:	**BE**
Credits:	**2**	No. of hours:	**3 per week**
Department:	**Mech. Engg.**		

1. Introduction to AutoCAD, Beginning a new drawing, exploring and interacting with the drawing window, saving and opening a file, Coordinate systems (Cartesian ,polar and relative co-ordinate system)
2. Introduction to draw commands – line, circle, rectangle, polygon etc.
3. Introduction to modify commands – extend, trim, chamfer, rotate, etc.
4. Introduction to dimensioning and object properties.
5. Engineering Curves – Conics –general method, cycloid, epicycloids, hypocycloid, involutes.
6. Projection of planes
7. Sections and sectional views of solids – prism, pyramid, cylinder, cone
8. Developments of solids- prism, pyramid, cylinder, cone.
9. Intersection of solids- prism to prism, cylinder to cylinder

* * *

Integrated Dual Degree Program B.Tech (ECE) + M.Tech II Semester

Data Structures and Algorithms Laboratory

Code:	**EIRCS213**	Category:	**BE**
Credits:	**2**	No. of hours:	**3 per week**
Department: **CSE**			

1. Operation on arrays – insertion and deletion

2. Linked lists-creation, insertion, deletion of single, double and circular lists.

3. Stack- operations using arrays and linked lists.

4. Infix to postfix conversion

5. Evaluation to postfix expression.

6. Queue- operations using arrays and linked lists.

7. Dequeue, circular-operations

8. Binary tree traversals- In order, pre order, post order using recursion

9. Binary tree traversals- In order, pre order, post order using non recursion

10. Linear and binary search

11. Sorting – bubble, insertion, selection, quick sort.

12. Addition, multiplication of sparse matrices

13. Polynomial addition and multiplication

14. Depth first search of a graph

15. Breadth first search of a graph

NOTE:

Detailed description of problems is to be given by the instructor before or at the time of instruction.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Advanced Engineering Mathematics

Code: **EIREC301/EUREC301/EUREI301/EUREE301** Category: **MT**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT –I

Functions of Complex Variables&Applications Analytic functions, Cauchy – Ricmann equations, Harmonic functions, Application to flow problems, Some standard transformations, Conformal mappings, Special confomal mapping $(w = z^2, w = e^z, w = z + \frac{1}{z}, w = \cosh z)$.

UNIT – II

Complex Integration Cauchy's theorem, Cauchy's integral formulas, Taylors theorem(without proof), Laurents theorem (without proof) Residue theorem, evaluation of real and definite integrals.

UNIT – III

Fourier Transforms: Definition, Fourier integral theorem, Fourier transforms, properties of Fourier transformations, Convolution theorem, Parseval's identity for fourier transformations, Relation between Fourier and laplace transforms, Fourier transforms of the derivatives of a functions.

UNIT –IV

Difference equations: Introduction – definition – order and solution of difference equations – linear difference equations – rules for finding complementary function- rules for finding Particular Integral – Difference equations reducible to linear form – simultaneous difference equations with constant coefficient.

UNIT – V

z-transforms: z-transform – definition , some standard z-transforms – linearity property – damping rule – some standard results – shifting rules – initial and final value theorems – convolution theorem – evaluation of inverse of transform- application to difference equations.

Text Books :

1. Higher Engineering Mathematics by Dr. B.S.Grewal, Khanna publishers.

Reference Books :

1. Kreyszig E., Advanced Engineering Mathematics , Wiley Eastern.
2. Text Book of Engineering Mathematics by N.P.Bali et.al, Laxmi publications.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester
Signals and Systems

Code:	**EIREC302/EUREC302**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Signals and Systems. Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Exponential and Sinusoidal Signals. The Unit Impulse and Unit Step Functions. Continuous-Time and Discrete-Time Systems. Basic System Properties

UNIT-II

Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.

UNIT-III

Fourier Series Representation of Periodic Signals: A Historical Perspective. The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering. Examples of Continuous-Time Filters Described by Differential Equations. Examples of Discrete-Time Filters Described by Difference Equations. **Continuous-Time Fourier Transform:** Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Convolution Property. The Multiplication Property. Tables of Fourier Properties and Basic Fourier Transform Pairs. Systems Characterized by Linear Constant-Coefficient Differential Equations.

UNIT-IV

The Discrete-Time Fourier Transform: Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform. The Convolution Property. The Multiplication Property. Tables of Fourier Transform Properties and Basic Fourier Transform Pairs. Duality. Systems Characterized by Linear Constant-Coefficient Difference Equations. **Time- and Frequency Characterization of Signals and Systems:** The Magnitude-Phase Representation of the Fourier Transform. The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Nonideal Filters.

UNIT-V

The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Some Laplace Transform Pairs. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform. **The Z-Transform:** The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Some Common z-Transform Pairs. Analysis and Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transforms.

Text Books:

1. Signals and systems, Alan V. Oppenheim, Alan S. Willsky 2/e, Pearson Education
2. Signals & Systems, P Ramakrishna Rao, Tata Mc Graw Hill, 2008.

Reference Books:

1. Signals & Systems, B P Lathi, B S Publishers
2. Signals & Systems, P Ramesh Babu, Scitech.
3. Signals & Systems, Nagrath, Sharan, Rajan et. Al, TMH.
4. Signals & Systems, Sanjay Sarma, S K Kataria

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Analog Electronic Circuits

Code:	**EIREC303**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

Unit – I

Single-Stage Integrated-Circuit Amplifiers: IC Design Philosophy, Comparison of the MOSFET and the BJT, IC Biasing--Current Sources, Current Mirrors and Current-Steering Circuits, High-Frequency Response--General Considerations, The Common-Source and Common-Emitter Amplifiers with Active Loads, The Common-Emitter Circuit

Unit-II

High-Frequency Response of the CS and CE Amplifiers, The Common-Gate and Common-Base Amplifiers with Active Loads, The Cascode Amplifier, The CS and CE Amplifiers with Source (Emitter) Degeneration, The Source and Emitter Followers, Some Useful Transistor Pairings, Current-Mirror Circuits with Improved Performance.

Unit-III

Differential and Multistage Amplifiers: The MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, the BJT Differential Pair, Other Non-ideal Characteristics of the Differential Amplifier, the Differential Amplifier with Active Load, Frequency Response of the Differential Amplifier, Multistage Amplifiers.

Unit-IV

Feedback: The General Feedback Structure, Some Properties of Negative Feedback, the Four Basic Feedback Topologies, the Series-Shunt Feedback Amplifier, the Series-Series Feedback Amplifier, the Shunt-Shunt and Shunt-Series Feedback Amplifiers, Determining the Loop Gain.

Unit-V

Output Stages and Power amplifiers: Classification of output stages, class A output stage, class B output stage, Class AB output stage, biasing the Class AB output stage, power BJTs, variation on the Class AB configuration, IC power amplifiers, MOS power transistors.

Text Books:

1. Sedra and Smith, Microelectronics 5/e, Oxford Publications, 2007
2. Milliman & Halkias, Integrated Electronics, Tata McGraw Hill Publications

Reference Books:

1. Electronic Devices and Circuits – RL Boylestad & Louis Nashelsky, Pearson Education.
2. Electronic Devices & Circuits, Dharma Raj Cheruku & B T Krishna, 2/e Pearson Education, 2005.
3. Behzad Razavi, Fundamentals of Microelectronics by Wiley Publications, 2009

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

FILTERS AND WAVESHAPING CIRCUITS

Code:	**EIREC304**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Passive Filter Design: Introduction. Filter Transmission, Types and Specification. The Filter Transfer function. Butterworth and Chebyshev Filters. First Order and Second Order Filter Functions. The Second Order LCR Resonator.

UNIT-II

Active Filter Design and Tuned Amplifiers: Second Order Active Filters based on Inductor Replacement. Second Order Active Filters based on the two integrator loop topology. Single Amplifier Biquadratic Active Filters. Sensitivity. Switched Capacitor Filters. Tuned Amplifiers

UNIT-III

Waveshaping Circuits: Integrators and Differentiators: Nonlinear function operations: logarithmic amplifiers, antilogarithmic amplifiers, analog multipliers, sample and hold circuits. Linear halfwave rectifiers, precision rectifiers, peak detectors, ac-to-dc converters, dead zone circuits, precision clipper. Nonlinear Waveshaping circuits. Precision Rectifier Circuits.

UNIT-IV

Oscillators: Basic Principles of Sinusoidal Oscillators. Op Amp RC Oscillator Circuits. LC and Crystal Oscillators. Multivibrators: Bistable Multivibrators, Monostable Multivibrators, Astable multivibrators.

UNIT-V

Sweep Generators: Voltage time base generators: Different sweep circuits, Exponential charging circuit, Miller sweep, Bootstrap sweep, Analysis & design of a VTBG. Current Time Base generators. **Synchronization & Frequency Division:** Pulse Synchronization, Frequency Division in Sweep circuit, Synchronization of sweep circuit with symmetrical signals, Sine wave frequency division with sweep circuit.

Text books:

1. Microelectronic Circuits 5/e Sedra and Smith, Oxford University Press.
2. Pulse & Digital Switching Waveforms, Taub & Schilling, TMH Publications
3. Design of Analog Filters, Rolf Schaumann, Van Valkenburg, Oxford University Press.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Electrical Machines

Code:	**EIREC305/ EUREC305**	Category:	**BE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

DC Machines: Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test, Applications of DC Machines**.**

UNIT-II

Transformers: Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

UNIT-III

Three– Phase Induction Motors: Construction, Rotating Magnetic Field and 3ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting and Speed Control, Losses and Efficiency.

UNIT-IV

Synchronous Machines: Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No – Load and Load, Synchronous Impedance and Voltage Regulation, V–Curves and Inverted V–Curves, Synchronous Condenser, Starting of Synchronous Motors, Applications of Synchronous Machines.

UNIT-V

Single – Phase Motors: Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, split phase type, capacitor start, and capacitor run, shaded pole motors, Universal Motor, Stepper Motor.

Text Books:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.
2. Electrical Machines – P S Bhimbra.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Electromagnetic Waves and Transmission Lines

Code:	**EIREC306/EUREC306**	Category:	**CE**
Credits:	**4**	No. of hours:	**5 per week**
Department: **ECE**			

UNIT-I

Electrostatic Fields: Coulomb's law, Field due to different Charge Distributions, Gauss' law in Integral and Point Form, Concept of Electric Flux Density, Potential Gradient, Conductors & Dielectrics, Concept of Polarization, boundary conditions, Energy stored in Electrostatic field, Poisson's and Laplace Equations and their Applications, Capacitors, Uniqueness theorem, Method of Images.

UNIT-II

Magnetostatic Fields: Steady current, Current distributions, Biot – Savart law, Ampere's Circuital law in Integral and Differential form, Force on Current Elements, Magnetic Potentials, Concept of Magnetic Flux Density, Energy stored in Magnetic Field, Fields in Magnetic Materials – Concept of Magnetization, Self and Mutual Inductances, boundary conditions.

UNIT-III

Electromagnetic Fields: Maxwell's Equations in both Differential and Integral form, Phasor representation of Time – Varying Fields, Displacement Current Density, Conduction Current Density, Boundary Conditions, Poynting Theorem and Applications, Retarded Potentials, Electromagnetic field in Conductors and Dielectrics, Depth of Penetration, Polarization**.**

UNIT-IV

Electromagnetic Waves: Wave Equations, Uniform Plane Wave, Reflection and Refraction of Plane wave, Normal and Oblique Incidence, Surface Impedance.

UNIT-V

Transmission Lines: Transmission Line parameters, Transmission Line equations, Transmission Line examples, Input impedance, Characteristic impedance, Reflection coefficient, VSWR, RF lines. Graphical methods and applications: Smith chart- construction, application, measurement of VSWR, impedance, reflection coefficient, quarter wave transformer, single and double stub matching techniques.

Textbooks:

1. Engineering Electromagnetics, W. H. Hayt Jr., McGraw Hill – New York, 5th edition
2. EM Waves and Radiating Systems, E. C. Jordan PHI, 2nd edition, 2007
3. Elements of Electromagnetics, M.N.O.Sadiku, Oxford Press, 2002.

Reference Books

1. Electromagnetic Field Theory And Transmission Lines, Gottapu Sasibhushana Rao, Wiley India, New Delhi 2012
2. Electromagnetics with Applications, Kraus and Fleisch, McGraw Hill, 1999.
3. Field and wave Electromagnetics, David.K.Cheng, Pearson Education, 2003.
4. Electromagnetic Waves by R. Shivagoenkar, TMH Publications.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Networks and Electrical Machines Laboratory

Code:	**EIREC311**	Category:	**BE**
Credits:	**2**	No. of hours:	**3 Hrs**

Department: **ECE**

1. Verification of KVL & KCL.
2. Verification of Superposition Theorem.
3. Verification of Thevenin & Norton theorem.
4. Measurement of Two port parameters (Z & Y).
5. Calibration of Wattmeter.
6. Parameters of Choke Coil.
7. Open circuit and short circuit tests on transformer.
8. Swimburne's test on DC shunt motor.
9. OCC and external characteristics of DC shunt generator.
10. Load test on 3-phase induction motor.
11. Load test on 1 phase induction motor.
12. Regulation of alternator by synchronous impedance method.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech III Semester

Analog Electronics Laboratory

Code:	**EIREC312**	Category:	**CE**
Credits:	**2**	No. of hours:	**3 Hrs**

Department: **ECE**

1. Feedback Amplifier - Calculation of Gain, Input Resistance, Output Resistance with and without feedback, Frequency Response Characteristic.
2. Design and Implementation of RC Coupled BJT Amplifier
3. Design and Implementation of Cascode MOS Amplifier
4. Design and Implementation of Basic Current Mirror & Cascode Current Mirror
5. Design and Implementation of a Differential Amplifier
6. Understanding the frequency response of CE, CS, Differential Amplifier stages
7. Design and implementation of MOS/BJT Power Amplifier
8. RC Phase-Shift Oscillator
9. Colpitts Oscillator
10. RC Differentiator & RC Integrator
11. Clipping Circuits.
12. Clamping Circuits.
13. Bisatble Multivibrator
14. Monostable multivibrator
15. Astable Multivibrator

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Digital Logic Design

Code:	**EIREC401/EUREC401**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Number Systems: Digital Systems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers. Binary Logic**. Boolean Algebra and Logic Gates.** Basic Definitions. Axiomatic Definition of Boolean Algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other Logic Operations. Digital Logic Gates. Integrated Circuits.

UNIT-II

Gate-Level Minimization: The Map Method. Four-Variable Map. Five-Variable Map. Product of Sums Simplification. Don't-Care Conditions. NAND and NOR Implementation. Other Two-Level Implementations. Exclusive-OR Function. **Combinational Logic:** Combinational Circuits. Analysis Procedure. Design Procedure. Binary Adder-Subtractor. Decimal Adder. Binary Multiplier. Magnitude Comparator. Decoders. Encoders. Multiplexers.

UNIT-III

Synchronous Sequential Logic: Sequential Circuits. Latches. Flip-Flops. Analysis of Clocked Sequential Circuits. HDL For Sequential Circuits. State Reduction and Assignment. Design Procedure. **Registers ad Counters:** Registers. Shift Registers. Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters.

UNIT-IV

Memory and Programmable Logic: Introduction. Random-Access Memory. Memory Decoding. Error Detection and Correction. Read-Only Memory. Programmable Logic Array. Programmable Array Logic. Sequential Programmable Devices

UNIT-V

Asynchronous Sequential Logic : Introduction. Analysis Procedure. Circuits With Latches. Design Procedure. Reduction of State and Flow Tables. Race-Free State Assignment. Hazards. Design Example. **Digital Integrated Circuits**: Introduction. Special Characteristics. Bipolar-Transistor Characteristics. RTL and DTL Circuits. Transistor-Transistor Logic (TTL). Emitter-Coupled Logic (ECL). Metal-Oxide Semiconductor (MOS). Complementary MOS (CMOS). CMOS Transmission Gate Circuits.

Text Books:

1. Switching and finite automata theory, 2nd Ed, Zvi Kohavi, Tata McGraw-Hill ,
2. Digital Design, Morris Mano, Michael D. Ciletti 4/e. Pearson Education
3. Digital Design by John F. Wakerly, 4th edition, PHI

References:

1. Introduction to Switching theory and logic design, 3rd Edition, Frederick J. Hill and Gerald R. Peterson, John Willey and sons, 1981
2. Fundamentals of Logic design, 5th Edition, Charles H. Roth Jr. Thomson Pub.
3. Engineering Approach to Digital Design by Fletcher, Pearson Education

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Linear Integrated Circuits

Code:	**EIREC402**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

Unit- I

DC Performance of an Opamp: Introduction, Input Bias Currents, Input Offset Current, Effect of Bias Current on Output Voltage, Effect of Offset current on Output Voltage, Input Offset Voltage, Input offset Voltage for the adder circuit. Nulling-Out Effect of Offset Voltage and Bias Currents. **AC Performance of an Opamp**: Introduction, Frequency Response of an OpAmp, Amplifier Gain and Frequency Response, Slew Rate and Output Voltage, Noise in the Output Voltage, Loop Gain

Unit- II

Comparators and Controls: Effect of noise on comparator circuits, Positive feedback, Zero crossing detector with hysteresis, voltage level detectors with hysteresis, On-Off control principles, IC Precision comparator, Independently adjustable set point controller. **Differential, Instrumentation and Bridge Amplifiers:** Basic Differential Amplifier, Differential vs Single Ended Amplifiers, Improving the basic differential amplifier, Instrumentation Amplifier, Sensing and Measuring with the Instrumentation Amplifier, Instrumentation Amplifier as a signal conditioning circuit. Measurement of a small resistance change, Balancing a strain gauge bridge.

Unit – III

Modulation, Demodulation and Frequency Changing with the multiplier: Multiplying DC Voltages, Squaring a number of dc voltages, frequency doubling, phase angle detection, analog divider, finding square roots, amplitude modulation, demodulation, balanced modulator, single sideband modulator/demodulator, frequency shifting **Power Supplies:** Introduciton to unregulated power supply, dc voltage regulation, ac ripple voltage, design of a full wave bridge unregulated supply, Need for voltage regulation, history of linear voltage regulators, linear ic voltage regulators.

Unit-IV

Integrated Circuit Timers: Introduction, Operating Modes of the 555 Timer, Terminals of the 555 Timer, Free Running mode and applications, Monostable operation and applications timer/counter applications, switch programmable timer

Unit-V

Digital-to-Analog Converters: Introduction, DAC Characteristics, Digital-to-Analog conversion process, Voltage Output DACs, Multiplying DAC, 8-Bit Digital to Analog Converter DAC-08. Microprocessor Compatibility. **Analog-to-Digital Converters:** ADC Characteristics, Integrating ADC, Successive Approximation ADC, ADCs for Microprocessors. Flash Converters: Principle of Operation, Conversion Time.

Text Books:

1. Op-Amps and Linear Integrated Circuits by R.F Coughlin and F.F Driscoll by Pearson Education, 6th Edition

References:

1. Linear Integrated Circuits by S.Salivahanan,V.S.Kanchan Bhaskaran, TMH edition
2. Op-Amps and Linear ICs, Ramakanth Gayakward, Pearson Education
3. Linear Integrated Circuits, Roy Choudary and Vishal.K.Jain, New Age Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Analog Communications

Code:	**EIREC403/EUREC403**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**

Department: **ECE**

Unit-I

Signals and Signal Space: Size of a Signal, Classification of Signals, Unit Impulse Signal, Signals vs Vectors, Correlation of Signals, Orthogonal Signal Set, Exponential Fourier Series. Analysis and Transmission of Signals: Aperiodic signal representation by Fourier integral, Transforms of useful functions, Some Properties of the fourier transform, Signal Transmission through a linear system, Ideals vs practical filters, Signal distortion over a communication channel, Signal energy and energy spectral density, signal power and power spectral density, Numerical computation of the fourier transform: the DFT.

Unit – II

Amplitude Modulation and Demodulation: Need for modulation. Baseband vs carrier communications, Double Sideband amplitude modulation, Amplitude modulation, Bandwidth efficient amplitude modulation, Vestigial Sideband modulation, Local carrier synchronization, Frequency division multiplexing, Phase locked loop and its applications.

Unit-III

Angle Modulation and Demodulation: Nonlinear modulation, Bandwidth of angle modulated waves, Generating FM waves, Demodulation of FM signals, Effects of nonlinear distortion and interference, superheterodyne analog AM/FM receivers. FM Broadcasting systems.

Unit-IV

Noise: Sources of noise, thermal noise, shot noise flicker noise, white noise, mathematical representation of noise, power spectral density, effect of filtering on noise power spectral density, linear filtering, noise bandwidth, quadrature representation of noise and their power spectral density, noise figure, effective noise temperature, noise calculations for cascade stages.Noise in AM and FM: Signal power, Noise power, Signal to noise ratio for DSBSC, SSB and FM, FM threshold effect.

Unit-V

TRANSMITTERS : Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feed back on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. RECEIVERS : Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting.

Text Books:

1. Modern Digital and Analog Communications Systems 4/e B. P. Lathi, BSP
2. Principles of communication H. Taub and Schilling McGraw Hill.
3. Electronic Communications – Dennis Roddy and John Coolean , 4th Edition, PEA, 2004

Reference Books

1. Electronic Communication Systems G. Kennedy, McGraw Hill.
2. Communication Systems by Bruce Carlson
3. Communications Systems 4/e Simon Haykins, Wiley Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Probability Theory and Random Processes

Code:	**EIREC404/EUREC404**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**

Department: **ECE**

Unit I:

Probability: Probability introduced through Sets and Relative Frequency, Joint and Conditional Probability, Independent Events, Combined Experiments, Bernoulli Trials.

Unit II:

The Random Variable: Introduction, Random Variable Concept, Distribution Function, Density Function, The Gaussian Random Variable, Other distribution and density examples, conditional distribution and density functions. Operation on One Random Variable – Introduction, Expectation, Moments, Functions that give moments, Transformations of a Random Variable

Unit III:

Multiple Random Variables : Vector Random Variables, Joint Distribution and density functions, Properties, Conditional Distribution and Density, Statistical Independence, Distribution and density of a sum of random variables, Central Limit Theorem, (Proof not expected). Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case.

Unit IV:

Random Processes – Temporal Characteristics : The Random Process Concept, Stationarity and Statistical Independence, Correlation Functions, Gaussian Random Processes, Poisson Random Process

Unit V:

Random Processes – Spectral Characteristics : The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function Linear Systems With Random Inputs : Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response

Text Books :

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4tth Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

Reference Books

1. Communication Systems – 3rd Edition Simon Haykin, TMH, 1995.
2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Theory and Random Processes - S.P. Eugene Xavier, SChand Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Antennas and Wave Propagation

Code:	**EIREC405**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Introduction to Antennas: Introduction, Types of Antennas, Radiation Mechanism, Current Distribution on a Thin Wire Antenna. **Fundamental Parameters of Antennas**: Introduction, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Numerical Techniques, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna Vector Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friis Transmission Equation and Radar Range Equation, Antenna Temperature

UNIT-II

Radiation Integrals and Auxiliary Potential Functions: Introduction, The Vector Potential A for an Electric Current Source J, The Vector Potential F for a Magnetic Current Source M, Electric and Magnetic Fields for Electric (J) and Magnetic (M), Current Sources, Solution of the Inhomogeneous Vector Potential Wave Equation, Far-Field Radiation, Duality Theorem, Reciprocity and Reaction Theorems.

UNIT-III

Antennas for Communications and Radar Applications: Wire antennas: Short Dipole Half-Wave Dipole, Monopole, Small Loop Antenna. **Aperture Antennas:** Magnetic current and its fields, Sheet current distribution, Sheet current distribution in free space, General current distribution, aperture in a conducting screen. Slot Antenna, Open-ended Waveguide radiator, Horn antenna, Pyramidal Horn Antenna, Reflector Antennas. **Special Antennas:** Monopole and Dipole antennas, Long wire, V and Rhombic antennas, Yagi-Uda array, Turnstile antenna, Helical Antenna, Biconical antenna, Log-periodic dipole array, Spiral antenna, Microstrip Patch antenna.

UNIT-IV

Arrays: Linear, Planar, and Circular: Introduction, Two-Element Array, N-Element Linear Array: Uniform Amplitude and Spacing, N-Element Linear Array: Directivity, Design Procedure, N-Element Linear Array: Three-Dimensional Characteristics, Rectangular-to-Polar Graphical Solution, N-Element Linear Array: Uniform Spacing, Nonuniform Amplitude, Superdirectivity, Planar Array Design Considerations. **Antenna Synthesis and Continuous Sources**: Introduction, Continuous Sources, Schelkunoff Polynomial Method, Woodward-Lawson Method.

UNIT-V

Wave Propagation: Ground wave propagation: Free space propagation, ground reflection, surface waves, diffraction, wave propagation in complex environments, Tropospheric propagation, Tropospheric scatter. Ionospheric Propagation: Electrical properties of the ionosphere, effect of earth's magnetic field

Textbooks:

1. Antenna Analysis and Design **3/e** Contantine A. Balanis Wiley Publications, 2009.
2. Antennas and Wave Propagation, **1/e**, A.R. Harish & M. Sachidananda, Oxford University Press, 2007

Reference Books:

1. Antennas and Wave Propagation by A.Harish, Satchidananda, Oxford University Press
2. EM Waves and Radiation Systems, E. C. Jordan and K. G. Balmain, PHI–N. Delhi, 1997
3. Antennas J.D. Kraus, McGraw Hill Publications.
4. Antenna Theory and Practice, Rajeswari Chatterjee, Wiley Eastern Ltd. – N. Delhi
5. Electronic and Radio Engineering, F. E. Terman, McGraw Hill – New York
6. Antennas and Wave Propagation, Annapurna K. Das, Sisir K. Das, Tata Mc Graw Hill, 2012.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Control Systems

Code:	**EIREC406/EUREC406**	Category:	**CE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Transfer functions of linear systems: Impulse Response of linear systems, Block diagrams of control systems, signal flow graphs(simple problems), reduction techniques for complex block diagrams and signal flow graphs. Introduction mathematical modeling of physical systems, Equations of electrical networks, modeling of Mechanical systems, equations of mechanical systems .

UNIT-II

Time domain Analysis of control systems: Time response First and Second order systems with standard input signals, steady state error constants, Introduction to PD, PI and PID Controllers, effect of derivative and integral control on transient and steady state performance of feedback control systems.

UNIT-III

Concepts of stability and necessary conditions for Stability: Routh-Hurwitz criterion, relative stability analysis, the concept and construction of Root loci. Analysis of control systems with Root locus.

UNIT-IV

Frequency Response Analysis: correlation between time and frequency responses, Polar Plots, Bode Plots, Log Magnitude versus Phase Plots, All pass and Minimum phase systems, Nyquist stability Criterion, Constant M and N circles.

UNIT-V

State Space Analysis; Introduction, Concept of state, State variables and State Model, state model for linear continuous time systems, solutions of state equations, concept of controllability and observability.

Textbook:

1. Control Systems Engineering. I.J.Nagarath and M.Gopal, Wiley Eastern ltd
2. Control Systems-A.Nagoorkani, RBA Publications, 1998

Reference Books:

1. Modern Control Engineering, Ogata, PHI publication
2. Automatic Control Systems, Benjamin C. Kuo, PHI publication.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Digital Logic Design Laboratory

Code:	**EIREC411**	Category:	**CE**
Credits:	**2**	No. of hours:	**3 per week**
Department: **ECE**			

1. Minimization and realization of a given function using gates
2. Function generation using deCoders and multiplexers
3. Experiments on priority enCoder using 74LS148
4. Applications of multiplexers
5. Seven-segment display experiments
6. Four bit and eight bit adders and subtractors
7. Experiments using 74LS181 and 74LS182 ICs (ALU and Carry look ahead adders)
8. Experiments on SR latch and Master-Slave JK flip-flops using SSI gates
9. Design and testing of ripple counters using ICs (binary and mod-N)
10. Design and testing of Mod-N synchronous counters
11. Design and testing of Shift registers, Ring and Johnson Counters
12. Experiments using ROMs
13. Study of Programmable Logic Devices

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Linear Integrated Circuits Laboratory

Code:	**EIREC412**	Category:	**CE**
Credits:	**2**	No. of hours:	**3 per week**
Department: **ECE**			

1. Study of Inverting & Non inverting Op Amp Characteristics.
2. Measurement of Op Amp Parameters
3. Applications of Op Amps
4. Binary using 741 IC.
5. Schmitt Trigger using 741 IC.
6. 555 Timer - Monostable and Astable mode
7. Three Terminal IC Voltage Regulator
8. A/D Converters
9. D/A Converters
10. Active filters.
11. PLL and its applications
12. VCO Characteristics
13. Simulation of any FOUR experiments of the above using PSPICE

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

English Language Laboratory

Code:	**EIREC413**	Category:	**CE**
Credits:	**2**	No. of hours:	**3 per week**
Department:	**ECE**		

Topics
Introduction to Phonetics
Accent / Stress
Intonation
Telephone Etiquette
Synonyms
Antonyms
One Word substitutes
Foreign Phrases
Idiomatic Expressions
Vocabulary & Grammar exercises
Listening Comprehension
E-mail Etiquette
Report Writing

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IV Semester

Industrial Tour

Code:	**EIREC414**	Category:	**IT**
Credits:	**Non credit audit course**	Department:	**ECE**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

MICROPROCESSORS AND INTERFACING

Course Code: **EIREC501/EUREC501** Category: **CE**

Credits: **3** Hours: **4 per week**

Department: **ECE**

UNIT I:

8086- Architechture, Pin Diagrams And Timing Diagrams: Register Organization, Architecture, Signal description of 8086, Physical Memory Organization, General Bus organization, I/O Addressing Capability, Special Processor Activities, Minimum Mode and Maximum Mode Systems and Timings.

UNIT II:

8086 - Instruction Set And Assembler Directives: Machine Language Instruction Formats, Addressing Modes, Instruction Set, Assembler Directives and Operators, a Few Machine Level programs, Machine Coding the Programs, Programming the Assembler, Assembly Language Example Programs.

UNIT III:

Basic Peripherals And Their Interfacing With 8086: Semi conductor Memory Interfacing, Dynamic RAM Interfacing, Interfacing I/O Ports, PIO 8255, Modes of Operation of 8255, Interfacing A/D converters, Interfacing D/A converters, Stepper motor Interfacing, Programmable Communication interface 8251 USART.

UNIT IV:

Interrupts And Programming: Introduction to Stack, Stack Structure of 8086, Interrupts and Interrupt Service Routines, Instruction Cycle of 8086, Non Mask able Interrupt, Mask able interrupt, Interrupt Programming, Passing Parameters to Procedures, Handling Programs of Size more than 64k, Programmable Interrupt controller 8259, Programmable interval Timer 8253, DMA Controller 8257

UNIT V:

An Introduction To Micro Contollers 8051: Intel Family of 8 Bit Micro Controllers, Architecture, Signal Description, Register Set of 8051, important operational features of 8051, Memory and I/O Addressing, Interrupts of 8051, Instruction set of 8051**.**

Text Books:

1. Advanced Microprocessors And Peripherals by A .K .Ray , K.M Bhurchandi**,**TMH Publishers,2006

Reference Books:

1. Micro computer systems, The 8086/8088 Family Architecture, Programming and Design – Y.Liu and G.A. Gibson, PHI, 2nd edition.
2. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486,and Pentium processors. Architecture, programming and interfacing".
3. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd edition, TMH.
4. 8086 Micro Processor -Kenneth J. Ayala, Penram International/ Thomson,1995.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester
DIGITAL COMMUNICATIONS

Course Code:	**EIREC502/EUREC502**	Category: **CE**
Credits:	**3**	Hours: **4 per week**
Department: **ECE**		

Unit-I

Pulse Modulation: Sampling Process, Pulse-Amplitude Modulation, Pulse-Position Modulation, Completing the Transition from Analog to Digital, Quantization Process, Pulse-Code Modulation, Delta Modulation, Differential Pulse-Code Modulation, Line Codes, Theme Examples.

Unit-II

Baseband Data Transmission: Baseband Transmission of Digital Data, The Intersymbol Interference Problem, The Nyquist Channel, Raised-Cosine Pulse Spectrum, Baseband Transmission of M-ary Data, The Eye Pattern, Theme Example: Equalization

Unit-III

Digital Band-Pass Modulation Techniques: Some Preliminaries, Binary Amplitude-Shift Keying, Phase-Shift Keying, Frequency-Shift Keying, Summary of Three Binary Signaling Schemes, Noncoherent Digital Modulation Schemes, M-ary Digital Modulation Schemes, Mapping of Digitally Modulated Waveforms onto Constellations of Signal Points, Theme Examples.

Unit-IV

Noise in Digital Communications: Bit Error Rate, Detection of a Single Pulse in Noise, Optimum Detection of Binary PAM in Noise, Optimum Detection of BPSK, Detection of QPSK and QAM in Noise, Optimum Detection of Binary FSK, Differential Detection in Noise, Summary of Digital Performance.

Unit-V

Information Theory: Uncertainty, Information and Entropy, Source Coding Theorem, Data compaction, Discrete Memoryless channels, Mutual Information, Channel Capacity, Channel coding theorem, Differential Entropy. **Error Control Coding:** Rationale for coding, Linear Block Codes, Cyclic Codes, Convolutional Codes, Maximum Likelihood Decoding of Convolutional Codes, Sequential Decoding.

Text Books

1. Simon Haykin, Michael Moher :An Introduction to Analog and Digital Communications, 2nd Edition, Wiley Publications, 2006
2. Simon Haykin, Communication Systems, Fourth Edition, 2001

Reference Books

1. John G. Proakis, Digital Communications, 5/e, Tata Mcgraw Hill Publications, 2010.
2. John Proakis and Salehi, Fundamentals of Communication Systems, Pearson Education, 2005
3. Herbert Taub & Schilling, Principles of Communication Systems, Tata McGraw Hill publications, 2007 revised edition
4. A. Bruce Carlson, Paul B. Crilly, Janet C. Rutledge, Communication Systems, Fourth Edition, Tata Mcgraw Hill publications, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

MICROWAVE ENGINEERING

Course Code: **EIREC503/EUREC503** Category: **CE**

Credits: **3** Hours: **4 per week**

Department: **ECE**

UNIT-I

Microwave waveguides: Introduction, Microwave Frequencies, Rectangular waveguides,Circular waveguides,Microwave cavities.

UNIT-II

Microwave Tubes: High frequency limitations of conventional tubes, Reentrant cavities, Klystrons, velocity modulation process, bunching process, output power and beam loading. Multi cavity Klystron amplifiers. Applications. Reflex Klystron: Velocity modulation, power output and efficiency, electronic admittance, mode patterns. Slow wave structures, Traveling wave tube, amplification process, wave modes, gain considerations.

Microwave Crossed-Field Tubes : Magnetron - types, principle of operation of cylindrical magnetron, cavity magnetron, theory of oscillations, Hartee resonance condition: Pi-mode separation

UNIT-III

Microwave Circuits and passive components: Concept of microwave circuit, normalized voltage and current. Introduction to scattering parameters & their properties, Faraday rotation, ferrite devices, gyrators, isolators, circulators and their properties, wave meters, Scattering matrix representation of microwave junctions, bends, directional couplers, wave guide tees, magic tee, attenuator, phase shifter.

UNIT-IV

Microwave Semiconductor Devices: Classification, GUNN diode principle of operation, Modes. IMPATT Diodes, Physical Structures, Negative Resistance, Power Output and efficiency, TRAPATT Diodes, Physical Structures, Principles of Operation, Power Output and Efficiency, PIN diode, varactor diode, parametric amplifiers, Tunnel diode, point contact diode, Schottky barrier diode, Microwave transistors.

UNIT-V

Microwave Measurements: Introduction, microwave bench measurement setup, Frequency and wavelength measurements, measurement of power, VSWR, impedance, coupling & directivity of directional coupler, dielectric constant and phase shift constant.

Textbooks:

1. Microwave Devices and Circuits - Samuel Y. Liao, PHI,3rd edition
2. Microwave & Radar Engineering – M. Kulkarni.

Reference Books:

1. Microwave and Radar Engineering, Gottapu Sasibhushana Rao, Pearson Education., New Delhi, 2014
2. Foundations of Microwave Engg.-R.E.Collins,TMH

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

DIGITAL SIGNAL PROCESSING

Course Code: **EIREC504** Category: **CE**

Credits: **3** Hours: **4 per week**

Department: **ECE**

UNIT-I

Review of discrete time signals, systems and transforms: Discrete time signals-sequences, Linear shift Invariant systems, Stability and causuality, Linear constant coefficient Difference equations, Frequency Domain representation of Discrete Time Systems and signals, Some symmetry properties of the Fourier transform, **Z-transform**-Inverse Z-transform, Z-transform theorems and properties, System function.

UNIT-II

The Discrete Fourier transform(DFT): Representation of Periodic sequences-The Discrete Fourier series, Fourier representation of Finite Duration sequences-The Discrete Fourier transform, computation of DFT, Properties of the DFT, Circular convolution and linear convolution using DFT, overlap-add method, overlap-save method, Fast Fourier Transform(FFT), Radix-2 decimation-in-time and decimation-in -frequency algorithms, Inverse FFT.

UNIT-III

Implementation of Discrete time systems: **Structures for FIR systems**: Direct form structure, Cascade-Form Structures. **Structures for IIR systems**: Direct form structure, Cascade-Form Structures Parallel form Structures. **Finite word length effects in digital filters**: Fixed and floating point representation of numbers, Quantization of filter coefficients -Analysis of sensitivity to Quantization of filter coefficients ,Quantization of coefficients in FIR filters, Round off effects in digital filters-Limit cycle oscillations in recursive systems.

UNIT-IV

Design of IIR filters: Design of IIR filters from analog filters, Butterworth filters,

Chebyshev filters, IIR filter design by impulse Invariance, IIR filter design by the Bilinear Transformation.

UNIT-V

Design of FIR filters&DSP processors: Linear phase characteristics, Design of Linear phase FIR Filters using Windows and frequency sampling method,Design of Optimum Equiripple Linear Phase FIR filters. **DSP architecture** for signal processing-Harvard architecture, pipelining, hardware multiplier- accumulator, Fixed point digital processors, Floating point digital signal processors.

Text Books:

1. A. V. Oppenheim and R. W. Shafer, Discrete-Time Signal Processing, Prentice Hall India, 2/e, 2004.
2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007.

Reference Books

1. Sanjay K.Mitra- Digital signal processing- A computer based approach, TMH.
2. Ifeacher E.C & Jervis B.W, Digital signal processing –A practical approach, Pearson Edu.
3. Digital Signal Processing, P.Ramesh Babu, Scitech Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Course Code: **EIREC505** Category: **BE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction- Measurement and error definitions, Accuracy and precision significant figures, Types of errors. Standard Analysis:- Probability errors, limiting errors. Standards of measurement, classification of standards, emf, resistance, current, induction, capacitance standards. Bridges

UNIT-II

Electronic Instrumentation for Measuring basic Parameters: Introduction – PMMC Principle – PMMC ammeters, voltmeters – extension of ranges, AC voltmeters using rectifiers – True RMS responding voltmeter – Electronic Multimeter – Digital Voltmeters – Component Measuring Instruments – Q-meter – Vector Impedance Meter – Vector Voltmeter RF Power and Voltage Measurement.

UNIT-III

Oscilloscopes – Block diagram – Cathode ray tube – electrostatic focusing-deflection system-Oscilloscope probes and transducers – Oscilloscope Techniques – observation of the wave forms – Lissajous patters. Special Oscilloscope – analog storage oscilloscope – Digital storage oscilloscope – Sampling oscilloscope.

UNIT-IV

Signal Analysis : Wave analyzer – Heterodyne analyzer – Harmonic distortion analyzer spectrum analyzer**.**

UNIT-V

Data acquisition system – types, components of analog and digital data acquisition system – multiplexing –use of analog and digital recorders-use of filters and sample hold circuits – Bus interface standards – IEEE-488 GPIB organization.

Text Books :

1. Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney,2002 edition
2. Electronic Measurements and Instrumentation by B.H. Oliver and Cage,McGraw Hill.

Reference Books:

1. Electronic Measurements by Terman and Pettit, McGraw Hill Publications.
2. Electronic Measurements, H.S. Kalsi, TMH

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

COMPUTER ARCHITECTURE & ORGANIZATION

Course Code: **EIREC506** Category: **CE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

UNIT-I

Register Transfer and Micro operations: Register transfer language - Register transfer - Bus and Memory transfers – Arithmetic micro operations - Logic micro operations – Shift micro operations – Arithmetic Logic Shift Unit

Computer Arithmetic: Introduction- Addition and Subtraction- Floating point Arithmetic operations- Decimal Arithmetic Unit

UNIT-II

Basic Computer Organization: Instruction Course Codes – computer registers – computer instructions – timing and control – instruction cycle – memory reference instructions – input-output and interrupt – complete computer description

UNIT-III

CPU Organization: Introduction - general register organization – stack organization - instruction formats – addressing modes – data transfer and manipulation – program control – Reduced Instruction Set Computer(RISC) – Complex Instruction Set Computer(CISC)

UNIT-IV

Micro programmed Control: Control memory – address sequencing – microinstruction format – vertical and horizontal microinstructions – micro program example – design of control unit.

UNIT-V

Memory Organization: Memory hierarchy – main memory – associative memory – cache memory – virtual memory.

Input-Output organization: Peripheral devices – input/output interface – asynchronous data transfer – modes of transfer – direct memory access.

Text Book:

1. Mano, Morris M., Computer System Architecture, 3rd ed. Pearson Education Asia, 2000.

References:

1. Stallings W., Computer Organization and Architecture, 6th ed. Pearson Education Asia, 2000

2. Hamacher, V.C., Z.G.Vranesic, and S.G.Zaky, Computer Organization, 3rd ed, McGraw-Hill, 1990

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester
COMMUNICATION SYSTEMS LABORATORY

Course Code: **EIREC511** Category: **CE**
Credits: **2** Hours: **3 per week**
Department: **ECE**

1. AM generation and demodulation.
2. FM generation and FM demodulation (using 1496, 565 & 566 ICs)
3. Pre-emphasis and de-emphasis
4. Radio Receiver Measurements
5. Balanced Modulator
6. Frequency Multiplier
7. IF amplifier
8. SSB Generation and Detection
9. Transmission Lines parameters
10. Pulse Amplitude Modulation.
11. Sampling
12. Multiplexing & Demultiplexing
13. PWM & PPM.

Integrated Dual Degree **Program B.Tech (ECE) + M.Tech V Semester**
ELECTRONIC CIRCUIT SIMULATION LABORATORY

Course Code: **EIREC512** Category: **CE**
Credits: **2** Hours: **3 per week**
Department: **ECE**

1. V-I characteristics of a PN junction diode, Zener Diode & LED.
2. Zener diode Regulator.
3. Characteristics of CE Transistor and its h parameters.
4. Analysis of Emitter Follower
5. RC Phase - Shift Oscillator.
6. Wien - Bridge Oscillator.
7. RC Differentiator & RC Integrator.
8. Clipping Circuits.
9. Clamping Circuits.
10. Schmitt Trigger using 741 IC.
11. 555 Timer - Monostable and Astable modes

Integrated Dual Degree Program B.Tech (ECE) + M.Tech V Semester

English Communication Skills Lab

Course Code: **EIREC513** Category: **HS**
Credits: **2** Hours: **3 per week**
Department: **ECE**

Department: English

I. Concept and Importance of Communication.

II. Developing Communicative Abilities.

III. Paper Presentation – Planning, Preparation and Presentation using Audio-Visual aids.

IV. Research Reports.

V. Oral Presentation:

a. Group Discussion.

b. Interviews

c. Conducting a Meeting.

Recommended Books:

1. Himstreet, William C., Gerald w.Maxwell, Mary Jean Onorato. Business Communications. A Guide to effective writing, speaking and listening. Gelencoe publishing company. California 1982.
2. Murphy, Hurta A etal, Effective Business communications, The McGraWHill companies Inc. 1997.
3. Thill, John V./ Bovee, Courtland L. Excellence in Business Communication. McGraw Hill Inc. 1996.
4. Lesitar & Pettit. Report writing for Business. Irwin – McGraw Hill. 1995. Tenth Edition.
5. Paulery and Riordan. Technical report writing today. Houghton Mifflin company. 1999.5th edition. Reprint.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
RADAR ENGINEERING

Course Code:	**EIREC601/EUREC601**	Category:	**CE**
Credits:	**4**	Hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Introduction: Introduction to Radar, Radar Waveform, Radar Equation, Radar Block Diagram and Operation, applications, Radar frequencies, Radar Cross-section of targets, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Probability density function, false alarm, Signal to Noise ratio, Integration of Radar Pulses, Transmitter Power, PRF, Range Ambiguities, Radar Antenna Parameters, System Lossless and Propagation Effects.

UNIT-II
CW Radar and FM CW Radar: Doppler Effect, CW Radar, FM CW Radar, FM-CW Altimeter, Airborne Doppler Navigation, Multiple Frequency CW Radar. MTI and Pulse Doppler Radar: Introduction, principle, MTI radar with power amplifier and power oscillator transmitter, Delay line Cancellers, blind speeds, double cancellation, staggered PRFs, Range gated Doppler filter, Limitations to the MTI performance Moving target Detector, , MTI from a moving platform, MTI verses Pulse Doppler Radar.

UNIT-III
Tracking Radar: Introduction, Sequential Lobing, Conical Scanning, Monopulse tracking Radar, Phase comparison Monopulse, Low range tracking, Comparison of trackers, tracking in range.

UNIT-IV
Radar Receiver and Elementary Concepts of Compression: Radar receiver, Receiver Noise, Noise figure, Duplexers, Radar Displays, Receiver Protectors. Matched filter receiver. Phase Course Coded pulse compression, Synthetic Aperture Radar (SAR), Phased Array Radars, MST Radar, ECM, and ECCM.

UNIT-V
Radar Navigational aids: Principles of Direction finders, Aircraft Homing, Instrument Landing System, Hyperbolic Navigation, LORAN, DECCA, OMEGA, Inland Shipping Aids .Introduction to the Radar Clutter, Surface clutter radar equation, sea clutter, detection of targets in clutter.

Text Book:
1.Introduction to Radar Systems, Skolnik, McGraw Hill, 2nd Edition

Reference Book:
1.Radar Principles ,Technology,Applications, Byron Edde,Prentice Hall.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS

Code:	**EIREC602**	Category:	**CE**
Credits:	**4**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I
Telecommunication Switching Systems: Introduction, Elements of switching network configuration, strowger switching components, principles of cross bar switching, Electronic space division switching.

UNIT-II
Time division switching, Combination switching. **Telephone Networks**: Subscriber loop systems, switching hierarchy and routing, transmission plan, numbering plan, charging plans.

UNIT-III
Signaling Techniques: In channel signaling, common channel signaling. Network traffic parameters, grade of service and blocking probability

UNIT-IV
Data Communication Networks: Introduction, network architecture, layered network protocols, data communications hardware, Public switched data networks, connection oriented & connection less service, Circuit Switching, switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN, Repeaters, Bridges, Routers and gate ways.

UNIT-V
Integrated Services Digital Networks: Introduction, motivation, ISDN interfaces, functional grouping, reference points, protocol architecture, signaling, numbering, BISDN, **DSL Technology**: ADSL, Cable Modem, HFC Networks. **SONET**: Devices, Frame, Frame Transmission.

Text Books:

1. Telecommunication switching systems and networks-Thiagarajan Viswanathan, PHI, 2007.
2. Advanced electronic communications systems - Wayne Tomasi, PHI, 2004

Reference Books:

1. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001.
2. Data Communications & Networks - Achyut. S.Godbole, TMH, 2004.
3. Principles of Communication Systems – H. Taub & Schilling, TMH, 2nd Ed.
4. Data Communication & Networking- B.A.Forouzan, TMH, 3rd Edition, 2004.
5. Data Communications, Prakash. C. Gupta, PHI, 2001.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
SATELLITE COMMUNICATIONS

Course Code: **EIREC603** Category: **CE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

UNIT I

Over View of Satellite Systems: Introduction, frequency allocations for Satellite services, Intelsat,InSAT,Polar Orbiting satellites, Indian scenario, Applications

UNIT II

Orbits and Launching methods : Keplers Laws of planetary motion,Orbital elements,Orbit perturbations,Inclined orbits,Geostationary orbits, sub satellite point, predicting satellite position, Standard Time,Antenna Look angles,

UNIT III

The space segment : Introduction ,Power supply and attitude control, Station keeping, TT&C, transponders,The antenna sub system, Link design: Up link , down Link and satellite link design

UNIT IV

Modulation , multiplexing and multiple access :Introduction, analog and digital transmission systems, analog and digital modulations, Multiplexing techniques, FDMA,TDMA,CDMA,PN Sequence, spread spectrum, Demand assignment multiple access, SPADE

UNIT V

The earth segment:Introduction, Polarization of satellite signal and antenna. Atmospheric effects, Ionospheric effects, Rain attenuation and other propagation impairments, Transmit-receive earth stations,Satellite networks:Bandwidth, ATM over satellite , Internet through satellites and satellite mobile services.

Text books:

1. Satellite Communications : Dennis Roddy ,Tata McGrawHill, fourth edition.

2. Satellite Communication, T. Pratt and S. W. Bostian, John Wiley and Sons.

Reference Books:

1. Satellite Communication, D. C. Agarwal, Khanna Publishers.
2. Satellite Communication, Dharma Raj Cheruku, IK International Publishing House, New Delhi, 2009.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
ENGINEERING ECONOMICS & MANAGEMENT

Course Code:	**EIREC604/EUREC605/EUREI605**	Category:	**HS**
Credits:	**3**	Hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Fundamentals of Economics – Scarcity and Efficiency Market, Command and Mixed Economics. Basic Elements of Supply and Demand – Law of Demand – Elasticity of Demand.

UNIT-II

Business Organizations – Individual Proprietorship – Partnership – The Corporation. Statement of Profit and Loss – The Balance Sheet – Break-Even Analysis – Cost Concepts – Elements of Costs.

UNIT-III

Principles and Functions of Management – Evolution of Management Thought – Decision Making Process. Organization Theory and Process – Leadership – Motivation – Communication – Conflict Management in Organization.

UNIT-IV

Plant Location – Plant Layout – Production Planning and Control – Product Design and Development – Channels of Distribution.Materials Management – Inventory Control.

UNIT-V

Industrial Disputes and their Settlement – Provision of Factories Act and Industrial Disputes Act.
Recent Trends in Contemporary Business Environment.

Text Books:

1. Engineering Economics – Vol. 1 – Tara Chand, Nem Chand & Brothers , 13th ed
2. Industrial Engineering and Management by o.P Khanna, Khanna Publishers Ltd.

References:

1. Engineering and Managerial Economics – Maheswari, Sultan Chand & Co, 19th ed.
2. A Text book of Economic Theory by Dhingra and Garg, Sultan Chand & Sons, 2nd ed.
3. Cost accounts by Shukla and Grewal, S. Chand & Company, 14th ed.
4. Principles and Practice of Managament by L.M. Prasad, Sultan Chand & Sons.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
DIGITAL SIGNAL PROCESSING LABORATORY

Course Code: **EIREC611** Category: **CE**
Credits: **2** Hours: **3 per week**
Department: **ECE**

Part – I: Digital Signal Processing with Matlab (6 Lab Sessions)

Generation of Discrete Time Sequences, Implementation of Discrete Time Systems, Frequency Analysis of Discrete Time Sequences, Frequency Analysis of Discrete Time Systems, Structures for Digital Filter Design, FIR Filter Design, IIR Filter Design Discrete Fourier Transform, Properties, Applications to Spectral Analysis, Speech, Audio, Image and Video Processing (Basic Operations)

Part – II: Real-Time Digital Signal Processing Laboratory (6 Lab Sessions)

Review of DSP Processor Basics, Study of TMS320C6713 DSP Processor architecture, Study of DSK6713 Hardware and Software API, LED Blinking, Line-In Line-Out, Sine Wave Generation (using Look Up Table Method), FIR Filter Implementation, IIR Filter Implementation, FFT Implementation, Adaptive Filter Implementation

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
ADVANCED COMMUNICATIONS LABORATORY

Course Code: **EIREC612** Category: **CE**
Credits: **2** Hours: **3 per week**
Department: **ECE**

1. Generation of PSK Signals and detection
2. Generation of FSK Signals and detection
3. PCM Transmission
4. Differential PCM
5. Delta Modulation and Detection
6. Continuously variable slope Delta Modulation
7. Design of Fiber-Optic Digital Link for Transmission of Digital Signals
8. Study of Pseudo Random Binary Sequences (PRBS)
9. Study of Error Check Course Course CodeLogic
10. Calculation of Attenuation, Coupling losses, Bending losses of Fiber Optic Cable
11. Study of Electromagnetic / Radio Frequency Interference using Optic Link
12. Measurement of Antenna Parameters.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
MICROPROCESSOR LABORATORY

Course Code: **EIREC613** Category: **CE**
Credits: **2** Hours: **3 per week**
Department: **ECE**

1. Block manipulation.
2. Arithmetic operations-Addition and subtraction of n numbers.
3. Multiplication.
4. Hexadecimal counters: 8-bit and 16-bit.
5. Decimal counters: up and down
6. Hexadecimal clock
7. Flashing displays
8. Keyboard management.
9. Interrupts
10. Interfacing D/A converter
11. Interfacing A/D converter
12. Traffic light interface
13. Logic controller interface
14. Elevator interface

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

PERSONALITY DEVELOPMENT

Course Code: **EIREC614** Category: **HS**
Credits: **Noncredit course** Department: **ECE**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

OPERATING SYSTEMS

Course Code:	**EIREC621**	Category:	**UE**
Credits:	**3**	Hours:	**4 per week**
Department:	**ECE**		

UNIT I

Computer System and Operating System Overview: Overview of Computer System hardware , Instruction execution , I/O function , Interrupts ,Memory hierarchy , I.O Communication techniques. Operating System Objectives and functions , Evolution of operating System , Introduction to the issues in communication with devices, kernel and shell of an operating system. Example Systems.

UNIT II

Process Description , Process Control ,Process States, Process and Threads , Examples of Process description and Control. **Concurrency :** Principles of Concurrency , Mutual Exclusion , semaphores , Monitors , Message Passing. **Principles of deadlock** , deadlock prevention, detection and avoidance dining philosophers problem , example Systems.

UNIT III

Memory Management : Memory Management requirements , linking and loading, processes and primary memory management , memory allocation policies ,virtual memory , hardware and Control structures , OS Software , Examples of Memory Management.

UNIT IV

Uniprocessor Scheduling : Types of Scheduling , Scheduling algorithms , I/O management and Disc Scheduling , I/O devices , organization , of I/O function , OS design issues , I/O buffering , Disk I/O , disk scheduling Policies , examples System.

UNIT V

File Management and Security : Overview of file management , file organization and access , File Directories , File sharing , record blocking , secondary Storage Management , example system.

Security : Security threats , Protection , intruders , Viruses , trusted System. Case studies of Linux, Unix, Windows XP, VxWorks operating systems

Text Books :

1. Operating Systems' , Internal and Design Principles, Stallings, Fifth Edition,2005, Pearson Education/PHI.
2. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.

References :

1. Operating System A Design Approach,Crowley,TMH.
2. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
Digital Image Processing

Course Code: **EIREC622** Category: **UE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

UNIT-I
Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels, distance measures, connectivity, Image Geometry, Photographic film. Histogram: Definition, decision of contrast basing on histogram, operations basing on histograms like image stretching, image sliding, Image classification. Definition and Algorithm of Histogram equalization. **Image Transforms** 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform

UNIT-II
Image Enhancement: (by SPATIAL Domain Methods) Arithmetic and logical operations, point operations, Smoothing filters-Mean, Median, Mode filters. Edge enhancement filters – Directorial filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, Prewitt filter, Contrast Based edge enhancement techniques. Low Pass filters, High Pass filters, sharpening filters. **Color image processing**: Color fundamentals, color models.

Unit III
Image Enhancement: (by FREQUENCY Domain Methods) Design of Low pass, High pass, EDGE Enhancement, smoothening filters in Frequency Domain. Butter worth filter, Homomorphic filters in Frequency Domain, Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain.

UNIT-IV
Image Compression: Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM.,Lossy Compression: Transform coding –– Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

UNIT-V
Image Segmentation Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.
Image Restoration Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.
Applications: Automatic visual system in part inspection, forensic and security system, entertainment- multimedia, scientific and medical investigation.

Text Books:

1.Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson Ed., 2nd Education, 2002.

2.Fundamentals of Digital Image processing – A.K.Jain, Prentice Hall of India.

Reference Books:

1.Digital Image processing using MAT LAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Edition, PEA, 2004.

2.Digital Image Processing – William K. Pratt, John Wiley, 3rd Edition, 2004.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

SPEECH SIGNAL PROCESSING

Course Code: **EIREC623** Category: **UE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

Unit 1
Introduction:The Speech Signal, Digital Speech Processing Applications, The Process of Speech Production, Acoustic Phonetics, The Acoustic Theory of Speech Production, Models Based upon the Acoustic theory,: Vocal Tract, Radiation, Excitation, Digital Models for Speech Signals

Unit II
Time-domain methods for Speech Processing:Time-Dependent Processing 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.
Digital Representation of the Speech Waveform:Delta Modulation: Linear Delta Modulation, Adaptive Delta Modulation, Differential PCM (DPCM): DPCM with Adaptive Quantization, DPCM with Adaptive Prediction, and Comparison of Systems

Unit III
Short-Time Fourier Analysis:Definitions and Properties of Fourier Transform Interpretation, Spectrographic Displays, Pitch Detection, Analysis-by-Synthesis, Analysis-Synthesis Systems.
Homomorphic Speech Processing: Homomorphic Systems for Convolution, the Complex Cepstrum of Speech, Pitch detection, Formant Estimation, the Homomorphic Vocoder

Unit IV
Linear Predictive Coding of Speech:Basic Principles of Linear Predictive Analysis, Solution of the LPC Equations, The Prediction Error Signal, Relations between the Various Speech Parameters, Synthesis of Speech from Linear Predictive Parameters, Applications of LPC Parameters

Unit V
Digital Speech Processing for Man-Machine Communications by Voice:Voice Response Systems: Speech Synthesis by concatenation of Formant-Coded Words, Typical Applications of computer voice response systems. Speaker Recognition Systems: Speaker Verification systems, Speaker Identification systems. Speech Recognition Systems: Isolated digit recognition system

Text Book

1. Rabiner L.R. & Schafer R.W., "Digital Processing of speech signals", PHI, 1978

Reference Books

1. Discrete-Time Speech Signal Processing, Principles and Practice, Thomas F.Quatieri, Pearson Education
2. A Practical Handbook of Speech Coders, Randy Goldberg, Lance Riek, CRC Press
3. Digital Speech Transmission, Enhancement, Coding and Error Concealment, by Peter vary and Rainer Martin, Wiley
4. Applied Speech and Audio Processing with Matlab examples by Ian McLaughlin, Cambridge University Press
5. Springer Handbook of Speech Processing by Jabcob Benesty, M.Mohan Sondhi, Yiteng Huang Springer.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

OBJECT ORIENTED ANALYSIS AND DESIGN

Course Code:	**EIREC624**	Category:	**UE**
Credits:	**3**	Hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT-II

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

UNIT-III

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

Basic Behavioral Modeling-I: Interactions, Interaction diagrams.

UNIT-IV

Basic Behavioral Modeling-II: Use cases, Use case Diagrams, Activity Diagrams.

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

UNIT-V

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

Case Study: The Unified Library application.

Text books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.

Reference books:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEYDreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hil Companies.
4. Mark Priestley: Practical Object-Oriented Design with UML,TATA McGrawHill
5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester
CELLULAR AND MOBILE COMMUNICATIONS

Code:	**EIREC631**	Category:	**UE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Cellular mobile radio systems: Introduction to Cellular Mobile System, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells.**Elements Of Cellular Radio System Design :** General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, Cell splitting, consideration of the components of Cellular system

UNIT-II

Interference : Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

Cell Coverage For Signal And Traffic: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model

UNIT-III

Cell site and mobile antennas : Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

UNIT-IV

Frequency management and channel assignment: Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

UNIT-V

Handoff:Dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

Textbooks:

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn, 2006.
2. Principles of Mobile Communications – Gordon L.Stuber, Springer International 2nd Edition,2007.

Reference Books:

1. Mobile Cellular Communication, Gottapu Sasibhushana Rao, Pearson Education., New Delhi, 2013.
2. Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.
3. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.
4. Wireless Communication and Networking – Jon W. Mark and Weihua Zhqung, PHI, 2005.
5. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

WIRELESS COMMUNICATIONS AND NETWORKS

Course Code:	**EIREC632**	Category:	**CE**
Credits:	**3**	Hours:	**4 per week**
Department: **ECE**			

UNIT-I

History and evolution. Types of mobile wireless services / systems -Cellular Standards, Future trends in personal wireless systems. Cellular concept and frequency reuse, Channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations. Radio wave propagation issues-Propagation models , Multipath fading-Parameters of mobile multipath channels, Antenna systems in mobile radio.

UNIT-II

Multiple Access Techniques for Wireless Communication: Introduction, FDMA, TDMA, Spread Spectrum Multiple access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols. Introduction to Wireless Networking, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks.

UNIT-III

Wireless Data Services: Common channel signaling, ISDN, BISDN and ATM, SS7, SS7 user part, signaling traffic in SS7. **Mobile IP and Wireless Access Protocol:** Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

UNIT-IV

Wireless LAN Technology: Infrared LANs, Spread spectrum LANs, Narrow bank microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer. **BlueTooth:** Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

UNIT-V

Mobile Data Networks: Introduction, Data oriented CDPD Network, GPRS and higher data rates, Short messaging service in GSM, Mobile application protocol. **Wireless ATM & HiPER LAN:** Introduction, Wireless ATM, HIPERLAN, Adhoc Networking and WPAN.

Text Books:

1. Wireless Communication and Networking – William Stallings, PHI, 2003.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2nd Edn., 2002.

Reference Books:

1. Mobile communications – Jochen Schiller, Pearson Education.
2. Lee W.C.Y., "Mobile Communications Engineering: Theory and Applications", Second Edition, McGraw Hill, New York,1998
3. Telecommunication switching systems and networks – Thiagarajan Viswanathan, PHI
4. Wireless Digital Communications – Kamilo Feher, PHI, 1999.

5. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, Pearson Education, 2002.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

EMBEDDED SYSTEMS

Course Code:	**EIREC633**	Category:	**UE**
Credits:	**3**	Hours:	**4 per week**
Department: **ECE**			

UNIT I

A First look at Embedded Systems: Examples of Embedded Systems, Typical Hardware. **Hardware Fundamentals for the Software Engineer**: Terminology, gates, a few other basic consideration, timing diagrams, memory. **Advanced Hardware Fundamentals**: Microprocessors, Buses, Direct Memory Access, Interrupts, Other common parts, built-Ins on the microprocessor, conventions used on schematics, A sample schematics, A last word about Hardware.

UNIT II

Interrupts: Microprocessor Architecture, Interrupt Basics, The Shared-Data Problem, Interrupt Latency**.** Survey of Software Architectures: Round-Robin, Round-Robin with Interrupts, Function-Queue-Scheduling Architecture, Real-Time Operating System Architecture, Selecting an Architecture.

UNIT III

Introduction to Real-Time Operating Systems: Tasks and Tasks States, Tasks & data, Semaphores and Shared Data. **More Operating System Service:** Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT IV

Basic Design Using a Real-Time Operating System: Overview, Principles, An Example, Encapsulating Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory Space, Saving Power.

UNIT V

Embedded Software Development Tools: Host and Targets Machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System. **Debugging Techniques**: Testing on your host machine, Instruction set simulators, the assert macro.

Text Books:

1. David E. Simon, “An Embedded Software Primer”, Pearson Education India

Reference Books:

1. David E. Simon, “An Embedded Software Primer”, Pearson Education India
2. Wayne Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman Publishers.
3. Jane.W.S. Liu, “Real-Time systems”, Pearson Education Asia.
4. C. M. Krishna and K. G. Shin, “Real-Time Systems” , McGraw-Hill, 1997
5. Frank Vahid and Tony Givargis, “Embedded System Design: A Unified Hardware/Software Introduction” , John Wiley & Sons.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VI Semester

ADVANCED COMMUNICATION SYSTEMS

Course Code: **EIREC634** Category: **UE**
Credits: **3** Hours: **4 per week**
Department: **ECE**

UNIT – I :**Optical Fiber Transmission Media**:

Introduction, History of optical fiber communications, Optical Fibers vs metallic cable facilities, electromagnetic spectrum, block diagram of an optical fiber communication system, optical fiber types, light propagation, optical fiber configurations, optical fiber classifications, losses in optical fiber cables, light sources, optical sources, light detectors, lasers, optical fiber system link budget

UNIT – II :Microwave Radio Communications and System Gain

Introduction, Advantages and Disadvantages of Microwave radio, Analog vs digital microwave, frequency vs amplitude modulation, frequency modulated microwave radio system, fm microwave radio repeaters, diversity, protection switching arrangements, fm microwave radio stations, microwave repeater station, light of sight path characteristics, microwave radio system gain

UNIT – III: Digital Telephone Transmission

Pulse Modulation, PCM, PCM Sampling, Signal to Quantization Noise ratio, linear vs nonlinear pcm codes, idle channel noise, coding methods, companding, vocoders, pcm line speed, delta modulation pcm, adaptive delta modulation pcm, differential pcm, pulse transmission, signal power in binary digital signals. Time division multiplexing, T1 digital carrier, North American Digital hierarchy, Digital Carrier line coding, T-Carrier systems, European Digital Carrier System, Digital Carrier frame synchronization, Bit vs Word interleaving, statistical time division multiplexing, codecs and combo chips, frequency division multiplexing, AT&Ts FDM hierarchy, composite baseband signal, formation of a mastergroup, wavelength division multiplexing. Public Telephone Network: Telephone transmission system environment, public telephone network, instruments, local loops, trunk circuits and exchanges.

UNIT- IV: Cellular Telephone Concepts

Mobile Telephone Service, evolution of cellular telephone, cellular telephone, frequency reuse, interference, cell splitting, sectoring, segmentation and dualization, celluar system topology, roaming and handoffs, cellular telephone network components, cellular telephone call processing

UNIT V: Cellular Telephone Systems

Introduction, First generation analog cellular telephone, personal communications, system, second generation cellular telephone systems, Digital Cellular telephone, interim standard 95 (IS-95), North americal cellular and pcs summary, global system for mobile communications, personal satellite communication systems.

Text book:

Advanced electronic communication systems-Wayne Tomasi, Prentice Hall

Reference Books:

1.Electronic Communication systems.George Kennedy.TMH

2.Digital telephony.John BELLAMY,Wiley PUBLICATIONS.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VII Semester
Introduction to VLSI Design

Code :	**EIREC701**	Category:	**PGC**
Credits	: **4**	No. of hours:	**8 per week**
Department:	**ECE**		

UNIT-I

Review of microelectronics and introduction to MOS technology: Introduction to IC Technology, MOS and related VLSI technology, Enhancement mode MOS transistor, Depletion mode MOS transistor, nMOS fabrication, CMOS fabrication, Comparison of NMOS, CMOS, BICMOS, GaAs Technologies, thermal aspects of processing, production of E beam masks.

UNIT-II

Basic Electrical Properties of MOS and BiCMOS Circuits: Drain-to-Source Current vs Voltage relationships, Aspects of MOS transistor threshold voltage, MOS transistor transconductance and output conductance, The Pass Transistor, The NMOS inverter, Determination of Pullup to Pulldown ratio of NMOS transistor driven by another nmos transistor. Alternate forms of Pullup. The CMOS inverter. MOS transistor circuit model. Latch up in CMOS circuits.

Unit-III

MOS and BICMOS circuit design process: MOS layers, stick diagrams, design rules and layout, 2μ.meter, 1. 2μ.meter CMOS rules. Layout diagrams, Symbolic diagrams.

UNIT-IV

Basic circuit concepts: Sheet resistance, Area capacitance of layers, delay unit, wiring capacitances, choice of layers. **Scaling of MOS circuits:** Scaling models, Scaling function for device parameters, Limitation of Scaling.

UNIT-V

Sub system design and Layout: Architectural issues, switch logic, Gate logic, examples of structural design (Combinational logic), Some clocked sequential circuits. **Memory Register and Aspects of System Timing:** Some commonly used storage/memory elements. **Subsystem Design Process:** General Arrangement of 4-bit arithmetic processor, Regularity, Design of an ALU subsystem. **CMOS Projects:** Incrementer/Decrementer, Comparator for two n-bit numbers.

Text book:

1. Douglas A, Pucknell, Kamran Eshraghian, Basic VLSI design, Prentice-Hall, 1996 3rd edition.
2. Douglas A, Pucknell, Kamran Eshraghian, Essentials of VLSI Circuits and Systems, Prentice Hall Publications.

Reference book:

1. Mead, C.A and Conway, L.A, Introduction to VLSI systems, Wesley-Wesley
2. Kang, Leblibici, CMOS Digital Integrated Circuits, Tata McGraw Hill Publications, 2001
3. Jan M. Rabaey, Digital Integrated Circuits, Second Edition, Pearson Education, 2002.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VII Semester

Industrial Training*

Code:	**EIREC711**	Category:	**IT**
Credits:	**8**		

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

VHDL Laboratory

Code:	**EIREC811**	Category:	**CE**
Credits:	**2**	No. of hours:	**6 per week**
Department:	**ECE**		

Modeling and Functional Simulation of the following digital circuits (with Xilinx/ModelSim tools) using VHDL/Verilog Hardware Description Languages

Part – I Combinational Logic:
Basic Gates, Multiplexer, Comparator, Adder/ Substractor, Multipliers, DeCourse Coders, Address deCourse Coders, parity generator, ALU

Part – II Sequential Logic:
D-Latch, D-Flip Flop, JK-Flip Flop, Registers, Ripple Counters, Synchronous Counters, Shift Registers (serial-to-parallel, parallel-to-serial), Cyclic EnCourse Coder / DeCourse
Coder.

Part – III Memories and State Machines
Read Only Memory (ROM), Random Access Memory (RAM), Mealy State Machine, Moore State Machine, Arithmetic Multipliers using FSMs. Demonstration of FPGA and CPLD Boards, Demonstration of Digital design using FPGAs and CPLDs

Text Books:
1.VHDL Primer J. Bhasker, Pearson Education, India
2.Digital Systems Design Using VHDL by Charles H. Roth, Thomson Brookle

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Project-I

Code:	**EIREC813**	Category:	**UPW**
Credits:	**10**	No. of hours:	**6 per week**
Department:	**ECE**		

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VII Semester

Analog IC Design

Code:	**EIRVD702**	Category:	**PGC**
Credits:	**3**	No. of hours:	**8 per week**
Department:	**ECE**		

UNIT I

Basic MOS Device Physics: General Considerations, MOSFET as a Switch, MOSFET Structure, MOS Symbols, MOS I/V Characteristics, Threshold Voltage, Derivation of I/V Characteristics, Second-Order Effects, MOS Device Models, MOS Device Layout, MOS Device Capacitances, MOS Small-Signal Model, MOS SPICE models, NMOS versus PMOS Devices, Long-Channel versus Short-Channel Devices.

UNIT II

Single-Stage Amplifiers, Basic Concepts , Common-Source Stage, Common-Source Stage with Resistive Load ,CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode, Choice of Device Models.

UNIT III

Differential Amplifiers, Single-Ended and Differential Operation. Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell, **Passive and Active Current Mirrors,** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties

UNIT IV

Frequency Response of Amplifiers, General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair **Feedback** General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise

UNIT V

Operational Amplifiers, General Considerations , Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps , Gain Boosting , Comparison , Common-Mode Feedback . Input Range Limitations, Slew Rate, Power Supply Rejection. **Stability and Frequency Compensation** General Considerations, Multipole Systems, Phase Margin, Frequency Compensation, Compensation of Two-Stage Op Amps, Slewing in Two-Stage Op Amps, Other Compensation Techniques.

Text Books:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill, 2001.

Reference Books:

1. P. R. Gray & R. G. Meyer, Analysis and Design of Analog Integrated Circuits, Fifth Edition, John Wiley, 2010.
2. R. Gregorian and Temes, Analog MOS Intgrated Circuits for Signal Processing, Wiley, 1986.
3. Ken Martin, Analog Integrated Circuit Design, Wiley Publications, 2002.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2001
5. B.Razavi, Fundamentals of Microelectronics, Wiley Publications, 2008

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VII Semester
Digital System Design

Code: **EIRVD703/ EIRDS703** Category: **PGC**
Credits: **3** No. of hours: **8 per week**
Department: **ECE**

UNIT I

Review of Logic Design Fundamentals: Combinational Logic / Boolean Algebra and Algebraic Simplification Karnaugh Maps / Designing with NAND and NOR Gates / Hazards in Combinational Circuits / Flip-Flops and Latches / Mealy Sequential Circuit Design / Design of a Moore Sequential Circuit / Equivalent States and Reduction of State Tables / Sequential Circuit Timing / Tristate Logic and Busses

UNIT II

Introduction to VHDL: Computer-Aided Design / Hardware Description Languages / VHDL Description of Combinational Circuits / VHDL Modules / Sequential Statements and VHDL Processes / Modeling Flip-Flops Using VHDL Processes / Processes Using Wait Statements / Two Types of VHDL Delays: Transport and Inertial Delays / Compilation, Simulation, and Synthesis of VHDL Code / VHDL Data Types and Operators / Simple Synthesis Examples / VHDL Models for Multiplexers / VHDL Libraries / Modeling Registers and Counters Using VHDL Processes / Behavioral and Structural VHDL / Variables, Signals, and Constants / Arrays / Loops in VHDL / Assert and Report Statements

UNIT III

Introduction to Programmable Logic Devices: Brief Overview of Programmable Logic Devices / Simple Programmable Logic Devices (SPLDs) / Complex Programmable Logic Devices (CPLDs) / Field-Programmable Gate Arrays (FPGAs) Design Examples: BCD to 7-Segment Display Decoder / A BCD Adder / 32-Bit Adders / Traffic Light Controller / State Graphs for Control Circuits / Scoreboard and Controller / Synchronization and Debouncing / A Shift-and-Add Multiplier / Array Multiplier / A Signed Integer/Fraction Multiplier / Keypad Scanner / Binary Dividers

UNIT IV

SM Charts and Microprogramming: State Machine Charts / Derivation of SM Charts / realization of SM Charts / Implementation of the Dice Game / Microprogramming / Linked State Machines

UNIT V

Designing with Field Programmable Gate Arrays: Implementing Functions in FPGAs / Implementing Functions Using Shannon's Decomposition / Carry Chains in FPGAs / Cascade Chains in FPGAs / Examples of Logic Blocks in Commercial FPGAs / Dedicated Memory in FPGAs / Dedicated Multipliers in FPGAs / Cost of Programmability / FPGAs and One-Hot State Assignment / FPGA Capacity: Maximum Gates Versus Usable Gates / Design Translation (Synthesis) / Mapping, Placement, and Routing

Text Books :

1. Charles Roth, Lizy Kurian John, Principles of Digital System Design using VHDL, Cengage Learning, 2009.

Reference Books:

1. John F. Wakerly, Digital Design Principles and Practices, Pearson Education, 2002..
2. Digital Systems Design using VHDL by Charles Roth, Cengage Learning, 1998.
3. Michael Ciletti, Advanced Digital Design using Verilog HDL, Prentice Hall Publications, 2006
4. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte) 1994.
5. S.Trimberger, Field Programmable Gate Array Technology, Kluwer Academic Publications ,1994.
6. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
7. S.Brown, R.Francis, J.Rose, Z.Vransic, Field Programmable Gate Array, Kluwer Pubications, 1992.
8. S.Brown, R.Francis, J.Rose, Z.Vransic, Fundamentals of Digital Logic with Verilog Design, Kluwer Pubishers, 1992.FPGA Based system Design, Wayve Woldf, Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester
Digital IC Design

Code:	**EIRVD801**	Category:	**PGC**
Credits:	**3**	No. of hours:	**4 per week**

Department: **ECE**

UNIT-I

Introduction: Historical Perspective, Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design - Cost of an Integrated Circuit, Functionality and Robustness, Performance, Power and Energy Consumption – The Manufacturing Process - Introduction, Manufacturing CMOS Integrated Circuits, The Silicon Wafer, Photolithography, Some Recurring Process Steps Simplified CMOS Process Flow, Design Rules — The Contract between Designer and Process Engineer

UNIT-II

Devices: Introduction, The Diode, A First Glance at the Diode — The Depletion Region, Static Behavior, Dynamic, or Transient, Behavior, The Actual Diode—Secondary Effects, The SPICE Diode Model, The MOS(FET) Transistor, A First Glance at the Device, The MOS Transistor under Static Conditions, Dynamic Behavior, The Actual MOS Transistor—Some Secondary Effects, SPICE Models for the MOS Transistor – **Wire:** Introduction, A First Glance, Interconnect Parameters — Capacitance, Resistance, and Inductance, Capacitance, Resistance, Inductance

UNIT-III

The CMOS Inverter: Introduction, The Static CMOS Inverter — An Intuitive Perspective, Evaluating the Robustness of the CMOS Inverter: The Static Behavior, Switching Threshold, Noise Margins, Robustness Revisited, Performance of CMOS Inverter: The Dynamic Behavior, Computing the Capacitances, Propagation Delay: First-Order Analysis, Propagation Delay from a Design Perspective, Power, Energy, and Energy-Delay, Dynamic Power Consumption, Static Consumption, Perspective: Technology Scaling and its Impact on the Inverter Metrics

UNIT-IV

Designing Combinational Logic Gates in CMOS: Introduction, Static CMOS Design, Complementary CMOS, Ratioed Logic, Pass-Transistor Logic, Dynamic CMOS Design, Dynamic Logic: Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Perspectives, How to Choose a Logic Style, Designing Logic for Reduced Supply Voltages

UNIT-V

Designing Sequential Logic Circuits: Introduction, Timing Metrics for Sequential Circuits, Classification of Memory Elements, Static Latches and Registers, The Bistability Principle, Multiplexer-Based Latches Master-Slave Edge-Triggered Register, Low-Voltage Static Latches, Static SR Flip-Flops—Writing Data by Pure Force, Dynamic Latches and Registers, Dynamic Transmission-Gate Edge-triggered Registers C2MOS—A Clock-Skew Insensitive Approach, True Single-Phase Clocked Register (TSPCR), Pipelining: An approach to optimize sequential circuits, Latch- vs. Register-Based Pipelines, NORA-CMOS—A Logic Style for Pipelined Structures, Non-Bistable Sequential Circuits, The Schmitt Trigger, Monostable Sequential Circuits, Astable Circuits, Perspective: Choosing a Clocking Strategy

Text Books :

1. Jan M. Rabaey Anantha Chandrakasan, & Borivoje Nikolic, Digital Integrated Circuits – A design perspective, Second Edition, PHI, 2003

Reference Books:

1. S. M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits, Third Edition, McGraw Hill, 2003.
2. Jackson & Hodges, Analysis and Design of Digital Integrated circuits. 3rd Ed. TMH Publication, 2005.
3. Ken Martin, Digital Integrated Circuit Design, Oxford Publications, 2001.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Semiconductor Devices

Code: **EIRVD821** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT I

Review of Electronics in Solids. Electronics in Semiconductors: Introduction, Bandstructure of semiconductors, Holes in semiconductors, bandstructures of some semiconductors, Mobile carriers, Doping, Carriers in doped semiconductors, **Carrier Dynamics in Semiconductors**: Introduction, Scattering in semiconductors, Velocity electric field relations in semiconductors, Very high field transport, carrier transport by diffusion, charge injection and quasi Fermi levels, carrier generation and recombination, Continuity equation.

UNIT II

Junctions in Semiconductors: Device demands, Unbiased p-n junction, p-n junction under bias, real diode, high voltage effects in diodes, modulation and switching ac response. Spice model**. Semiconductor Junctions with metal and insulators:** Metals as conductors, Schottky barrier diode, Ohmic contacts, Insulator-semiconductor junctions.

UNIT III

Bipolar Junction Transistors: Introduction, Bipolar transistor, static characteristics of bipolar transistors, bjt static performance parameters, secondary effects in real devices, a charge control analysis, bipolar transistor as an inverter, high frequency behavior of bjt. Spice model. Bipolar transistors: A Technology roadmap.

UNIT IV

Field Effect Transistors(MOSFET): Introduction, MOSFET, structure and fabrication, metal-oxide semiconductor capacitor, capacitance voltage characteristics of the mos structure, metal oxide semiconductor field effect transistor, important issues in real mosfets,

UNIT V

Field Effect Transistors (JFET, MESFET): Introduction, JFET, MESFET, Current voltage characteristics, effects in real devices, high frequency high speed issues. **Semiconductor Optoelectronics:** Introduction, Optical absorption in a semiconductor, photo current in a p-n diode, P-I-N photodetector, Light emission, semiconductor laser-basic principles.

Text Books:

1. Jasprit Singh, Semiconductor Devices, Basic Principles, Wiley Student Edition, 2001
2. Ben G. Streetman, Solid State Electronic Devices, Sixth Edition, Prentice Hall India, 2009.

Reference Books:

1. Yuan Taur, Tak.H.Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press, 1998
2. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003
3. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.
4. Semiconductor Devices, Basic Principles Jasprit Singh, Wiley Publications, 2001
5. S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 1998
6. Analysis and Design of Analog Integrated Circuits 4/e, Paul R. Gray, Paul J. Hurst, Robert G Meyer, 2001, Wiley Publications
7. Physics of Semiconductor Devices 3/e S. M. Sze, Wiley Publications, 2007.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Operation and Modeling of MOS Transistor

Code: **EIRVD822** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Semiconductors, Junctions, and Mosfet Overview: Introduction, Semiconductors, Conduction Contact Potentials, Thepn Junction, Overview of the MOS Transistors, Fabrication Processes and Device Features. **The Two Terminal MOS Structure:** Introduction, The Flat-Band Voltage, Potential Balance and Charge Balance, Effect of Gate - Body Voltage on Surface Condition, Accumulation and Depletion, Inversion, Small - Signal Capacitance, Summary of Properties of the Regions of Inversion

UNIT-II

The Three Terminal MOS Structure: Introduction, Contacting the Inversion Layer, The Body Effect, Regions of Inversion, "CB Control" Point of View. **The Four - Terminal MOS Transistor**
Introduction, Transistor Regions of Operation, Complete All - Region Model, Simplified All - Region Models, Models Based on Quasi - Fermi Potentials, Regions of Inversion in Terms of Terminal Voltages, Strong Inversion, Complete Strong -Inversion Model, Weak Inversion Special Conditions in Weak Inversion , Moderate Inversion and Single - Piece Models, Source - Referenced vs. Body - Referenced Modeling, Effective Mobility, Effect of Extrinsic Source and Drain Series Resistances, Temperature Effects, Breakdown, The p-Channel MOS Transistor

UNIT-III

Small Dimension Effects: Introduction, Carrier Velocity Saturation, Channel Length Modulation, Charge Sharing, Drain - Induced Barrier Lowering, Punchthrough, Combining Several Small - Dimension Effects Into One Model - A Strong Inversion Example, Hot Carrier Effects; Impact Ionization, Velocity Overshoot and Ballistic Operation, Polysilicon Depletion, Quantum Mechanical Effects, DC Gate Current, Junction Leakage; Band - to - Band Tunneling; GIDL, Leakage Currents – Examples, The Quest for Ever - Smaller Devices.

UNIT-IV

The MOS Transistor In Dynamic Operation - Large Signal Modeling: Introduction, Quasi - Static Operation, Terminal Currents in Quasi - Static Operation, Evaluation of Intrinsic Chargers in Quasi - Static Operation, Transit Time Under DC Conditions, Limitations of the Quasi - Static Model, Non - Quasi - Static Modeling, Extrinsic Parasitics,

UNIT-V

Small - Signal Modeling for Low and Medium Frequencies: Introduction, A Low - Frequency Small - Signal Model for the Intrinsic Part, A Medium - Frequency Small - Signal Model for the Intrinsic Part, Including the Extrinsic Part, Noise, All - Region Models. **High Frequency Small - Signals Models:** Introduction, A Complete Quasi - Static Model, y- Parameter Models, Non - Quasi - Static Models, High - Frequency Noise, Consideration In MOSFet Modeling for RF Applications

Text Books :

1. Yannis Tsividis and Colin McAndrew , Operation and Modeling of the MOS Transistor, Third Edition, Oxford University Press, 2011

Reference Books:

1. Taur and Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press.
2. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003
3. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.
4. Semiconductor Devices, Basic Principles Jasprit Singh, Wiley Publications, 2001
5. S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 1998
6. Analysis and Design of Analog Integrated Circuits 4/e, Paul R. Gray, Paul J. Hurst, Robert G Meyer, 2001, Wiley Publications
7. Physics of Semiconductor Devices 3/e S. M. Sze, Wiley Publications, 2007

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Advanced Digital Signal Processing

Code: **EIRVD823/ EIRRM824** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department:**ECE**

UNIT-I

Multirate Digital Signal Processing – Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Implementation of Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications of Sampling Rate Conversion, Digital Filter Banks Two-Channel Quadrature Mirror Filter Bank.

UNIT-II

Linear Prediction And Optimum Linear Filters - Random Signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations Wiener Filters for Filtering and Prediction.

UNIT-III

Adaptive Filters - Applications of Adaptive Filters, Adaptive Direct-Form FIR Filters-The LMS Algorithm, Adaptive Direct-Form FIR Filters-RLS Algorithms.

UNIT-IV

Power Spectrum Estimation – Basic Methods Estimation of Spectra from Finite-Duration Observations of Signals, Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation.

UNIT-V

Power Spectrum Estimation – Advanced Methods: Filter Bank Methods: Capon's method, Eigenanalysis Algorithms for Spectrum Estimation: Pisarenko Harmonic Decomposition Method, MUSIC algorithm, ESPIRIT algorithm, Eigen Decomposition method

Text Books

1. Digital Signal Processing : Principles, Algorithms and Applications - Proakis, J.Gard and D.G.Manolakis, Fourth Edition, PHI, 2006.

Reference Books

1. Monson Hayes, Statistical Digital Signal Processing, Wiley Student Edition, 2008
2. Manolakis, Vijay Ingle, Statistical and Adaptive Signal Processing by Artech Book House, 2009.
3. P.P. Vaidyanathan, Multirate systems and Filter banks, Prentice Hall, 1993
4. V. Oppenheim and R.W.Schafer, Discrete time Signal Processing, PHI 1994
5. S.J. Orfanidis, Optimum Signal Processing, McGraw Hill, 1989.
6. Wavelet Transforms: Introduction to Theory and Applications, Raghuveer M Rao, Ajit S, Bopardikar, Pearson Education 2000.
7. Insight into Wavelets, Ramachandran and Soman, Prentice Hall Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Advanced Computer Organization

Code:	**EIRVD824**	Category:	**PGE**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

Unit-I

Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Stacks, Subroutines, Additional Instructions, Dealing with 32-Bit Immediate Values, CISC Instruction Sets, RISC and CISC Styles, Example Programs, Encoding of Machine Instructions

Unit-II

Basic Input/Output: Accessing I/O Devices, Interrupts**. Software:** The Assembly Process, Loading and Executing Object Programs, Linker, Libraries, Compiler, Debugger, High Level Language for IO Tasks, Interaction between Assembly and C Language, The Operating System

Unit-III

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors. **Pipelining:** Basic Concept—The Ideal Case, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource Limitations, Performance Evaluation, Superscalar Operation, Pipelining in CISC Processors

Unit-IV

Input/Output Organization: Bus Structure, Bus Operation, Arbitration, Interface Circuits, Interconnection Standards. **The Memory System:** Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage

Unit-V

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication. Integer Division, Floating-Point Numbers and Operations. **Parallel Processing and Performance**: Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling

Text Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, Computer Organization and Embedded Systems Sixth Edition, Mc Graw Hill Publications, 2010

Reference Books

1. Patterson, Hennessy, Computer Organization and Design, Fourth Edition, Elsevier Publications
2. Computer Architecture and Parallel Processing- Kaui Hwang and A. Briggs International Edition Mcgraw hill
3. Advanced Computer Architecture, Dezso Sima,terence Fountain ,peter Kacsuk Pearson Education

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

VLSI Technology

Code: **EIRVD831** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT I

Introduction : Semiconductor materials, Semiconductor Devices, Semiconductor process technology, Basic fabrication steps. Crystal Growth : Silicon Crystal Growth from melt, Silicon Float-Zone Process, GaAs Crystal Growth Techniques, Material Characterization.

UNIT II

Silicon Oxidation : Thermal oxidation, Impurity Redistribution during oxidation, masking properties of silicon dioxide, oxide quality, oxide thickness characterization. Photolithography: Optical lithography, Next-Generation lithographic.

UNIT III

Etching : Wet chemical etching, Dry etching. Diffusion : Basic Diffusion Process, Extrinsic Diffusion, Lateral Diffusion.

UNIT IV

Ion Implantation : Range of Implanted ions, Implant Damage and annealing, Implantation-related Process. Film Deposition : Epitaxial growth techniques, Structures and defects in epitaxial layers, Dielectric deposition, Polysilicon deposition, Metallization.

UNIT V

Process Integration : Passive Components, Bipolar Technology, MOSFET technology, MESFET

technology, MEMS technology. IC Manufacturing : Electrical testing, Packaging.

Text Books:

1. Gary S. May, Simon M. Sze, Fundamentals of Semiconductor Fabrication, John Wiley Inc., 2004.

Reference Books:

1. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
3. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

4. The Science and Engineering of Microelectronic Fabrication, Stephen Cambell, Oxford University Press, 2001.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Modeling and Design with HDLs

Code: EIRVD832/EIRDS832 Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
Basic Concepts:Lexical Conventions. Data Types. System Tasks and Compiler Directives.**Modules and Ports:** Modules. Ports. Hierarchical Names. **Gate-Level Modeling:** Gate Types. Gate Delays.

Unit-II
Dataflow Modeling: Continuous Assignments. Delays. Expressions, Operators, and Operands. Operator Types. Examples.

Unit-II
Behavioral Modeling: Structured Procedures. Procedural Assignments. Timing Controls. Conditional Statements. Multiway Branching. Loops. Sequential and Parallel Blocks. Generate Blocks. Examples.

Unit-III
Tasks and Functions: Difference between Tasks and Functions. Tasks. Functions. **Procedural Continuous Assignments.** Overriding Parameters. Conditional Compilation and Execution. Time Scales. Useful System Tasks. **Timing and Delays:** Types of Delay Models. Path Delay Modeling. Timing Checks. Delay Back-Annotation.

Unit- IV
Switch Level Modeling: Switching-Modeling Elements. Examples. **User-Defined Primitives**: UDP basics. Combinational UDPs. Sequential UDPs. UDP Table Shorthand Symbols. Guidelines for UDP Design.

Unit-V
Writing test benches: Basic testbenches, Testbench structure, Constrained random stimulus generation, Object-oriented programming, Assertion-based verification. **SystemVerilog simulation**: Event-driven simulation, SystemVerilog simulation Races, Delay models, Simulator tools**. SystemVerilog synthesis:** RTL synthesis: Non-synthesizable SystemVerilog, Constraints, Attributes, Area and structural constraints Synthesis for FPGAs, Behavioral synthesis, Verifying synthesis results

Text Books

1. Samir Palnitkar, Verilog HDL 2/e, Pearson Education,
2. Mark Zowilski, Digital System Design with SystemVerilog, Pearson Education, 2010

Reference Books

1. J.Bhasker, Verilog HDL Primer, Pearson Education
2. J.Bhasker, Verilog Synthesis Primer, B.S.Publications.
3. M.Ciletti, Advanced Digital Design with Verilog HDL,Second Edition Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

DSP Processors and Architectures

Code: EIRVD833/ EIRDS801/ EIRRM834/ EUREC835 Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Review of Digital signal processing. ,the sampling process,Discrte time sequences, discrete fourier transform and FFT, Linear time –invariant systems, digital filters, decimation and Interpolation,analysys and design tool for DSP systems. **Computational accuracy IN DSP Implementations:** number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D conversion errors, DSP computational errors.D/A conversion errors, compensating filter.

UNIT-II

Architectures for Programmable DSP Devices : basic architectural features,DSP computational building blocks. Bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, speed issues, features for external interfacing. **Programmable Digital Signal Processors:** Introduction. Commercial Digital Signal Processing Devices. The Architecture of TMS320C54xx Digital Signal Processors. Addressing Modes of the TMS320C54xx Processors. Memory Spaces of TMS320C54xx Processors. Program Control. TMS320C54xx Instructions and Programming. On-Chip Peripherals. Interrupts. Pipeline Operation of the TMS320C54xx Processors

UNIT-III

Implementation of Basic DSP Algorithms: Introduction. The Q-notation. FIR Filters. IIR Filters. Interpolation Filters. Decimation Filters. PID Controller. Adaptive Filters. 2-D Signal Processing. **Implemenation of FFT Algortihms:** Introduction. An FFT Algorithm for DFT Computation. A Butterfly Computation. Overflow and Scaling. Bit-Reversed Index Generation. An 8-point FFT Implementation of TMS320C54xx. Computation of Signal Spectrum

UNIT-IV

Interfacing Memory and Parallel IO Peripherals to Programmable DSP Devices: Introduction. Memory Space Organization of the TMS320C54xx Devices. Memory and I/O Signals of the TMS320C54xx Devices. Memory Interface. Parallel I/O. Programmed I/O. Interrupts and I/O. Direct Memory Access (DMA).

UNIT-V

Interfacing Serial Converters to a Programmable DSP Device: Introduction. Synchronous Serial Interface between the DSP and an AIC. A Multi-channel Buffered Serial Port (McBSP). The McBSP Programming. A CODEC Interface Circuit. CODEC Programming. A CODEC-DSP Interface Example. **Applications:** Introduction. A DSP System. DSP Based Biotelemetry System. A Speech Processing System. An Image Processing System. A Position Control System for a Hard Disk Drive. DSP Based Power Meter

Text Books:

1. Digital Signal Processing- Avtar Singh and S. Srinivasan, Thompson Publications, 2004.

Reference Books:

2. Digital signal processors, Archtecture, programming and applications- B. venkata ramani and M. Bhaskar, TMH, 2004.
3. Sen. M. Kuo, Real-Time Digital Signal Processing: Implementations and Applications 2/e, Wiley Publications, 2006
4. Rulph Chassaing, Digital Signal Processing with C6713 and C6416 DSK, 2/e Wiley Publications, 2005
5. DSP processor fundamentals,Archtecture & Features-Lapsley et al. S. Chand & Co.2000

Logic Synthesis and Verification

Code:	**EIRVD834**	Category:	**PGE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Background and Hardware Modeling: Graphs, Combinatorial Optimization, Graph Optimization Problems and algorithms, Boolean Algebra and its applications. **Hardware Modeling:** Introduction, Hardware Modeling Languages, Abstract Models, Compilation and Behavioral Optimization.

UNIT-II

Two Level Combinational Logic Optimization: Introduction, Logic Optimization Techniques, Operations on Two level logic covers, algorithms for logic minimization, Symbolic minimization and encoding problems.

UNIT-III

Multilevel Combinational Logic Optimization: Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model, Synthesis of Testable Networks. Algorithms for delay evaluation and optimization. Rule based systems for logic optimization.

UNIT-IV

Sequential Logic Optimization: Introduction, Sequential Circuit Optimization using state based models, sequential circuit optimization using network models, Implicit finite state machine traversal methods. Testability considerations for synchronous circuits.

UNIT-V

Cell Library Binding: Introduction, Problem formulation and Analysis, Algorithms for Library binding, specific problems and algorithms for library binding, rule based library binding

Text Books

1. G. De Micheli, Synthesis and Optimization of Digital Circuits, McGraw-Hill, Inc., 1994.

Reference Books:

1. G.D. Hachtel and F. Somenzi, Logic Synthesis and Verification Al-gorithms, Kluwer Academic Publishers, 1996

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

VLSI Design Laboratory

Code:	**EIRVD812**	Category: **PGC**
Credits:	**2**	No. of hours: **6 per week**
Department:	**ECE**	

This laboratory course shall be carried out in two 3-Hour sessions per week. Experiments shall be carried out using Tanner/Mentor Graphics/Cadence/Xilinx Tools

Session – I: Digital IC Design Laboratory

1. Introduction to SPICE (Operating Point Analysis, DC Sweep, Transient Analysis, AC Sweep, Parametric Sweep, Transfer Function Analysis).
2. Modeling of Diodes, MOS transistors, Bipolar Transistors etc using SPICE.
3. An Overview of Tanner EDA Tool/MicroWind/Electric/ Magic/LTSpice
4. I-V Curves of NMOS and PMOS Transistors
5. DC Characteristics of CMOS Inverters (VTC, Noise Margin)
6. Dynamic Characteristics of CMOS Inverters (Propagation Delay, Power Dissipation)
7. Schematic Entry/Simulation/ Layout of CMOS Combinational Circuits
8. Schematic Entry/Simulation/ Layout of CMOS Sequential Circuits
9. High Speed and Low Power Design of CMOS Circuits

Session-II: Analog IC Design Laboratory

Experiments shall be carried out using Tanner/Mentor Graphics/Cadence Tools

1. Study of MOS Characteristics and Characterization
2. Design and Simulation of Single Stage Amplifiers (Common Source, Source Follower, Common Gate Amplifier)
3. Design and Simulation of Single Stage Amplifiers (Cascode Amplifier, Folded Cascode Amplifier)
4. Design and Simulation of a Differential Amplifier (with Resistive Load, Current Source Biasing)
5. Design and Simulation of Basic Current Mirror, Cascode Current Mirror
6. Analysis of Frequency response of various amplifiers (Common Source, Source Follower, Cascode, Differential Amplifier
7. Design/Simulation/Layout of Telescopic Operational Amplifier/ Folded Cascode Operational Amplifier

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

VLSI CAD

Code:	**EIRVD901**	Category:	**PGC**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

Unit – I

Algorithmic Graph Theory and Computational Complexity – Terminology, Data Structures for the Representation of Graphs, Computational Complexity, Examples of Graph Algorithms, Depth-first Search, Breadth-first Search, Dijkstra's Shortest-path Algorithm, Prim's Algorithm for Minimum Spanning Trees - **Tractable and Intractable Problems**, Combinatorial Optimization Problems, Decision Problems, Complexity Classes, NP-completeness and NP-hardness

Unit - II

Simulation - General Remarks on VLSI Simulation, Gate-level Modeling and Simulation, Signal Modeling, Gate Modeling, Delay Modeling, Connectivity Modeling, Compiler-driven Simulation Event-driven Simulation, Switch-level Modeling and Simulation, Connectivity and Signal Modeling, Simulation Mechanisms,

Unit - III

Logic Synthesis and Verification , Introduction to Combinational Logic Synthesis, Basic Issues and Terminology, A Practical Example, Binary-decision Diagrams, ROBDD Principles, ROBDD Implementation and Construction, ROBDD Manipulation, Variable Ordering, Applications to Verification, Applications to Combinatorial Optimization, Two-level Logic Synthesis, Problem Definition and Analysis, A Heuristic Based on ROBDDs, **High-level Synthesis**, Hardware Models for High-level Synthesis, Hardware for Computations, Data Storage, and Interconnection, Data, Control, and Clocks, Internal Representation of the Input Algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some Aspects of the Assignment Problem, High-level Transformations

Unit - IV

Layout Compaction, Design Rules, Symbolic Layout, Problem Formulation, Algorithms for Constraint-graph Compaction, A Longest-path Algorithm for DAGs, The Longest Path in Graphs with Cycles, The Liao- Wong Algorithm, The Bellman-Ford Algorithm, Discussion: Shortest Paths, Longest Paths and Time Complexity, Other Issues **Placement and Partitioning**, Circuit Representation, Wire-length Estimation, Types of Placement Problem, Placement Algorithms, Constructive Placement, Iterative Improvement, Partitioning, The Kernighan-Lin Partitioning Algorithm.

Unit - V

Floorplanning, Floorplanning Concepts, Terminology and Floorplan Representation, Optimization Problems in Floorplanning, Shape Functions and Floorplan Sizing **Routing**, Types of Local Routing Problems, Area Routing, Channel Routing, Channel Routing Models, The Vertical Constraint Graph, Horizontal Constraints and the Left-edge Algorithm Channel Routing Algorithms, Introduction to Global Routing, Standard-cell Layout, Building-block Layout and Channel Ordering, Algorithms for Global Routing, Problem Definition and Discussion, Efficient Rectilinear Steiner-tree Construction, Local Transformations for Global Routing

Text Books

1. Algorithms for VLSI Design Automation, S.H.Gerez, WILEY Student Edition, John wiley & Sons (Asia) Pvt. Ltd., 1999.

Reference Books

1. Majid Sarrafzadeh and C. K. Wong, An Introduction to VLSI Physical Design, McGraw Hill, 1996.
2. Naveed Sherwani, Algorithms for VLSI Physical Design Automation, 3rd ed., Kluwer Academic Pub., 1999
3. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, Wiley, 1993.
4. Modern VLSI Design: Systems on silicon – Wayne Wolf, Pearson Education Asia, 2nd Edition, 1998

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Digital Systems Testing and Testability

Code:	**EIRVD902**	Category:	**PGC**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Introduction: Introduction, Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing. **VLSI Testing Process and Test Equipment:** How to test chips. **Test Economics and Product Quality:** Test Economics, Yield. **Fault Modeling:** Defects, Errors and Functional Versus Structural Testing, Levels of Fault Models, Glossary of Fault Models, Single Stuck-at Fault. **LOGIC AND Fault Simulation:** Simulation for Design Verification, Simulation for Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-Value Simulation, Algorithms for Fault Simulation, Statistical Methods for Fault Simulation

UNIT-II

Combinational Circuit Test Generation: Algorithms and Representations, Redundancy Identification (RID), Testing as a Global Problem, Definitions, Significant Combinational ATPG Algorithms

UNIT-III

Sequential Circuit Test Generation: ATPG for Single-Clock Synchronous Circuits, Time-Frame Expansion Method, Simulation-Based Sequential Circuit ATPG.

UNIT-IV

Memory Test: Memory Density and Defect Trends, Faults, Memory Test Levels, March Test Notation, Fault Modeling, Memory Testing **Digital DFT and Scan Design:** Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

UNIT-V

Built-In Self Test: The Economic Case for BIST, Random Logic BIST, Memory BIST, Delay Fault BIST. **Boundary Scan Standard**: Motivation, System Configuration with Boundary Scan, Boundary Scan Description Language

Text Books

1. M. L. Bushnel and V. D. Agarwal, Essentials of Testing for Digital, Memory and Mixed – Signal VLSI Circuits, Boston: Kluwer Academic Publishers, 2000

Reference Books

1. M. Abramovici, M. A. Breuer, and A. D. Friedman, Digital Systems Testing and Testable Design, Piscataway, New Jersey: IEEE Press, 1994. Revised printing.
2. Niraj Jha, Sandeep Gupta, Test of Digital Systems, Cambridge University Press, 2003.
3. Robert J. Feugate, Steven. M. McIntyre, Introduction to VLSI Testing, Prentice Hall Publications, 1988
4. Ed. Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, VLSI Test Principles and Architectures, Elsevier Publications.
5. Alexander Miczo, Digital Logic Testing and Simulation, Second Edition, John Wiley and Sons, 2003.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Analog System Design

Code: **EIRDS923** / **EIRVD921** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit- I

Noise Analysis and Modeling: Statistical Characteristics of Noise, Noise Spectrum, Amplitude Distribution, Correlated and Uncorrelated Sources, Types of Noise, Thermal Noise, Flicker Noise, Representation of Noise in Circuits, Noise in Single-Stage Amplifiers, Common-Source Stage, Common-Gate Stage, Source Followers, Cascode Stage, Noise in Differential Pairs, Noise in Op-Amps, Noise Bandwidth.

Unit-II

Active and Passive Filter Design (Elementary Treatment): General Considerations, Filter Characteristics, Classification of Filters, Filter Transfer Function, Problem of Sensitivity, First-Order Filters, Second-Order Filters, Special Cases, RLC Realizations, Active Filters, Sallen and Key Filter, Integrator-Based Biquads, Biquads Using Simulated Inductors, Approximation of Filter Response, Butterworth Response, Chebyshev Response. **Comparators:** Characterization of a Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators, High-Speed Comparators

Unit-III

Introduction to Switched-Capacitor Circuits General Considerations, Sampling Switches, MOSFETS as Switches , Speed Considerations, Precision Considerations , Charge Injection Cancellation, Switched-Capacitor Amplifiers , Unity-Gain Sampler/Buffer, Noninverting Amplifier, Precision Multiply-by-Two Circuit, Switched-Capacitor Integrator, Switched-Capacitor Common-Mode Feedback

Unit –IV

Bandgap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, PTAT Current Generation, Constant-Gm Biasing, Speed and Noise Issues, Case Study. **Nonlinearity and Mismatch:** Nonlinearity, Mismatch

Unit-V

OSCILLATORS General Considerations , Ring Oscillators, LC Oscillators , Crossed-Coupled Oscillator Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs. **Phase-Locked Loops** Simple PLL , Phase Detector, Basic PLL Topology, Dynamics of Simple PLL, Charge-Pump PLLs, Problem of Lock Acquisition, Phase/Frequency Detector and Charge Pump, Basic Charge-Pump PLL, Nonideal Effects in PLLs , PFD/CP Nonidealities, Jitter in PLLs , Delay-Locked Loops, Applications, Frequency Multiplication and Synthesis, Skew Reduction, Jitter Reduction

Text Books

1. B. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill Publications, 2002
2. Allen Holberg, CMOS Analog Circuit Design, Oxford Publications, 2002
3. B.Razavi, Fundamentals of Microelectronics, Wiley Publications, 2008

Reference Books:

1. Baker, Li, Boyce, CMOS Mixed Circuit Design, Wiley Publications, 2002
2. Baker, Li, Boyce, CMOS Circuit Design Layout and Simulation, IEEE Press, 2000
3. David A Johns, Ken Martin, Analog Integrated Circuit Design, Wiley Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Active Filter Design

Code:	**EIRVD922**	Category:	**PGE**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Operational Amplifiers: Operational Amplifier models, Opamp slew rate, Operational Amplifier with Resistive feedback, Analyzing opamp circuits. Examples. **First Order Filters:** Bilinear transfer function and its parts, realization with passive elements, bode plots, Active realizations, Effect of A(s), Cascade design.

UNIT-II

Second Order LowPass and BandPass Filters: Design parameters Q and w_0, Second order circuit, frequency response of lowpass and bandpass circuits, Integrators, Other Biquads. **Second Order Filters with Arbitrary transmission zeros:** Summing, Voltage feedforward, Cascade design revisited.

UNIT-III

Low Pass filters with Maximally flat magnitude: Ideal low pass filter, butterworth response, butterworth pole locations, low pass filter specifications, arbitrary transmission zeros. **Low Pass filters with Equal Ripple Magnitude Response:** The chebyshev polynomial, chebyshev magnitude response, local of chebyshev poles, comparision of maximally flat and equal ripple responses. Chebyshev filter design. **Frequency Transformation:** Low pass to highpass, low pass to bandpass, low pass to bandstop, lowpass to multiple passband transformation.

UNIT-IV

LC Ladder Filters: Some properties of lossless ladders, a synthesis strategy, General ladder design methods, frequency transformation, design of passive equalizers. **Ladder Simulations by Element Replacement:** The general impedance converter, optimal design of the gic, realizing simple ladders, gorski-popiel embedding technique, bruton's fdnr technique, creating negative components

UNIT-V

Transconductance-C filters: Transconductance Cells, Elementary transconductance building blocks, first order and second order filters, higher order filters. **Switched Capacitor Filters:** The MOS Switch, The switched capacitor, first order building blocks, second order sections, sampled data operation, switched capacitor first order and second order sections, bilinear transformation, design of switched capacitor cascade filters.

Text Books :

1.Rolf Schaumann, Van Valkenburg, Design of Analog Filters, Oxford University Press, 2001

Reference Books:

1. Integrated Continuous Time Filters, Yannis Tsividis and Johannes Voorman, IEEE Press.
2. Design of Analog Filters: Passive, Active RC and Switched Capacitor, Rolf Schaumann, M.S. Ghausi, Kenneth R. Laker

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Advanced Computer Architecture

Code: **EIRVD923 /EIRDS943** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Fundamentals of Computer Design : technology trends, cost Measuring and reporting, performance quantitative principles of computer design, **Instruction set principles and examples**, classifying instruction set, memory addressing ,type and size of operands, addressing modes for signal processing, Operations in the instruction set ,instruction for control ,encoding an instruction set.

UNIT-II

Pipelining: Introduction, The Major Hurdle of Pipelining—Pipeline Hazards, How Is Pipelining Implemented? What Makes Pipelining Hard to Implement?, Extending the MIPS Pipeline to Handle Multicycle Operations. **Instruction Level Parallelism**: Overcoming hazards, reducing branch costs, High performance instruction delivery, hardware based speculation ,Limitation of ILP,ILP software approach, compiler techniques, static branch Protection VLIW approach.

UNIT-III

Memory Hierarchy Design: Introduction, Review of the ABCs of Caches, Cache Performance, Reducing Cache Miss Penalty, Reducing Miss Rate, Reducing Cache Miss Penalty or Miss Rate via Parallelism, Reducing Hit Time, Main Memory and Organizations for Improving Performance, Memory Technology, Virtual Memory, Protection and Examples of Virtual Memory. Basics of Virtual Machines.

UNIT-IV

Multiprocessors and Thread-Level Parallelism: Introduction, Characteristics of Application Domains, Symmetric Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory Architectures, Performance of Distributed Shared-Memory Multiprocessors, Synchronization, Models of Memory Consistency: An Introduction, Multithreading: Exploiting Thread-Level Parallelism within a Processor

UNIT-V

Storage Systems: Introduction, Types of Storage Devices, Buses—Connecting I/O Devices to CPU/Memory, Reliability, Availability, and Dependability, RAID: Redundant Arrays of Inexpensive Disks, Errors and Failures in Real Systems, I/O Performance Measures, Designing an I/O System in Five Easy Pieces

Text Books

1. Computer Architecture a quantitative approach 3rd edition John L. Hennessy & David A Patterson Morgan Kuffman,2002

Reference Books

1. Computer Architecture a quantitative approach 4th edition John L. Hennessy & David A Patterson Morgan Kuffman,2005
2. Computer Architecture and Parallel Processing- Kaui Hwang and A. Briggs International Edition Mc graw hill
3. Advanced Computer Architecture, Dezso Sima,terence Fountain ,peter Kacsuk Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

VLSI Physical Design Automation

Code: **EIRVD924** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Data Structures and Basic Algorithms: Basic Terminology, Complexity Issues and NP-hardness, Basic Algorithms, Basic Data Structures, Graph Algorithms for Physical design.

UNIT-II

Partitioning: Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms, Simulated Annealing and Evolution, Other Partitioning Algorithms. Performance Driven Partitioning

UNIT-III

Floorplanning and Pin Assignment: Floorplanning, Chip planning, Pin Assignment. **Global Routing:** Problem Formulation, Classification of Global Routing, Maze Routing Algorithms, Line-Probe Algorithms, Shortest Path Based Algorithms, Steiner Tree based Algorithms Integer Programming Based Approach, Performance Driven Routing.

UNIT-IV

Detailed Routing: Problem Formulation, Classification of Routing Algorithms, Single-Layer Routing Algorithms, Two-Layer Channel Routing Algorithms, Three-Layer Channel Routing Algorithms, Multi-Layer Channel Routing Algorithms, Switchbox Routing Algorithms

UNIT-V

Over-the-Cell Routing and Via Minimization: Over-the-cell Routing, Via Minimization. **Clock and Power Routing:** Clock Routing, Power and Ground Routing. **Compaction:** Problem Formulation, Classification of Compaction Algorithms, One-Dimensional Compaction, Two-Dimensional Compaction

Text Books

1. Naveed Sherwani, Algorithms for VLSI Physical Design Automation, Springer Publications.

Reference Books

1. Sung Kyu Lim, Practical Problems for VLSI Physical Design Automation, Springer Publications
2. Majid Sarrafzadeh and C. K. Wong, An Introduction to VLSI Physical Design, McGraw Hill, 1996.
3. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, Wiley, 1993.
4. Modern VLSI Design: Systems on silicon – Wayne Wolf, Pearson Education Asia, 2nd Edition, 1998

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

RF IC Design

Code: **EIRVD931** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Basic Concepts in RF Design: General Considerations, Effects of Nonlinearity, Noise, Sensitivity and Dynamic Range, Passive Impedance Transformation, Scattering Parameters, Analysis of Nonlinear Dynamic Systems, Volterra Series. **Communication Concepts**: General Considerations, Analog Modulation, Digital Modulation, Spectral Regrowth, Mobile RF Communications, Multiple Access Techniques, Wireless Standards, Differential Phase Shift Keying.

UNIT-II

Transceiver Architectures: General Considerations, Receiver Architectures, Transmitter Architectures, OOK Transceivers.

UNIT-III

Low-Noise Amplifiers: General Considerations, Problem of Input Matching, LNA Topologies, Gain Switching, Band Switching, High-IP2 LNAs, Nonlinearity Calculations.

UNIT-IV

Mixers: General Considerations, Passive Down conversion Mixers, Active Down conversion Mixers, Improved Mixer Topologies, Upconversion Mixers. **Passive Devices:** General Considerations, Inductors, Transformers, Transmission Lines, T-Line Structures, Varactors, Constant Capacitors.

UNIT-V

Oscillators: Performance Parameters, Basic Principles, Cross-Coupled Oscillator, Three-Point Oscillators, Voltage-Controlled Oscillators, LC VCOs with Wide Tuning Range, Phase Noise, Design Procedure, Low-Noise VCOs, LO Interface, Mathematical Model of VCOs, Quadrature Oscillators. **Phase-Locked Loops:** Basic Concepts, Type-I PLLs, Type-II PLLs, PFD/CP Nonidealities, Phase Noise in PLLs, Loop Bandwidth, Design Procedure. Overview of integer and fractional Frequency synthesizers, power amplifiers. Transceiver design example.

Text Books :

1.Behzad Razavi, RF Microelectronics, Second Edition, Prentice Hall Publications, 2011.

Reference Books:

1. Leung, Bosco, VLSI for Wirless Communication, Second Edition, Springer 2011.
2. Thomas Lee, Design of CMOS Radio Frequency Integrated Circuits, Cambridge University Press, 2002

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester
Statistical Digital Signal Processing

Course Code:	**EIRVD932**	Category:	**PGC**
Credits :	**3**	No. of hours:	**4 per week**
Department :	**ECE**		

UNIT-I

Background: Discrete-Time Signal Processing: Linear Algebra, Discrete-Time Random Processes: Introduction, Random Variables, Random Processes, Filtering Random Processes, Spectral Factorization, Special Types of Random Processes.

UNIT-II

Signal Modeling: Introduction, The Least Squares (Direct) Method, The Pade Approximation, Prony's Method, Finite Data Records, Stochastic Models. **The Levinson Recursion:** Introduction, The Levinson-Durbin Recursion, The Levinson Recursion.

UNIT-III

Lattice Filters: Introduction, FIR Lattice filter, IIR lattice filters. **Optimum Filters:** Introduction, The FIR Wiener Filter, The IIR Wiener Filter, Discrete Kalman Filter

UNIT-IV

Spectrum Estimation: Introduction, Nonparametric Methods, Minimum Variance Spectrum Estimation, The Maximum Entropy Method, Parametric Methods, Frequency Estimation, Principal Components Frequency Estimation

UNIT-V

Adaptive Filtering: Introduction, FIR Adaptive Filters, Adaptive Recursive Filters, Recursive Least Squares

Text Books

1. Monson Hayes, Statistical Digital Signal Processing, Wiley Student Edition,
2. Proakis, J.Gard & D.G.Manolakis, Digital Signal Processing : Principles, Algorithms and Applications , Fourth Edition, PHI, 2006.

Reference Books

1. Manolakis, Vijay Ingle, Stephen Kogon, Statistical and Adaptive Signal Processing, Artech Book House.
2. P.P. Vaidyanathan, Multirate systems and Filter banks, Prentice Hall, 1993
3. V. Oppenheim and R.W.Schafer, Discrete time Signal Processing, PHI 1994
4. S.J. Orfanidis, Optimum Signal Processing, McGraw Hill, 1989.
5. Insight into Wavelets, Ramachandran and Soman, Prentice Hall Publications, 2003
6. Wavelet Transforms: Introduction to Theory and Applications, Raghuveer M Rao, Ajit S, Bopardikar, Pearson Education 2000
7. John. G. Proakis, Algorithms for Statistical Signal Processing Pearson Education, 2002.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Digital Systems Engineering

Code: **EIRVD933** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction: Engineering view of a digital system, Technology Trends and Digital Systems Engineering, Packaging of Digital Systems: A typical digital system, On chip wiring, Integrated Circuit Packages, Printed Circuit Boards, Chassis and Cabinets, Backplanes and Mother Boards, Wire and Cable, Connectors, **Modeling and Analysis of Wires:** Geometry and Electrical Properties, Electrical Models of Wires, Simple Transmission Lines, Special Transmission Lines, Wire Cost Models

UNIT-II

Power Distribution: The Power Supply Network, Local Regulation, Logic Loads and On chip supply distribution, Power Supply Isolation, Bypass capacitors, Example power distribution system. **Noise in Digital Systems:** Noise Sources in a digital system, Power supply noise, Crosstalk, Intersymbol Interference, Managing Noise.

UNIT-III

Signalling Conventions: A Comparison of two transmission systems, considerations in a transmission system design, Signalling modes for transmission lines, signaling over lumped transmission media, Signal Encoding. **Advanced Signalling Conventions:** Signalling over RC Interconnect, Driving lossy LC lines, Simultaneous bidirectional signaling, AC and N of M Balanced Signalling, Examples.

UNIT-IV

Timing Conventions: A comparison of two timing conventions, considerations in timing design, timing fundamentals, Encoding timing: Signals and Events, Open Loop Synchronous timing, Closed loop timing, clock distribution. **Synchronization:** A Comparision of two synchronization strategies, synchronization fundamentals, synchronizer design, asynchronous design,

UNIT-V

Signalling Circuits: Terminations, transmitter circuits, receiver circuits, ESD Protection, An example signaling system. **Timing Circuits:** Delay line circuits, Voltage controller oscillators, Phase comparators, loop filters, Clock aligners.

Text Books :

1. William J. Dally and John Poulton, Digital Systems Engineering, Cambridge University Press,

Reference Books:

1. S. M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits, Third Edition, McGraw Hill, 2003.
2. Jackson & Hodges, Analysis and Design of Digital Integrated circuits. 3rd Ed. TMH Publication, 2005.
3. Jan M Rabaey, Digital Integrated Circuits, Second Edition, Prentice Hall Publications.
4. Ken Martin, Digital Integrated Circuit Design, Oxford Publications, 2001

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Computer Arithmetic

Code:	**EIRVD934**	Category:	**PGE**
Credits:	**3**	No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Number Representation: Numbers and Arithmetic: What is computer arithmetic?, Motivating Examples, Numbers and their encodings, Fixed-radix positional number systems, Number radix conversion, Classes of number representations **Representing Signed Numbers:** Signed-magnitude representation, Biased representations, Complement representations, Two's- and 1's-complement numbers, Direct and indirect signed arithmetic, Using signed positions or signed digits, **Redundant Number Systems**, Coping with the carry problem, Redundancy in computer arithmetic, Digit sets and digit-set conversions, Generalized signed-digit numbers, Carry-free addition algorithms, Conversions and support functions. Introduction to Residue Number systems.

UNIT-II

Addition/Subtraction: Basic Addition and Counting: Bit-serial and ripple-carry adders, Conditions and exceptions, Analysis of carry propagation, Carry completion detection, Addition of a constant: counters, Manchester carry chains and adders, **Carry-Lookahead Adders**: Unrolling the carry recurrence, Carry-lookahead adder design, Ling adder and related designs, Carry determination as prefix computation, Alternative parallel prefix networks, VLSI implementation aspects **Variations in Fast Adders**: Simple carry-skip adders Multilevel carry-skip adders, Carry-select adders, Conditional-sum adder, Hybrid designs and optimizations, Modular two-operand adders

UNIT-III

Multiplication: Basic Multiplication Schemes, Shift/add multiplication algorithms, Programmed multiplication, Basic hardware multipliers, Multiplication of signed numbers, Multiplication by constants, Preview of fast multipliers. **High-Radix Multipliers**: Radix-4 multiplication, Modified Booth's recoding, Using carry-save adders, Radix-8 and radix-16 multipliers, Multibeat multipliers, VLSI complexity issues, **Tree and Array Multipliers**: Full-tree multipliers, Alternative reduction trees, Tree multipliers for signed numbers, Partial-tree and truncated multipliers, Array multipliers, Pipelined tree and array multipliers.

UNIT-IV

Division: Basic Division Schemes: Shift/subtract division algorithms, Programmed division, Restoring hardware dividers, Nonrestoring and signed division, Division by constants, Radix-2 SRT division, **High-Radix Dividers:** Basics of high-radix division, Using carry-save adders, Radix-4 SRT division, General high-radix dividers, Quotient-digit selection, Using p-d plots in practice, **Variations in Dividers**, Division with prescaling , Overlapped quotient-digit selection, Combinational and array dividers, Modular dividers and reducers, The special case of reciprocation, Combined multiply/divide units.

UNIT-V

Real Arithmetic: Floating-Point Representations, Floating-point numbers, The ANSI/IEEE floating-point standard, Basic floating-point algorithms, Conversions and exceptions, Rounding schemes, Logarithmic number systems, **Floating-Point Operations**: Floating-point adders/subtractors, Pre- and postshifting, Rounding and exceptions, Floating-point multipliers and dividers, Fused-multiply-add units, Logarithmic arithmetic unit.

Text Books

1. B. Parhami, Computer Arithmetic: Algorithms and Hardware Designs, 2nd edition, Oxford University Press, New York, 2010.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Low Power VLSI Design

Code:	**EIRVD941**	Category:	**PGE**
Credits:	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

Unit- I

Physics of Power Dissipation in CMOS FET Devices: Physics of power dissipation in MOSFET devices, power dissipation in cmos, low power vlsi design: Limits

Unit-II

Power Estimation: Modeling in signals, Signal Probability calculation, Probabilistic Techniques for signal activity estimation, Statistical Techniques, Estimation of Glitching power, Sensitivity Analysis. Power estimation using the input vector compaction, power dissipation in domino cmos, high level power estimation, Information theory based approaches, Estimation of maximum power.

Unit-III

Synthesis for Low Power: Behavioural Level Transforms, Logic Level Optimization for Low power, Circuit Level Optimization. **Design and Test of Low Voltage CMOS Circuits:** Circuit Design style, Leakage current in deep submicrometer transistors, Deep submicrometer device design issues, Key to minimizing SCE, Low voltage circuit design techniques, Designing deep submicrometer ics with elevated intrinsic leakage, multiple supply voltages.

Unit-IV

Low Power Static RAM Architectures: Organization of a static RAM, MOS Static RAM Memory cell, Banked organization of SRAMs, Reducing voltage swings on bit lines, Reducing power in write driver circuits, Reducing power in sense amplifier circuits, method for achieving low core voltages from a single supply.

Unit –V

Low Energy Computing using Energy Recovery Techniques: Energy dissipation in transistor channel using an RC model, Energy recovery circuit design, Designs with partially reversible logic, Supply clock generation.

Text Books

1.Kaushik Roy, Sharat C. Prasad, Low Power CMOS VLSI Circuit Design, John Wiley and Sons, 2000
2.Jan Rabaey, Low Power Design Essentials, Springer Publications, 2009

Reference Books:

1. 1.Chandrakasan and R. Brodersen, Low-Power CMOS Design, IEEE Press, 1998 (Reprint Volume).
2. 2.Chandrakasan, Bowhill, and Fox, Design of High-Performance Microprocessors, IEEE Press, 2001
3. 3.Gary Yeap, Practical Low Power Digital VLSI Design , Springer Publications, 1997.
4. M. Keating et al., Low Power Methodology Manual, Springer, 2007.
5. S. Narendra and A. Chandrakasan, Leakage in Nanometer CMOS Technologies, Springer, 2006.
6. M. Pedram and J. Rabaey, Ed., Power Aware Design Methodologies, Kluwer Academic Publishers, 2002.
7. Piguet, Ed., Low-Power Circuit Design, CRC Press, 2005.
8. J. Rabaey and M. Pedram, Ed., Low Power Design Methodologies, Kluwer Academic Publishers, 1995.
9. J. Rabaey, A. Chandrakasan, and B. Nikolic, Digital Integrated Circuits - A Design Perspective, Prentice Hall, 2003.
10. S. Roundy, P. Wright and J.M. Rabaey, Energy Scavenging for Wireless Sensor Networks, Kluwer Academic Publishers, 2003.
11. Wang, Adaptive Techniques for Dynamic Power Optimization, Springer, 2008

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Advanced Digital IC Design

Code: **EIRVD942/EIRDS941** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Implementation Strategies for Digital ICs: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective—The Implementation Platform of the Future

UNIT-II

The Wire: Introduction, A First Glance, Interconnect Parameters — Capacitance, Resistance, and Inductance, Electrical Wire Models, SPICE Wire Models**. Coping with Interconnect:** Introduction, Capacitive Parasitics, Capacitance and Reliability—Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability—Ohmic Voltage Drop, Electromigration, Resistance and Performance—RC Delay

UNIT-III

Timing Issues in Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Synchronizers and Arbiters, Synchronizers—Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL

UNIT-IV

Designing Arithmetic Building Blocks: Introduction, Datapaths in Digital Processor Architectures, The Adder, The Binary Adder: Definitions, The Full Adder: Circuit Design Considerations, The Binary Adder: Logic Design Considerations, The Multiplier, The Multiplier: Definitions, Partial-Product Generation, Partial Product Accumulation, Final Addition, Multiplier Summary, The Shifter, Barrel Shifter, Logarithmic Shifter

UNIT-V

Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control

Text Books :

1. Jan M. Rabaey Anantha Chandrakasan, & Borivoje Nikolic, Digital Integrated Circuits – A design perspective, Second Edition, PHI, 2003

Reference Books:

1. S. M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits, Third Edition, McGraw Hill, 2003.
2. Jackson & Hodges, Analysis and Design of Digital Integrated circuits. 3rd Ed. TMH Publication, 2005.
3. Ken Martin, Digital Integrated Circuit Design, Oxford Publications, 2001.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

VLSI Digital Signal Processing

Code: **EIRVD943** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction to DSP Systems: Typical DSP algorithms, Representation of DSP algorithms. **Iteration Bound:** Introduction, Data flow graph representations, Loop Bound and Iteration bound, Algorithms for computing iteration bound, iteration bound of multirate dataflow graphs. **Pipelining and Parallel Processing:** Introduction, pipelining of fir digital filters, parallel processing, pipelining and parallel processing for low power.

UNIT-II

Retiming: Introduction, Definition and Properties, Solving systems of inequalities, retiming techniques. **Unfolding:** Introduction, An algorithm for unfolding, properties of unfolding, critical path, unfolding and retiming, applications of unfolding.

UNIT-III

Folding: Introduction, folding transformation, register minimization techniques, register minimization in folded architectures, folding of multirate systems. **Systolic Architecture Design:** Introduction, Systolic array design methodology, FIR systolic arrays, selection of scheduling vector, matrix-matrix multiplication and 2-D systolic array design. Systolic arrays for state representations containing delays.

UNIT-IV

Fast Convolution: Introduction, Cook-Toom algorithm, Winograd algorithm, Iterated convolution, Cyclic convolution. **Algorithmic strength reduction in Filters and Transforms:** Introduction, Parallel FIR filters, Discrete Cosine Transform and IDCT. **Pipelined and Parallel Recursive Filters:** Introduction, Pipeline interleaving in digital filters, Pipelining in first order IIR fiters, Pipelining in higher order IIR filters, Parallel processing for IIR filters.

UNIT-V

Bit-Level Arithmetic Architectures: Introduction, Parallel Multipliers, Interleaved floorplan and bitplane based digital filters, Bit serial multipliers, bit serial filter design and implementation. **Numerical strength reduction:** Introduction, subexpression elimination, multiple constant multiplication, sub-expression sharing in digital filters. **Low Power Design:** Introduction, Theoretical background, scaling vs. power consumption, power analysis, power reduction techniques, power estimation approaches.

Text Books

1. Keshab Parhi, VLSI Digital Signal Processing, Wiley Student Edition, 1999.

Reference Books

1. Lan Wanhammer, DSP Integrated Circuits, Academic Press
2. George A. Constantinides, Peter Y.K. Cheung, Wayne Luk, Synthesis and Optimization of DSP Algorithms, Kluwer Academic Publishers.
3. Digital Signal Processing : Principles, Algorithms and Applications - Proakis, J.Gard and D.G.Manolakis, Fourth Edn.,,PHI, 1996

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Data Converters

Code: **EIRVD944** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

Comparators: Comparator Specifications, Using An Opamp For A Comparator, Charge-Injection Errors, Latched Comparators, Examples Of Cmos And Bicmos Comparators. **Sample-And-Hold And Translinear Circuits:** Performance Of Sample-And-Hold Circuits, Mos Sample-And-Hold Basics, Examples Of Cmos S/H Circuits, Bipolar And Bicmos Sample And Holds, Translinear Gain Cell, Translinear Multiplier.

Unit-II

Continuous-Time Filters: Introduction To Continuous-Time Filters, Introduction To Gm-C Filters, Transconductors Using Fixed Resistors, Cmos Transconductors Using Active Transistors, Bicmos Transconductors, Active Rc And Mosfet-C Filters, Tuning Circuitry, Introduction To Complex Filters. **Discrete-Time Signals:** Overview Of Some Signal Spectra, Laplace Transforms Of Discrete-Time Signals, Spectra Of Discrete-Time Signals, Z-Transform, Downsampling And Upsampling, Discrete-Time Filters, Sample-And-Hold Response.

Unit-III

Switched-Capacitor Circuits: Basic Building Blocks, Basic Operation And Analysis, Noise In Switched-Capacitor Circuits, First-Order Filters, Biquad Filters, Charge Injection, Switched-Capacitor Gain Circuits, Correlated Double-Sampling Techniques, Other Switched-Capacitor Circuits. **Data Converter Fundamentals**: Ideal D/A Converter, Ideal A/D Converter, Quantization Noise, Deterministic Approach, Stochastic Approach, Signed Codes, Performance Limitations, Resolution. Offset And Gain Error, Accuracy And Linearity

Unit-IV

Nyquist-Rate D/A Converters: Decoder-Based Converters, Binary-Scaled Converters, Thermometer-Code Converters, Hybrid Converters. Nyquist-Rate A/D Converters: Integrating Converters, Successive-Approximation Converters, Algorithmic (Or Cyclic) A/D Converter, Pipelined A/D Converters, Flash Converters, Issues In Designing Flash A/D Converters, Two-Step A/D Converters, Interpolating A/D Converters, Folding A/D Converters, Time-Interleaved A/D Converters

Unit-V

Oversampling Converters: Oversampling Without Noise Shaping, Oversampling With Noise Shaping, System Architectures, Digital Decimation Filters, Higher-Order Modulators, Bandpass Oversampling Converters, Practical Considerations, Multi-Bit Oversampling Converters, Third-Order A/D Design Example

Text Books :

1.Tony Chan Carusone, Kenneth W. Martin, David A. Johns, Analog Integrated Circuit Design, 2nd Edition, Wiley Publications 2011.
2.Allen Holberg, Cmos Analog Circuit Design, Oxford Publications

Reference Books:

1.Cmos Data Converters For Communication - M. Gustavsson, J. Wikner, And N. Tan. Kluwer Academic Publishers, 2000.
2.Principles Of Data Conversion System Design - Behzad Razavi.
3.Data Converters, Franco Maloberti, Springer Publications
Cmos Mixed Signal Design, Baker Li, Boyce, Wiley Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

HDL Programming Laboratory

Code:	**EIRVD911**	Category:	**PGC**
Credits:	**2**	No. of hours:	**3 per week**
Department: **ECE**			

Modeling and Functional Simulation of the following digital circuits (with Xilinx/ ModelSim tools) using VHDL/Verilog Hardware Description Languages

1. Part – I Combinational Logic: Basic Gates, Multiplexer, Comparator, Adder/ Substractor, Multipliers, Decoders, Address decoders, parity generator, ALU

2. Part – II Sequential Logic: D-Latch, D-Flip Flop, JK-Flip Flop, Registers, Ripple Counters, Synchronous Counters, Shift Registers (serial-to-parallel, parallel-to-serial), Cyclic Encoder / Decoder.

3. Part – III Memories and State Machines: Read Only Memory (ROM), Random Access Memory (RAM), Mealy State Machine, Moore State Machine, Arithmetic Multipliers using FSMs

4. Part-IV: FPGA System Design: Demonstration of FPGA and CPLD Boards, Demonstration of Digital design using FPGAs and CPLDs. Implementation of UART/Mini Processors on FPGA/CPLD

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Advanced VLSI Design Laboratory

Code: **EIRVD912** Category: **PGC**
Credits: **2** No. of hours: **3 per week**
Department: **ECE**

This Laboratory Course takes two 3-Hour Sessions per week.

Session-I: VLSI System Design

1. Design/Simulation of other analog building blocks
    a. Comparators
    b. Oscillators
    c. PLLs
    d. switched capacitor circuits
    e. Noise Analysis

2. Miniprojects involving
    a. Unpipelined MIPS Processor
    b. Pipelined MIPS Processor
    c. Out of Order Execution with Tomasulo's Algorithm
    d. Communication Controllers
    e. Arithmetic Circuits
    f. DSP Systems

Session-II: ASIC Design

Experiments shall be carried out using Mentor Graphics/Cadence Tools

1. Part-I: Backend Design
   Schematic Entry/ Simulation / Layout/ DRC/PEX/Post Layout Simulation of CMOS Inverter, NAND Gate, OR Gate, Flip Flops, Register Cell, Half Adder, Full Adder Circuits

2. Part-II: Semicustom Design
   HDL Design Entry/ Logic Simulation, RTL Logic Synthesis, Post Synthesis Timing Simulation, Place & Route, Design for Testability, Static Timing Analysis, Power Analysis of Medium Scale Combinational, Sequential Circuits

3. Part-III: High Speed/Low Power CMOS Design
   Designing combinational/sequential CMOS circuits for High Speed
   Designing combinational/sequential CMOS circuits for Low Power

Integrated Dual Degree Program B.Tech (ECE) + M.Tech X Semester

Project-II

Code: **EIRVD011** Category: **PPW**
Credits: **18**
Department: **ECE**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VII Semester
Advanced Digital Signal Processing

Code : **EIRDS702/EUREC733** Category: **PGC**

Credits : **3** No. of hours: **8 per week**
Department: **ECE**

UNIT-I

Multirate Digital Signal Processing – Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Implementation of Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications of Sampling Rate Conversion, Digital Filter Banks Two-Channel Quadrature Mirror Filter Bank.

UNIT-II

Linear Prediction And Optimum Linear Filters - Random Signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations Wiener Filters for Filtering and Prediction.

UNIT-III

Adaptive Filters - Applications of Adaptive Filters, Adaptive Direct-Form FIR Filters-The LMS Algorithm, Adaptive Direct-Form FIR Filters-RLS Algorithms.

UNIT-IV

Power Spectrum Estimation – Basic Methods Estimation of Spectra from Finite-Duration Observations of Signals, Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation.

UNIT-V

Power Spectrum Estimation – Advanced Methods: Filter Bank Methods: Capon's method, Eigenanalysis Algorithms for Spectrum Estimation: Pisarenko Harmonic Decomposition Method, MUSIC algorithm, ESPIRIT algorithm, Eigen Decomposition method

Text Books

1 Digital Signal Processing : Principles, Algorithms and Applications - Proakis, J.Gard and D.G.Manolakis, Fourth Edition, PHI, 2006.

Reference Books

1. Monson Hayes, Statistical Digital Signal Processing, Wiley Student Edition, 2008
2. Manolakis, Vijay Ingle, Statistical and Adaptive Signal Processing by Artech Book House, 2009.
3. P.P. Vaidyanathan, Multirate systems and Filter banks, Prentice Hall, 1993
4. V. Oppenheim and R.W.Schafer, Discrete time Signal Processing, PHI 1994
5. S.J. Orfanidis, Optimum Signal Processing, McGraw Hill, 1989.
6. Wavelet Transforms: Introduction to Theory and Applications, Raghuveer M Rao, Ajit S, Bopardikar, Pearson Education 2000.
7. Insight into Wavelets, Ramachandran and Soman, Prentice Hall Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VII Semester
Digital System Design

Code	: EIRDS703/ EIRVD703	Category:	**PGC**
Credits	: **3**	No. of hours:	**8 per week**
Department:	**ECE**		

UNIT I

Review of Logic Design Fundamentals: Combinational Logic / Boolean Algebra and Algebraic Simplification Karnaugh Maps / Designing with NAND and NOR Gates / Hazards in Combinational Circuits / Flip-Flops and Latches / Mealy Sequential Circuit Design / Design of a Moore Sequential Circuit / Equivalent States and Reduction of State Tables / Sequential Circuit Timing / Tristate Logic and Busses

UNIT II

Introduction to VHDL: Computer-Aided Design / Hardware Description Languages / VHDL Description of Combinational Circuits / VHDL Modules / Sequential Statements and VHDL Processes / Modeling Flip-Flops Using VHDL Processes / Processes Using Wait Statements / Two Types of VHDL Delays: Transport and Inertial Delays / Compilation, Simulation, and Synthesis of VHDL Code / VHDL Data Types and Operators / Simple Synthesis Examples / VHDL Models for Multiplexers / VHDL Libraries / Modeling Registers and Counters Using VHDL Processes / Behavioral and Structural VHDL / Variables, Signals, and Constants / Arrays / Loops in VHDL / Assert and Report Statements

UNIT III

Introduction to Programmable Logic Devices: Brief Overview of Programmable Logic Devices / Simple Programmable Logic Devices (SPLDs) / Complex Programmable Logic Devices (CPLDs) / Field-Programmable Gate Arrays (FPGAs) Design Examples: BCD to 7-Segment Display Decoder / A BCD Adder / 32-Bit Adders / Traffic Light Controller / State Graphs for Control Circuits / Scoreboard and Controller / Synchronization and Debouncing / A Shift-and-Add Multiplier / Array Multiplier / A Signed Integer/Fraction Multiplier / Keypad Scanner / Binary Dividers

UNIT IV

SM Charts and Microprogramming: State Machine Charts / Derivation of SM Charts / realization of SM Charts / Implementation of the Dice Game / Microprogramming / Linked State Machines

UNIT V

Designing with Field Programmable Gate Arrays: Implementing Functions in FPGAs / Implementing Functions Using Shannon's Decomposition / Carry Chains in FPGAs / Cascade Chains in FPGAs / Examples of Logic Blocks in Commercial FPGAs / Dedicated Memory in FPGAs / Dedicated Multipliers in FPGAs / Cost of Programmability / FPGAs and One-Hot State Assignment / FPGA Capacity: Maximum Gates Versus Usable Gates / Design Translation (Synthesis) / Mapping, Placement, and Routing

Text Books :

1. Charles Roth, Lizy Kurian John, Principles of Digital System Design using VHDL, Cengage Learning, 2009.

Reference Books

1. John F. Wakerly, Digital Design Principles and Practices, Pearson Education, 2002..
2. Digital Systems Design using VHDL by Charles Roth, Cengage Learning, 1998.
3. Michael Ciletti, Advanced Digital Design using Verilog HDL, Prentice Hall Publications, 2006
4. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte) 1994.
5. S.Trimberger, Field Programmable Gate Array Technology, Kluwer Academic Publications ,1994.
6. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
7. S.Brown, R.Francis, J.Rose, Z.Vransic, Field Programmable Gate Array, Kluwer Pubications, 1992.
8. S.Brown, R.Francis, J.Rose, Z.Vransic, Fundamentals of Digital Logic with Verilog Design, Kluwer Pubishers, 1992.
9. FPGA Based system Design, Wayne Wolf, Pearson Education

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VII Semester
Industrial Training

Code : **EIREC711** Category: **IT**

Credits : **8**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
DSP Processors and Architectures

Course Code: EIRVD833/ EIRDS801/ EIRRM834/EUREC835 Category: **PGC**
Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Review of Digital signal processing. ,the sampling process,Discrte time sequences, discrete fourier transform and FFT, Linear time –invariant systems, digital filters, decimation and Interpolation,analysys and design tool for DSP systems. **Computational accuracy IN DSP Implementations:** number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D conversion errors, DSP computational errors.D/A conversion errors, compensating filter.

UNIT-II

Architectures for Programmable DSP Devices : basic architectural features,DSP computational building blocks. Bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, speed issues, features for external interfacing. **Programmable Digital Signal Processors:** Introduction. Commercial Digital Signal Processing Devices. The Architecture of TMS320C54xx Digital Signal Processors. Addressing Modes of the TMS320C54xx Processors. Memory Spaces of TMS320C54xx Processors. Program Control. TMS320C54xx Instructions and Programming. On-Chip Peripherals. Interrupts. Pipeline Operation of the TMS320C54xx Processors

UNIT-III

Implementation of Basic DSP Algorithms: Introduction. The Q-notation. FIR Filters. IIR Filters. Interpolation Filters. Decimation Filters. PID Controller. Adaptive Filters. 2-D Signal Processing. **Implemenation of FFT Algortihms:** Introduction. An FFT Algorithm for DFT Computation. A Butterfly Computation. Overflow and Scaling. Bit-Reversed Index Generation. An 8-point FFT Implementation of TMS320C54xx. Computation of Signal Spectrum

UNIT-IV

Interfacing Memory and Parallel IO Peripherals to Programmable DSP Devices: Introduction. Memory Space Organization of the TMS320C54xx Devices. Memory and I/O Signals of the TMS320C54xx Devices. Memory Interface. Parallel I/O. Programmed I/O. Interrupts and I/O. Direct Memory Access (DMA).

UNIT-V

Interfacing Serial Converters to a Programmable DSP Device: Introduction. Synchronous Serial Interface between the DSP and an AIC. A Multi-channel Buffered Serial Port (McBSP). The McBSP Programming. A CODEC Interface Circuit. CODEC Programming. A CODEC-DSP Interface Example. **Applications:** Introduction. A DSP System. DSP Based Biotelemetry System. A Speech Processing System. An Image Processing System. A Position Control System for a Hard Disk Drive. DSP Based Power Meter

Text Books:

1. Digital Signal Processing- Avtar Singh and S. Srinivasan, Thompson Publications, 2004.

Reference Books:

1. Digital signal processors, Archtecture, programming and applications- B. venkata ramani and M. Bhaskar, TMH, 2004.
2. Sen. M. Kuo, Real-Time Digital Signal Processing: Implementations and Applications 2/e, Wiley Publications, 2006
3. Rulph Chassaing, Digital Signal Processing with C6713 and C6416 DSK, 2/e Wiley Publications, 2005
4. DSP processor fundamentals, Archtecture & Features-Lapsley et al. S. Chand & Co.2000
5. Steve Tretter, Communication System Design using DSP Algorithms, Springer Publications.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
(ELECTIVE)
Linear Algebra and Random Processes

Course Code: **EIRDS821** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit I

Matrices and Gaussian Elimination, Vector Spaces: The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations. **Orthogonality:** Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections and Least Squares, Orthogonal Bases and Gram-Schmidt. **Determinants**: Applications of Determinants.

Unit-II

Eigenvalues and Eigenvectors: Diagonalization of a Matrix, Difference Equations and Powers A^k, Differential Equations and e^{At}, Complex Matrices, **Positive Definite Matrices:** Minima, Maxima, and Saddle Points, Tests for Positive Definiteness, Singular Value Decomposition, Minimum Principles, The Finite Element Method,.**Computations with Matrices**, **Linear Programming:** Linear Inequalities, the Simplex Method

Unit-III

Probability: Different Kinds of Probability. Joint, Conditional, and Total Probabilities; Independence. Bayes' Theorem and Applications. Combinatory. Bernoulli Trials—Binomial and Multinomial Laws. Asymptotic Behavior of the Binomial Law: The Poisson Law. Normal Approximation to the Binomial Law. **Random Variables:** Introduction. Probability Density Function. Continuous, Discrete and Mixed Random Variables. Conditional and Joint Distributions and Densities. Problems, Examples.

Unit-IV

Expectation and Estimation: Moment Generating Functions. Chernoff Bound. Characteristic Functions. Estimators for the Mean and Variance of the Normal Law. **Random Vectors and Parameter Estimation**: Joint Distributions and Densities. Multiple Transformations of Random Variables. Expectation Vectors and Covariance Matrices. Properties of Covariance Matrices.

Unit-V

Random Sequences: Random Sequences and Linear Systems. WSS Random Sequence. Markov Random Sequences. Vector Random Sequences and State Equations. Convergence of Random Sequences. Laws of Large Numbers. **Random Processes**: Some Important Random Processes. Continuous-Time Linear Systems with Random Inputs. Some Useful Classification of Random Processes. Wide-Sense Stationary Processes and LSI Systems. Periodic and Cyclostationary Processes. Vector Processes and State Equations.

Text Books:

1. Gilbert Strang, Linear Algebra and its applications, Fourth Edition, Pearson Education, 2009

2. Henry Stark, John W. Woods, Probability and Random Processes with Applications to Signal Processing, 3/E, Pearson Education, 2002.

Reference Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Communication Systems – 3rd Edition Simon Haykin, TMH, 1995.
4. Steven M. Kay, Intuitive Probability Theory and Random Processes using MATLAB, Springer, 2010
5. Horn and Johnson, Matrix Analysis, Cambridge Univ. Press, 1985.
6. Golub and Van Loan, Matrix Computations, John Hopkins University Press, 1983.
7. Hoppmann, Kunze, Linear Algebra 2/e, Pearson Education, 1971

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
(ELECTIVE)
Estimation and Detection Theory

Course Code: **EIRDS822 /EIRCM832** Category : **PGE**

Credits : **3** No. of hours: **4 per week**

Department: **ECE**

UNIT-I

Minimum Variance Unbiased Estimation: Introduction, summary, unbiased estimators, minimum variance criterion, existence criteria and finding minimum variance unbiased estimator, extension to a vector parameter. **Cramer-Rao Lower Bound:** Introduction, Summary, estimatory accuracy considerations, cramer-rao lower bound, general crlb for signals in white Gaussian noise, transformation of parameters, extension to a vector parameter, vector parameter CRLB.

UNIT-II

Linear Models: Introduction, summary, linear model examples. **Best Linear Unbiased Estimators:** Introduction, Summary, Definition of BLUE, Finding BLUE, Extension to a vector parameter. **Maximum Likelihood Estimation:** Introduction, summary, finding the MLE, Properties of the MLE, MLE for transformed parameters, extension to vector parameter. Signal Processing examples.

UNIT-III

Least Squares: Introduction, the least squares approach, linear least squares, order-recursive least squares, sequential least squares, constrained least squares. Bayesian Philosophy: General Bayesian estimators, Linear Bayesian estimators. **The Bayesian Philosophy:** Introduction, Summary, Prior Knowledge and estimation, choosing a prior pdf, properties of the Gaussian pdf, Bayesian linear model. **General Bayesian Estimators:** Introduction, Summary, Risk functions, minimum mean square error estimators, maximum aposteriori estimators, performance description, signal processing examples.

UNIT-IV

Introduction: Detection Theory in Signal Processing. The Detection Problem. The Mathematical Detection Problem. Hierarchy of Detection Problems. **Summary of Important PDFs. Statistical Decision Theory -** Neyman-Pearson Theorem. Receiver Operating Characteristics. Irrelevant Data. Minimum Probability of Error. Bayes Risk. Multiple Hypothesis Testing. Neyman-Pearson Theorem. Minimum Bayes Risk Detector - Binary Hypothesis. Minimum Bayes Risk Detector - Multiple Hypotheses.

Unit-V

Deterministic Signals: Matched Filters. Generalized Matched Filters. Multiple Signals. Linear Model. Signal Processing Examples. Reduced Form of the Linear Model. **Random Signals -** Estimator-Correlator. Linear Model, Estimator-Correlator for Large Data Records. General Gaussian Detection. Signal Processing Example. Detection Performance of the Estimator-Correlator.

Text Books

1. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol.1: Estimation Theory, Pearson Education, 1993.
2. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol.2: Detection Theory, Pearson Education, 1998

Reference Books

1. H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd Ed., Springer-Verlag, 1994.
2. H. L. Van Trees, Detection, Estimation and Modulation Theory, Parts 1 and 2, John Wiley Inter-Science.
3. E. L. Lehman, Testing Statistical Hypothesis, John Wiley, 1986.
4. M. D. Srinath, P. K. Rajasekaran and R. Vishwanathan, An Introduction to Statistical Signal Processing with Applications, Prentice-Hall, 1996.
5. Todd K. Moon, Wynn C. Stirling, Mathematical Methods and Algorithms for Signal Processing, Prentice Hall,1999

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
Communication Networks

Course Code:**EIRRM833/ EIRCM801/EIRDS823** Category: **PGE**
Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit - I

Communication Networks and Services, Evolution of Network Architecture and Services, Future Network Architectures and Their Services, Key Factors in Communication Network Evolution. Applications and Layered Architectures - Examples of Protocols. Services and Layering. The OSI Reference Model. Overview of TCP/IP Architecture. Network Management Overview

Unit - II

Digital Transmission Fundamentals: Characterization of Communication Channels, Fundamental Limits in Digital Transmission, Line Coding, Modems and Digital Modulation, Properties of Media and Digital Transmission Systems, Error Detection and Correction. **Circuit-Switching Networks – Multiplexing**: Circuit Switches, the Telephone Network, Signaling, Cellular Telephone Networks

Unit - III

Peer-to-Peer Protocols and Data Link Layer - Peer-to-Peer Protocols - Peer-to-Peer Protocols and Service Models, ARQ Protocols and Reliable Data Transfer Service, Data Link Controls, Framing, HDLC Data Link Control. Medium Access Control Protocols and Local Area Networks, Medium Access Control Protocols, Multiple Access Communications, Random Access, Channelization, Local Area Networks. LAN Protocols, Ethernet and IEEE 802.3 LAN Standard, Wireless LANs and IEEE 802.11 Standard, LAN Bridges

Unit - IV

Packet-Switching Networks, Network Services and Internal Network Operation, Packet Network Topology Datagrams and Virtual Circuits, Routing in Packet Networks, Shortest-Path Routing, ATM Networks,

Unit – V

TCP-IP and ATM Networks - TCP/**IP**, the Internet Protocol, IPv6, User Datagram Protocol, Transmission Control Protocol, and Mobile IP, **ATM Networks,** ATM Signaling,

Text Books:

1. Leon Garcia Widjaja, Communication Networks, Tata McGraw Hill, 2000

Reference Books:

2. ATM fundamentals-N.N. Biswas,Advenrture books publishers,1998
3. Data Networks, Robert Gallagher, PHI Publications
4. Computer Networks, A.To down approach featuring the Internet Kurose Pearson Education.
5. Data Communications & Networking, Forozam 4th Edition TMH Publication.
6. An Engineering Approach to Computer Networking, S. Keshav, Pearson Education, 2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
Digital VLSI Design

Course Code: **EIRDS824** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction: Overview of VLSI Design Methodologies, VLSI design flow, design hierarchy, concepts of regularity, modularity and locality, VLSI design styles. **Fabrication of MOSFET:** Introduction, Fabrication process flow: basic steps, the cmos n-well process, layout design rules, full custom mask layout design.

UNIT-II

MOS Transistor: The metal-oxide-semiconductor structure, the mos system under external bias, structure and operation of mos transistor, mosfet current voltage characteristics, mosfet scaling and small geometry effects, mos capacitances. **Modeling of MOS transistors using SPICE:** Basic concepts, Level-1 model equations, Level-2 model equations, Level-3 model equations, Capacitance models, comparison of spice mosfet models.

UNIT-III

MOS Inverters- Static Characteristics: Introduction, review of resistive load and n-type mosfet load inverters, CMOS inverter. **MOS Inverters – Switching Characteristics and Interconnect effects:** Introduction, delay-time definitions, calculation of delay times, inverter design with delay constraints, estimation of interconnect parasitic, calculation of interconnect delay. Switching power dissipation of cmos inverters. Super buffer design.

UNIT-IV

Combinational MOS Logic Circuits: CMOS Logic Circuits, Complex Logic circuits, CMOS transmission gates. **Sequential MOS Logic Circuits:** Introduction, Behavior of bistable elements, sr latch circuit, clocked latch and flip-flop circuits, CMOS d-latch and edge triggered flip-flop,

UNIT-V

Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS circuit techniques, High performance dynamic cmos circuits. **Semiconductor Memories:** Introduction, Dynamic Random Access memory, Static random access memory. Basics of flash memory.

Text Books:

1. S. M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits, Third Edition, McGraw Hill, 2003

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, & Borivoje Nikolic, Digital Integrated Circuits – A design perspective, Second Edition, PHI, 2003
2. Jackson & Hodges, Analysis and Design of Digital Integrated circuits. 3rd Ed. TMH Publication, 2005.
3. Ken Martin, Digital Integrated Circuit Design, Oxford Publications, 2001.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
Digital Signal Compression

Course Code:	**EIRDS831**	Category:	**PGE**
Credits : **3**		No. of hours:	**4 per week**
Department: **ECE**			

Unit-I

Mathematical Preliminaries for Lossless Compression: Overview, A Brief Introduction to Information Theory, Derivation of Average Information, Models, Coding. Algorithmic Information Theory, Minimum Description Length Principle. **Huffman Coding:** Overview, The Huffman Coding Algorithm. **Arithmetic Coding:** Overview, Introduction, Coding a Sequence, Generating a Binary Code, Comparison of Huffman and Arithmetic Coding, Adaptive Arithmetic Coding.

Unit-II

Mathematical Preliminaries for Lossy Coding: Overview, Introduction, Distortion Criteria, Information Theory Revisited, Rate Distortion Theory, Models. **Scalar Quantization:** Overview, Introduction, The Quantization Problem, Uniform Quantizer, Adaptive Quantization, Nonuniform Quantization.

Unit-III

Vector Quantization: Overview, Introduction, Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree-Structured Vector Quantizers, Structured Vector Quantizers. **Differential Encoding:** Overview, Introduction, The Basic Algorithm, Prediction in DPCM, Adaptive DPCM, Delta Modulation, Speech Coding.

Unit-IV

Transform Coding: Mathematical Preliminaries for Transforms, Subbands, and Wavelets, The Transform Transforms of Interest, Quantization and Coding of Transform Coefficients, Application to Image Compression—JPEG, Application to Audio Compression—the MDCT. S**ubband Coding:** Overview, Introduction, Filters, .1 Some Filters Used in Subband Coding, The Basic Subband Coding Algorithm, Design of Filter Banks, Perfect Reconstruction Using Two-Channel Filter Banks, M-Band QMF Filter Banks, The Polyphase Decomposition, Bit Allocation, Application to Speech Coding—G.722, Application to Audio Coding—MPEG Audio, Application to Image Compression.

Unit-V

Audio Coding: Overview, Introduction, MPEG Audio Coding, 16.4 MPEG Advanced Audio Coding, Dolby AC3 (Dolby Digital). **Video Compression:** Overview, Introduction, Motion Compensation, Video Signal Representation, ITU-T Recommendation H.261, Model-Based Coding, Asymmetric Applications, The MPEG-1 Video Standard, The MPEG-2 Video Standard—H.262.

Text Books:

1. K. Sayood, Introduction to Data Compression, Pearson Education, 2000.

Reference Books:

1. Jayant & Noll, Digital coding of waveforms-Principles and applications to speech & video, PH, 1984.
2. M.Nelson, The data compression book, BPB Publications, 2002.
3. D. Salomon, Data Compression – the complete reference, Springer, 2000.
4. Zi Nian Li, Fundamentals of Multimedia, Pearson Education, 2003.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

Modeling and Design with HDLs

Code: **EIRDS832/EIRVD832** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
Basic Concepts:Lexical Conventions. Data Types. System Tasks and Compiler Directives.**Modules and Ports:** Modules. Ports. Hierarchical Names. **Gate-Level Modeling:** Gate Types. Gate Delays.

Unit-II
Dataflow Modeling: Continuous Assignments. Delays. Expressions, Operators, and Operands. Operator Types. Examples.

Unit-II
Behavioral Modeling: Structured Procedures. Procedural Assignments. Timing Controls. Conditional Statements. Multiway Branching. Loops. Sequential and Parallel Blocks. Generate Blocks. Examples.

Unit-III
Tasks and Functions: Difference between Tasks and Functions. Tasks. Functions. **Procedural Continuous Assignments.** Overriding Parameters. Conditional Compilation and Execution. Time Scales. Useful System Tasks. **Timing and Delays:** Types of Delay Models. Path Delay Modeling. Timing Checks. Delay Back-Annotation.

Unit- IV
Switch Level Modeling: Switching-Modeling Elements. Examples. **User-Defined Primitives**: UDP basics. Combinational UDPs. Sequential UDPs. UDP Table Shorthand Symbols. Guidelines for UDP Design.

Unit-V
Writing test benches: Basic testbenches, Testbench structure, Constrained random stimulus generation, Object-oriented programming, Assertion-based verification. **SystemVerilog simulation**: Event-driven simulation, SystemVerilog simulation Races, Delay models, Simulator tools**. SystemVerilog synthesis:** RTL synthesis: Non-synthesizable SystemVerilog, Constraints, Attributes, Area and structural constraints Synthesis for FPGAs, Behavioral synthesis, Verifying synthesis results

Text Books

3. Samir Palnitkar, Verilog HDL 2/e, Pearson Education,
4. Mark Zowilski, Digital System Design with SystemVerilog, Pearson Education, 2010

Reference Books

4. J.Bhasker, Verilog HDL Primer, Pearson Education
5. J.Bhasker, Verilog Synthesis Primer, B.S.Publications.
6. M.Ciletti, Advanced Digital Design with Verilog HDL,Second Edition Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
Multirate Systems and Time Frequency Analysis

Course Code: **EIRDS833** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
Multirate Signal Processing: Fundamentals of Multirate Systems :- Introduction, basic multirate operations, interconnection of building blocks, polyphase representation, multistage implementations, special filters and filter banks;

Unit-II
Maximally Decimated Filter Banks:- Introduction, errors created in QMF bank, alias free QMF system, power symmetric QMF banks, M-channel filter banks, polyphase representation, perfect reconstruction systems; Paraunitary Perfect Reconstruction (PR) Filter Banks :- Introduction, lossless transfer matrices, filter bank properties induced by paraunitariness, two channel FIR paraunitary QMF banks, two channel paraunitary QMF lattice, M-channel FIR paraunitary filter banks;

Unit-III
Linear Phase Perfect Reconstruction QMF Banks:- Introduction, lattice structures for linear phase FIR PR QMF banks, formal synthesis of linear phase FIR PR QMF lattice; Cosine modulated Filter Banks: Introduction, pseudo QMF bank, design of pseudo QMF bank, efficient polyphase structures, cosine modulated perfect reconstruction systems. Applications of Multirate Signal Processing: Analysis of audio, speech, image and video signals.

Unit-IV
Time-Frequency Signal Analysis and Processing: Time-Frequency Concepts :- Time-domain representation, frequency domain representation, joint time-frequency representation, desirable characteristics of a time-frequency distribution (TFD), analytic signals, Hilbert transform, duration, bandwidth, bandwidth duration product, uncertainty principle, instantaneous frequency, time delay;

Unit-V
Time-Frequency Distributions:- Wigner distribution, wigner-ville distribution, time-varying power spectral density, short-term Fourier transform, spectrogram, Gabor transform, instantaneous power spectra, energy density, quadratic TFDs, relationship between TFDs; Applications of Time-Frequency Analysis:- analysis of non-stationary signals like speech, audio, image and video signals. **Wavelet Analysis**. Discrete Wavelet Transform, Continuous Wavelet Transform, Multiresolution Analysis, Relationship between wavelets and filter banks.

Text Books

1. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson-Education, Delhi, 2004.
2. B. Boashash, "Time-Frequency Signal Analysis and Processing: A Comprehensive Reference", Elsevier, UK, 2003.
3. L. Cohen, "Time-Frequency Analysis", Prentice Hall, 1995.
4. Spanias, T. Painter & V. Atti, "Audio Signal Processing & Coding", Wiley-Interscience, NJ, USA, 2007
5. Sidney Burrus, Introduction to Wavelets and Wavelet Transforms, Pearson Educatoin 1998

Reference Books

5. V. Oppenheim and R.W.Schafer, Discrete time Signal Processing, PHI 1994

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester
Analog IC Design

Course Code:	**EIRDS834**	Category:	**PGE**
Credits : **3**		No. of hours:	**4 per week**
Department: **ECE**			

UNIT I

Basic MOS Device Physics: General Considerations, MOSFET as a Switch, MOSFET Structure, MOS Symbols, MOS I/V Characteristics, Threshold Voltage, Derivation of I/V Characteristics, Second-Order Effects, MOS Device Models, MOS Device Layout, MOS Device Capacitances, MOS Small-Signal Model, MOS SPICE models, NMOS versus PMOS Devices, Long-Channel versus Short-Channel Devices.

UNIT II

Single-Stage Amplifiers, Basic Concepts , Common-Source Stage, Common-Source Stage with Resistive Load ,CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode, Choice of Device Models.

UNIT III

Differential Amplifiers, Single-Ended and Differential Operation. Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell, **Passive and Active Current Mirrors,** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties

UNIT IV

Frequency Response of Amplifiers, General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair **Feedback** General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise

UNIT V

Operational Amplifiers, General Considerations , Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps , Gain Boosting , Comparison , Common-Mode Feedback . Input Range Limitations, Slew Rate, Power Supply Rejection. **Stability and Frequency Compensation** General Considerations, Multipole Systems, Phase Margin, Frequency Compensation, Compensation of Two-Stage Op Amps, Slewing in Two-Stage Op Amps, Other Compensation Techniques.

Text Books:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill, 2001.

Reference Books:

1. P. R. Gray & R. G. Meyer, Analysis and Design of Analog Integrated Circuits, Fifth Edition, John Wiley, 2010.
2. R. Gregorian and Temes, Analog MOS Intgrated Circuits for Signal Processing, Wiley, 1986.
3. Ken Martin, Analog Integrated Circuit Design, Wiley Publications, 2002.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2001
5. B.Razavi, Fundamentals of Microelectronics, Wiley Publications, 2008

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) VIII Semester

Digital Systems design Laboratory

Course Code: **EIRDS812** Category: **PGC**

Credits : **2** No. of hours: **6 per week**
Department: **ECE**

This laboratory course shall be carried out in two 3-Hour sessions per week

Session-I: HDL Programming Laboratory

Modeling and Functional Simulation of the following digital circuits (with Xilinx/ ModelSim tools) using VHDL/Verilog Hardware Description Languages

1. **Part – I Combinational Logic:** Basic Gates, Multiplexer, Comparator, Adder/ Substractor, Multipliers, Decoders, Address decoders, parity generator, ALU

2. **Part – II Sequential Logic:** D-Latch, D-Flip Flop, JK-Flip Flop, Registers, Ripple Counters, Synchronous Counters, Shift Registers (serial-to-parallel, parallel-to-serial), Cyclic Encoder / Decoder.

3. **Part – III Memories and State Machines:** Read Only Memory (ROM), Random Access Memory (RAM), Mealy State Machine, Moore State Machine, Arithmetic Multipliers using FSMs

4. **Part-IV: FPGA System Design:** Demonstration of FPGA and CPLD Boards, Demonstration of Digital design using FPGAs and CPLDs. Implementation of UART/Mini Processors on FPGA/CPLD

Session-II: Microcontrollers Laboratory

Assembly, C Programming of 8051, PIC Microcontrollers and Interfacing shall be carried out in this session

1. Study of 8051 Architecture, Pin Diagram, Minimal Connections, Intex Hex File format. Usage of Microcontroller Programmer, Demonstration of **Keil Compiler**, Simulator and **Proteus** System Level Simulator (through simple examples
2. 8051 Assembly Programming, Delay Generation
3. 8051 Timer/Counter Programming (using Assembly and C)
4. 8051 Serial Port Programming (using Assembly and C)
5. 8051 Interrupt Programming (Timer Interrupts, Serial Port Interrupts, External Interrupts etc)
6. 8051 Interfacing (LCD, Keypad, ADC, DAC, External Memory)
7. Study of PCB Basics, Development of PCB Layout for simple microcontroller based embedded systems using Proteus ARES Professional
8. Study of PIC Microcontroller Families, Features, Architecture, Register Structure, Usage of PIC C (CCS) Compiler, Mikro C Compiler etc
9. Interfacing PIC Microcontrollers with SPI, I^2C, USB USART, etc
10. Study of ARM Architecture

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Microcontrollers and Interfacing

Course Code: **EIRDS901** Category: **PGC**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
The 8051 Microcontrollers: Microcontrollers and embedded processors, Overview of the 8051 family, 8051 assembly language programming, jump, loop and call instructions.

Unit-II:
I/O Port Programming: 8051 addressomg modes, 8051 programming in C, Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Accessing code ROM space in 8051 C

Unit-III:
8051 Hardware Connection and Intel Hex File: 8051 Timer Programming, 8051 Serial Port Programming, Interrupts Programming, Analog-to-Digital and Digital To Coverter Sensor Interfacing, 8051 interfacing to external memory.

Unit-IV
PIC Microcontrollers: PIC Microcontroller Families, PIC16X8XX Architecture, Peripherals, PIC18F architecture, Peripherals etc

Unit-V
ARM 32 Bit MCUs : Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set – Development tools.

Text Books

1. PIC Microcontroller and Embedded Systems – Using Assembly and C, Mazidi and Mazidi, Pearson Education, 2008
2. The 8051 Microcontroller and Embedded Systems – Using Assembly and C, Mazidi and Mazidi, 2nd Edition, Pearson Education, 2002.
3. Rajkamal, Microcontrollers, Pearson Education, 2002.

Reference Books:

1. Microcontrollers (Theory & Applications) – A.V. Deshmuk, WTMH, 2005.
2. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.
3. Michael Bates, Programming with 8-bit PIC Microcontrollers, Elsevier Publications, 2004.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
ASIC Design

Course Code:	**EIRDS902**	Category:	**PGC**
Credits : **3**		No. of hours:	**4 per week**
Department: **ECE**			

Unit-I
Types of ASICs : Full-Custom ASICs, Standard-Cell-Based ASICs, Gate-Array-Based ASICs, Channeled Gate Array, Channelless Gate Array, Structured Gate Array, Programmable Logic Devices, Field-Programmable Gate Arrays, Design Flow, Case Study. ASIC Cell Libraries. **CMOS Logic:** CMOS Transistors, Combinational Logic Cells, Sequential Logic Cells, Datapath Logic Cells, IO Cells. **ASIC Library Design:** Transistors as Resistors, Transistor Parasitic Capacitance, Library-Cell Design, Library Architecture, Gate-Array Design, Standard-Cell Design, Datapath-Cell Design.

Unit-II
Verilog: Basics of the Verilog Language, Operators, Hierarchy, Procedures and Assignments, Timing Controls and Delay, Tasks and Functions, Control Statements, Logic-Gate Modeling, Modeling Delay, Altering Parameters. **Logic Synthesis:** A Logic-Synthesis Example, A Comparator/MUX, Inside a Logic Synthesizer, Synthesis of the Viterbi Decoder, Verilog and Logic Synthesis. Performance Driven Synthesis.

Unit-III
Simulation: Types of Simulation, The Comparator/MUX Example, Logic Systems, How Logic Simulation Works, Cell Models, Delay Models, Static Timing Analysis, Formal Verification, Switch-Level Simulation, Transistor-Level Simulation. **Test:** The Importance of Test, Boundary-Scan Test, Faults, Fault Simulation, Automatic Test-Pattern Generation, Scan Test, Built-in Self-test, A Simple Test Example.

Unit-IV
ASIC Construction: Physical Design, CAD Tools, System Partitioning, Estimating ASIC Size, Power Dissipation, FPGA Partitioning, Partitioning Methods.

Unit-V
Floorplanning and Placement: Floorplanning, Placement, Physical Design Flow, Information Formats. **Routing:** Global Routing, Detailed Routing, Special Routing, Circuit Extraction and DRC.

Text Book :
1. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Pearson Education, 2001.

Reference Books

1. Jan. M. Rabaey, Digital Integrated Circuits, 2nd Edition, Prentice Hall Publications, 2001
2. Sabih Gerez, Algorithms for VLSI Design Automation, Wiley Publications, 1999.
3. Wayne Wolf, Modern VLSI Design 3/e , Pearson Education, 2002.
4. Samir Palnitkar, Verilog HDL 2/e, Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Data Structures and Algorithms

Course Code: **EIRDS921** Category: **PGE**

Credits : **3** No. of hours: **4 per week**

Department: **ECE**

Unit-I

Introduction: Mathematics Review, Exponents, Logarithms, Series, Modular Arithmetic, The P word, A Brief Introduction to Recursion. **Algorithm Analysis**: Mathematical Background, Model, What to Analyze, Running Time Calculations, A Simple Example, General Rules, Solutions for the Maximum Subsequence Sum Problem, Logarithms in the Running Time: **Lists, Stacks, and Queues:** Abstract Data Types (ADTs). The List ADT, Simple Array Implementation of Lists, Linked Lists, Programming Details, Common Errors, Doubly Linked Lists, Circularly Linked Lists, Examples.

Unit-II

The Stack ADT. Stack Model. Implementation of Stacks. Applications. The Queue ADT. Queue Model. Array Implementation of Queues. Applications of Queues. **Trees.** Preliminaries. Implementation of Trees. Tree Traversals with an Application. Binary Trees. Implementation. Expression Trees. The Search Tree ADT—Binary Search Trees. MakeEmpty. Find. FindMin and FindMax. Insert. Delete. Average-Case Analysis. AVL Trees. Single Rotation. Double Rotation. Tree Traversals (Revisited). B-Trees.

Unit-III

Hashing. General Idea. Hash Function. Separate Chaining. Open Addressing. Linear Probing. Quadratic Probing. Double Hashing. Rehashing. Extendible Hashing. Priority Queues (Heaps). Model. Simple Implementations. Binary Heaps. Structure Property. Heap Order Property. Basic Heap Operations. Other Heap Operations. Applications of Priority Queues. The Selection Problem. Event Simulation. d-Heaps. Leftist Heaps. Leftist Heap Property. Leftist Heap Operations. Skew Heaps. Binomial Queues. Binomial Queue Structure. Binomial Queue Operations. Implementations of Binomial Queues.

Unit-IV

Sorting: Preliminaries. Insertion Sort. The Algorithm. Analysis of Insertion Sort. A Lower Bound for Simple Sorting Algorithms. Shellsort. Analysis of Insertion Sort. Heapsort. Analysis of Heapsort. Mergesort. Analysis of Mergesort.

Quicksort. Picking the Pivot. Partitioning Strategy. Small Arrays. Actual Quicksort Routines. Analysis of Quicksort. A Linear-Expected-Time Algorithm for Selection. Sorting Large Structures. Decision Trees. Bucket Sort. External Sorting. Model for External Sorting. The Simple Algorithm. Multiway Merge. Polyphase Merge. Replacement Selection.

Unit-V

Graph Algorithms: Definitions. Representation of Graphs. Topological Sort. Shortest-Path Algorithms. Unweighted Shortest Paths. Dijkstra's Algorithm. Graphs with Negative Edge Costs. Acyclic Graphs. All-Pairs Shortest Path. Network Flow Problems. A Simple Maximum-Flow Algorithm. Minimum Spanning Tree. Prim's Algorithm. Kruskal's Algorithm. Applications of Depth-First Search. Undirected Graphs. Biconnectivity. Euler Circuits. Directed Graphs. Finding Strong Components. Introduction to the NP-Completeness. Easy vs. Hard. The Class NP. NP-Complete Problems.

Text Books

1.Mark A. Weiss, Data Structures and Algorithm Analysis in C, 2/E, Pearson Educatoin

Reference Books

1.Tanenbaum, Data Structures and Algorithms in C and C++, Pearson Education

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester

Advanced Microprocessors

Course Code: **EIRDS922** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

8086/8088 Hardware Specifications: Pinouts and pin functions, clock generator (8284A), bus buffering and latching, bus timing, ready and wait state, minimum mode vs maximum mode. **Memory Interface**: Memory devices, address decoding, 8088 and 80188 (8-bit) memory interface, 8086, 80186, 80286 and 80386 SX (16-bit) memory interface, 80386DX and 80486 (32-bit) memory interface, Pentium through Core2 (64-bit memory interface), Dynamic RAM

Unit-II

Basic I/O Interface: Introduction to I/O interface, I/O port address decoding, a programmable peripheral interface, 8254 programmable interval timer, 16550 programmable communication interface, analog to digital (ADC) and digital to analog (DAC) converters.

Unit-III

Interrupts: Basic Interrupt processing, hardware interrupts, expanding the interrupt structure, 8259A programmable interrupt controller, interrupt examples.

Unit-IV

Direct Memory Access and DMA Controlled I/O: Basic DMA operation, the 8237 DMA controller, shared bus operation, disk memory systems, video displays.

Unit-V

Bus Interface: The ISA bus, The peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the serial COM ports, the universal serial bus (USB), accelerated graphics port (AGP). Comparison of hardware architecture, memory management, register structure, system timing of 80186, 80188, 80286, 80386, 80486, Pentium, Pentium PRO, Pentium II, Pentium III, Pentium 4, CORE2 Microprocessors.

Text Book:

1. Barry B. Brey, The Intel Microprocessors, Architecture Programming and Interfacing, Eighth Edition, Pearson Education, 2009.

Reference Books:

1. Douglas V. Hall, Microprocessors and Interfacing, Second Edition, McGraw Hill Publications
2. Mohammed Rafiquzzaman, "Microprocessors and Microcomputer-Based System Design," 2nd Edition, Prentice Hall Publications
3. Walter A. Triebel Avtar Singh, 8088 and 8086 Microprocessors, The: Programming, Interfacing, Software, Hardware, and Applications, 4/E, Prentice Hall Publications, 2003.
4. Muhammad Ali Mazidi, Janice Mazidi, x86 PC: Assembly Language, Design, and Interfacing, The: International Edition, 5/E Pearson Education, 2010.

.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Analog System Design

Code: **EIRDS923 / EIRVD921** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

Unit- I

Noise Analysis and Modeling: Statistical Characteristics of Noise, Noise Spectrum, Amplitude Distribution, Correlated and Uncorrelated Sources, Types of Noise, Thermal Noise, Flicker Noise, Representation of Noise in Circuits, Noise in Single-Stage Amplifiers, Common-Source Stage, Common-Gate Stage, Source Followers, Cascode Stage, Noise in Differential Pairs, Noise in Op-Amps, Noise Bandwidth.

Unit-II

Active and Passive Filter Design (Elementary Treatment): General Considerations, Filter Characteristics, Classification of Filters, Filter Transfer Function, Problem of Sensitivity, First-Order Filters, Second-Order Filters, Special Cases, RLC Realizations, Active Filters, Sallen and Key Filter, Integrator-Based Biquads, Biquads Using Simulated Inductors, Approximation of Filter Response, Butterworth Response, Chebyshev Response. **Comparators:** Characterization of a Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators, High-Speed Comparators

Unit-III

Introduction to Switched-Capacitor Circuits General Considerations, Sampling Switches, MOSFETS as Switches , Speed Considerations, Precision Considerations , Charge Injection Cancellation, Switched-Capacitor Amplifiers , Unity-Gain Sampler/Buffer, Noninverting Amplifier, Precision Multiply-by-Two Circuit, Switched-Capacitor Integrator, Switched-Capacitor Common-Mode Feedback

Unit –IV

Bandgap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, PTAT Current Generation, Constant-Gm Biasing, Speed and Noise Issues, Case Study. **Nonlinearity and Mismatch:** Nonlinearity, Mismatch

Unit-V

OSCILLATORS General Considerations , Ring Oscillators, LC Oscillators , Crossed-Coupled Oscillator Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs. **Phase-Locked Loops** Simple PLL , Phase Detector, Basic PLL Topology, Dynamics of Simple PLL, Charge-Pump PLLs, Problem of Lock Acquisition, Phase/Frequency Detector and Charge Pump, Basic Charge-Pump PLL, Nonideal Effects in PLLs , PFD/CP Nonidealities, Jitter in PLLs , Delay-Locked Loops, Applications, Frequency Multiplication and Synthesis, Skew Reduction, Jitter Reduction

Text Books

1. B. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill Publications, 2002
2. Allen Holberg, CMOS Analog Circuit Design, Oxford Publications, 2002
3. B.Razavi, Fundamentals of Microelectronics, Wiley Publications, 2008

Reference Books:

1. Baker, Li, Boyce, CMOS Mixed Circuit Design, Wiley Publications, 2002
2. Baker, Li, Boyce, CMOS Circuit Design Layout and Simulation, IEEE Press, 2000
3. David A Johns, Ken Martin, Analog Integrated Circuit Design, Wiley Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Digital Speech Processing

Course Code: **EIRDS924** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

Speech Production: Human speech production mechanism, acoustic theory of speech production, Digital models for speech production. **Speech perception**: Human hearing, Auditory psychophysics, JND, Pitch perception, Auditory masking, Models for speech perception **Time Domain Models**: Short time Energy and average magnitude, Short time average zero crossing rate, Speech vs. silence discrimination using energy and zero crossing, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function

Unit-II

Short Time Fourier analysis: Introduction, Definitions and properties, Fourier transform interpretation, Linear filtering interpretation, sampling rates of X(ejw) in time and frequency, Filter bank summation method of short time synthesis, Spectrographic displays. **Digital Representations of the Speech Waveform**: Sampling speech signals, Review of the statistical model for speech, Instantaneous quantization, Adaptive quantization, General theory of differential quantization, Delta modulation, Differential PCM, Comparison of systems.

Unit-III

Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Applications of LPC parameters. **Audio Signal Processing** – Basic physics of sounds, music signal features and models, music coding, high quality audio coding (mp3)

Unit-IV

Speech Synthesis: Principles of Speech synthesis, Synthesis based on waveform coding, Synthesis based on analysis synthesis method, Synthesis based on speech production mechanism, Synthesis by rule, Text to speech conversion.

Unit-V

Speech Recognition: Principles of Speech recognition, Speech period detection, Spectral distance measures, Structure of word recognition systems, Dynamic time warping (DTW), Word recognition using phoneme units. Theory and implementation of HMM

Text Books

1. "Digital Processing of Speech Signals", L R Rabiner and R W Schafer, Pearson Education 2004.
2. Multimedia signal processing, Theory and applications of speech, music and communications by Saeed V. Vaseghi. Wiley.
3. Digital Speech Processing, Synthesis and Recognition", Sadoaki Furui, Second Edition, Mercel Dekker 2002.

Reference Books

1. Introduction to Data Compression, Khalid Sayood, Third Edition, Elsivier Publications.
2. Digital Speech, A M Kondoz, Second Edition, Wiley Publ
3. T.F Quatieri, Discrete-time speech signal processing: Principles and Practice Pearson, 2002
4. Zi Nian Li, Fundamentals of Multimedia, Pearson Education, 2003

Embedded Software Design

Course Code: **EIRDS925** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

A First Look at Embedded Systems: Examples of Embedded Systems, Typical Hardware. **Hardware Fundamentals:** Terminology, Gates, A Few Other Basic Considerations, Timing Diagrams, Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor.

Unit-II

Interrupts: Microprocessor Architecture, Interrupt Basics, The Shared-Data Problem, Interrupt Latency. **Survey of Software Architectures:** Round-Robin, Round-Robin with Interrupts, Function-Queue-Scheduling Architecture, Real-Time Operating System Architecture, Selecting an Architecture

Unit-III

Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores and Shared Data. **More Operating System Services:** Message Queues, Mailboxes, and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Unit-IV

Basic Design Using a Real-Time Operating System: Overview, Principles, An Example, Encapsulating Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory Space, Saving Power **Embedded Software Development Tools:** Host and Target Machines, Linker/Locators for Embedded Software. Getting Embedded Software into the Target System,

Unit- V

Debugging Techniques: Testing on Your Host Machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools. **Programming Concepts and Embedded Programming in C, C++ and Java:** Software Programming in Assembly Language (ALP) and in High-Level Language 'C', C Program Elements: Header and Source Files and Preprocessor Directives, Program Elements: Macros and Functions, Program Elements: Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java.

Text Books

1. An Embedded Software Primer by David Simon, Pearson Education
2. Rajkamal, Embedded Systems: Architecture, programming and design, 2/e, Tata McGraw Hill Publications

Reference Books

1. Embedded System design by Arnold S Burger, CMP
2. Embedded Systems Design: Real world design be Steve Heath; Butterworth Heinenann, Newton Mass USA 2002
3. Embedded Microcomputing Systems by Valvano, Cengage Learning, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Biomedical Signal Processing

Course Code: **EIRDS931** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction to Biomedical Signals: The Nature of Biomedical Signals, Examples of Biomedical Signals, Objectives of Biomedical Signal Analysis, Difficulties in Biomedical Signal Analysis, Computer-aided Diagnosis. **Concurrent, Coupled, and Correlated Processes:** Problem Statement, Illustration of the Problem with Case-studies, Application: Segmentation of the PCG

UNIT-II

Filtering for Removal of Artifacts: Problem Statement , Illustration of the Problem with Case-studies, Time-domain Filters, Frequency-domain Filters, Optimal Filtering: The Wiener Filter, Adaptive Filters for Removal of Interference, Selecting an Appropriate Filter, Application: Removal of Artifacts in the ECG, Application: Maternal - Fetal ECG, Application: Muscle-contraction Interference

UNIT-III

Event Detection: Problem Statement, Illustration of the Problem with Case-studies, Detection of Events and Waves, Correlation Analysis of EEG channels, Cross-spectral Techniques, The Matched Filter, Detection of the P Wave, Homomorphic Filtering, Application: ECG Rhythm Analysis, Application: Identification of Heart Sounds, Application: Detection of the Aortic Component of S2

UNIT-IV

Waveshape and Waveform Complexity: Problem Statement, Illustration of the Problem with Case-studies, Analysis of Event-related Potentials, Morphological Analysis of ECG Waves, Envelope Extraction and Analysis, Analysis of Activity, Application: Normal and Ectopic ECG Beats, Application: Analysis of Exercise ECG Application: Analysis of Respiration, Application: Correlates of Muscular Contraction

UNIT-V

Frequency-domain Characterization: Problem Statement, Illustration of the Problem with Case-studies, The Fourier Spectrum, Estimation of the Power Spectral Density Function, Measures Derived from PSD, Application: Evaluation of Prosthetic Valves. Modeling Biomedical Systems-Problem statement, Analysis of Non-stationary signals-problem statement, pattern classification and diagnostic decision-problem statement.

Text Books

Rangayyam, R.M., Biomedical Signal Analysis – A Case-Study Approach, John Wiley, 2002.

Reference Books

1. Tompkins, W.J. (ed.), Biomedical Signal Processing, Prentice Hall, 1993.
2. Chellis, R.E., and Kitney, R.I., Biomedical Signal Processing, in IV parts, Medical and Biological Engg. and Current Computing, 1990-91.
3. Eugene N. Bruce, Biomedical Signal Processing and Signal Modeling, Wiley Publications, 2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Radar Signal Processing

Course Code: **EIRDS932/EIRRM944** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
Introduction: History and Applications of Radar, Basic Radar Functions, Elements of a pulsed radar, signal processing concepts and operations, basic radar signal processing. **Sampling and Quantization of Pulsed Radar Signals:** Domains and criteria for sampling radar signals, Sampling in the fast time domain, Sampling in the slow time: selecting the PRI, sampling the Doppler spectrum, sampling in the spatial and angle dimensions, quantization, I/Q imbalance and digital I/Q

Unit-II
Radar Waveforms: Introduction, The waveform matched filter, matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency modulated pulse compression waveforms, range sidelobe control for fm waveforms, the stepped frequency waveform, phase modulated pulse compression waveforms, costas frequency codes.

Unit-III
Doppler Processing: Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, Pulse pair processing, Additional Doppler processing issues, clutter mapping and moving target detector, MTI for moving platforms: Adaptive displaced phase center antenna processing.

Unit-IV
Synthetic Aperture Imaging: Introduction to the SAR fundamentals, Stripmap SAR data characteristics, Stripmap SAR image formation algorithms, Spotlight SAR data characteristics, The polar format image formation algorithm for spotlight SAR, Interferometric SAR, Other considerations.

Unit-V
Beamforming and Space-Time Adaptive Processing: Spatial Filtering, Space-Time signal environment, Space Time Signal modeling, processing the space-time signal, computational issues in STAP, reduced dimension STAP, Advanced STAP algorithms and analysis, Limitations to STAP.

Text Book

1.Mark Richards, Fundamentals of Radar Signal Processing, Tata McGraw Hill Publications

Reference Books

1. N. Levanon, and E. Mozeson, Radar Signals, Wiley-Interscience, 2004.
2. P. Z. Peebles, Radar Principles, John Wiley, 2004.
3. M. I. Skolnik, Introduction to Radar Systems, 3/e, Tata McGraw Hill, 2001.
4. M. I. Skolnik, Radar Handbook, McGraw Hill, New York, 1990.
5. D. K. Barton, Radar System Analysis and Modeling, Artech House, 2005.
6. F. E. Nathanson, Radar Design Principles, Prentice Hall India, 1999.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Image and Video Processing

Course Code:	**EIRDS933**	Category:	**PGE**
Credits : **3**		No. of hours:	**4 per week**
Department: **ECE**			

UNIT-I

Digital image fundamentals – image acquisition, representation, visual perception, quality measures, sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Video spaces, analog and digital video interfaces, video standards.

UNIT-II

Two dimensional systems – properties, analysis in spatial, frequency and transform domains. Image transforms - DFT, DCT, Sine, Hadamard, Haar, Slant, KL transform, Wavelet transform.

UNIT-III

Image enhancement – point processing, spatial filtering, Image restoration – inverse filtering, de-blurring Image compression – lossless and lossy compression techniques, standards for image compression – JPEG, JPEG200

UNIT-IV

Image segmentation – feature extraction, region oriented segmentation, descriptors, morphology, Image recognition

UNIT-V

Video processing – display enhancement, video mixing, video scaling, scan rate conversion, Video compression – motion estimation, intra and interframe prediction, perceptual coding, standards - MPEG, H.264

Text Books

1. R. C. Gonzalez and R E Woods, Digital Image Processing, Pearson Education, 2002
2. Keith Jack, Video Demystified, LLH, 2001

Reference Books

1. A K Jain, Fundamentals of Digital Image Processing:, Pearson Education,1989
2. W Pratt, Digital Image Processing, Wiley, 2001
3. Bovik, Handbook of Image and Video Processing, Academic Press, 2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester

Multidimensional Signal Processing

Course Code: **EIRDS934** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department : **ECE**

UNIT-I

Multidimensional Discrete signals and Multidimensional systems: Frequency domain characterization of multidimensional signals and systems, sampling two dimensional signals, processing continuous signals with discrete systems. **Discrete Fourier analysis of multidimensional signals:** Discrete Fourier series representation of rectangularly periodic sequences, Multidimensional DFT, definition an properties, Calculation of DFT, Vector radix FFT, Discrete Fourier transforms for general periodically sampled signals, relationship between M dimensional and one dimensional DFTs.

UNIT-II

Design and implementation of two dimensional FIR filters: Implementation, Design using windows, Optimal FIR filter design- least squares design, Design of cascaded and parallel 2 D FIR filters, Design and implementation of FIR filters using transformations

UNIT-III

Multidimensional Recursive systems: Finite order difference equations- realizing LSI systems using difference equations, recursive computability, boundary conditions, ordering the computation of output samples, Multidimensional Z Transforms, stability of 2 D recursive systems, stability theorems, Two dimensional complex cepstrum.

UNIT-IV

Design and implementation of two dimensional IIR filters: Classical 2 D IIR filter implementations, Iterative implementation of 2 D IIR filters, signal flow graphs- circuit elements and their realizations, state variable realizations, Space domain Design techniques- Shank's method, Descent methods, Iterative prefiltering design method, Frequency domain design techniques, stabilization techniques.

UNIT-V

2-Dimensional Inverse problems: Constrained iterative signal restoration; iterative techniques for constrained deconvolution and signal extrapolation, reconstructions from phase or magnitude, Reconstruction of signals from their projections: Projection slice theorem, Discretization of the Reconstruction problem, Fourier domain reconstruction algorithms, Convolution/ back-projection algorithms, iterative reconstruction algorithms, Fan beam algorithms, Projection of discrete signals.

Text Books

1.Dan E Dudgeon and R M Mersereau, Multidimensional Digital Signal Processing, Prentice Hall, 1993.

Reference Books

1. Digital Signal and Image Processing- Tamal Bose, John Wiley publishers.
2. Two dimensional signal and Image Processing- J S Lim, Prentice Hall.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Digital Control Systems

Course Code: **EIRDS935** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I
Sampling process: Sampling process- continuous and sampled signal, uniform impulse sampling- time domain and frequency domain analysis, aliasing, sampling theorem, data reconstruction, zero order hold, first order hold.

UNIT-II

Z Transform methods: Z transform definition- theorem, inverse Z Transform, mapping s plane to Z plane, linear constant coefficient difference equation, solution by recursion and Z transform method, principles of discretization.

UNIT-III

Design of digital control systems: Digital Control systems, pulse transfer function, Z Transform analysis of closed loop and open loop systems, steady state accuracy, characteristic equation, stability, tests for stability, frequency domain analysis, Bode diagrams- gain margin, phase margin, root locus techniques

UNIT-IV

Design of Digital Control Systems: Cascade and feedback compensation using continuous data controllers, digital controller- design using bilinear transformation, root locus based design, digital PID controllers, Dead beat control design.

UNIT-V

State variable methods: State variable techniques for digital control systems, state space modelsalgebraic transformation-canonical forms, interrelations between Z Transform models and state variable models, controllability, observability, stability, response between sampling instants using state variable approach, state feedback, pole placement using state feedback, dynamic output feedback, SISO systems, effect of finite word length on controllability and closed loop placement, case study examples using MATLAB/clones.

Text Books

1. Digital Control systems, Benjamin C Kuo, Saunders College publishing, 1997.
2. Digital control and state variable methods, M Gopal, Tata McGraw Hill publishers, 1997.

Reference Books

1. Discrete-Time control systems, Katsuhito Ogata, Prentice Hall
2. Digital Control systems, Constantine H Houpis and Gary B Lamont, McGraw Hill

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Advanced Digital IC Design

Code:	**EIRVD942/EIRDS941**	Category: **PGE**
Credits:	**3**	No. of hours: **4 per week**
Department: **ECE**		

UNIT-I

Implementation Strategies for Digital ICs: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective—The Implementation Platform of the Future

UNIT-II

The Wire: Introduction, A First Glance, Interconnect Parameters — Capacitance, Resistance, and Inductance, Electrical Wire Models, SPICE Wire Models**. Coping with Interconnect:** Introduction, Capacitive Parasitics, Capacitance and Reliability—Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability—Ohmic Voltage Drop, Electromigration, Resistance and Performance—RC Delay

UNIT-III

Timing Issues in Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Synchronizers and Arbiters, Synchronizers—Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL

UNIT-IV

Designing Arithmetic Building Blocks: Introduction, Datapaths in Digital Processor Architectures, The Adder, The Binary Adder: Definitions, The Full Adder: Circuit Design Considerations, The Binary Adder: Logic Design Considerations, The Multiplier, The Multiplier: Definitions, Partial-Product Generation, Partial Product Accumulation, Final Addition, Multiplier Summary, The Shifter, Barrel Shifter, Logarithmic Shifter

UNIT-V

Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control

Text Books :

1. Jan M. Rabaey Anantha Chandrakasan, & Borivoje Nikolic, Digital Integrated Circuits – A design perspective, Second Edition, PHI, 2003

Reference Books:

1. S. M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits, Third Edition, McGraw Hill, 2003.
2. Jackson & Hodges, Analysis and Design of Digital Integrated circuits. 3rd Ed. TMH Publication, 2005.
3. Ken Martin, Digital Integrated Circuit Design, Oxford Publications, 2001.
4. Sedra and Smith, Microelectronic Circuits 5/e, Oxford Publications, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Array Signal Processing

Course Code: **EIRDS942** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department : **ECE**

Unit-I

Introduction: Signals in Space and Time: Coordinate Systems, propagating waves, dispersion and attenuation, refraction and diffraction, wavenumber frequency space, random fields, signal and noise assumptions. **Apertures and Arrays:** Finite continuous apertures, spatial sampling, arrays of discrete sensors.

Unit-II

Beamforming: Delay and Sum beamforming, space time filtering, filter and sum beamforming, frequency domain beamforming, array gain, resolution, sampling in time, discrete-time beamforming, averaging in time and space

Unit-III

Detection Theory: Elementary Hypothesis testing, Hypothesis testing in the presence of unknowns, detection of signals in Gaussian noise, detection in the presence of uncertainities, detection based array based algorithms.

Unit-IV

Estimation Theory: Terminology in Estimation theory, Parameter estimation, signal parameter estimation, linear signal waveform estimation, spectral estimation.

Unit-V

Adaptive Array Processing: Signal parameter estimation, constrained optimization methods, eigenanalysis methods, robust adaptive array processing, dynamic adaptive methods. **Tracking:** Source motion models, single array location estimate properties, prediction correction algorithms, tracking based on kalman filtering, multiarray tracking in clutter.

Text Book:

1.Johnson and Dudgeon, Array Signal Processing Concepts and techniques, Prentice Hall, 1993.

Reference Books:

1. Naidu, P.S., Sensor Array Signal Processing, CRC Press, 1999.
2. Harry L. Van Trees, Optimum Array Processing, John Wiley & Sons, 2002.
3. Dudgeon, Messermeau, Multidimensional Digital Signal Processing, Prentice Hall Publications
4. D.G.Manolakis, Statistical and Adaptive Signal Processing - Spectral Estimation, Signal Modeling, Adaptive Filtering and Array Processing, Artech Book House, 2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech IX Semester

Advanced Computer Architecture

Code: **EIRVD923 /EIRDS943** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Fundamentals of Computer Design : technology trends, cost Measuring and reporting, performance quantitative principles of computer design, **Instruction set principles and examples**, classifying instruction set, memory addressing ,type and size of operands, addressing modes for signal processing, Operations in the instruction set ,instruction for control ,encoding an instruction set.

UNIT-II

Pipelining: Introduction, The Major Hurdle of Pipelining—Pipeline Hazards, How Is Pipelining Implemented? What Makes Pipelining Hard to Implement?, Extending the MIPS Pipeline to Handle Multicycle Operations. **Instruction Level Parallelism**: Overcoming hazards, reducing branch costs, High performance instruction delivery, hardware based speculation ,Limitation of ILP,ILP software approach, compiler techniques, static branch Protection VLIW approach.

UNIT-III

Memory Hierarchy Design: Introduction, Review of the ABCs of Caches, Cache Performance, Reducing Cache Miss Penalty, Reducing Miss Rate, Reducing Cache Miss Penalty or Miss Rate via Parallelism, Reducing Hit Time, Main Memory and Organizations for Improving Performance, Memory Technology, Virtual Memory, Protection and Examples of Virtual Memory. Basics of Virtual Machines.

UNIT-IV

Multiprocessors and Thread-Level Parallelism: Introduction, Characteristics of Application Domains, Symmetric Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory Architectures, Performance of Distributed Shared-Memory Multiprocessors, Synchronization, Models of Memory Consistency: An Introduction, Multithreading: Exploiting Thread-Level Parallelism within a Processor

UNIT-V

Storage Systems: Introduction, Types of Storage Devices, Buses—Connecting I/O Devices to CPU/Memory, Reliability, Availability, and Dependability, RAID: Redundant Arrays of Inexpensive Disks, Errors and Failures in Real Systems, I/O Performance Measures, Designing an I/O System in Five Easy Pieces

Text Books

1. Computer Architecture a quantitative approach 3rd edition John L. Hennessy & David A Patterson Morgan Kuffman,2002

Reference Books

1. Computer Architecture a quantitative approach 4th edition John L. Hennessy & David A Patterson Morgan Kuffman,2005
2. Computer Architecture and Parallel Processing- Kaui Hwang and A. Briggs International Edition Mc graw hill Advanced Computer Architecture, Dezso Sima,terence Fountain ,peter Kacsuk Pearson Education.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Linear and Nonlinear Optimization

Course Code:	**EIRDS944**	Category:	**PGE**
Credits :	**3**	No. of hours:	**4 per week**
Department:	**ECE**		

UNIT-I

Introduction to Optimization: Engineering applications of optimization, statement of an optimization problem, classification of optimization problems. Optimization techniques. **Classicial Optimization Techniques:** Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints, Convex Programming problem.

UNIT-II

Linear Programming: Introduction, Applications of Linear Programming, Standard Form of a Linear Programming Problem, Geometry of Linear Programming Problems, Definitions and Theorems, Solution of a System of Linear Simultaneous Equations, Pivotal Reduction of a General System of Equations, Motivation of the Simplex Method, Simplex Algorithm, Two Phases of the Simplex Method

UNIT-III

Nonlinear Programming-One-Dimensional Minimization Methods: Introduction Unimodal Function Elimination Methods-Unrestricted Search Exhaustive Search Dichotomous Search Interval Halving Method Fibonacci Method Golden Section Method Comparison of Elimination Methods Interpolation Methods-Quadratic Interpolation Method Cubic Interpolation Method Direct Root Methods Practical Considerations

UNIT-IV

Nonlinear Programming-Unconstrained Optimization Techniques: Introduction, Direct Search Methods-Random Search Methods Grid Search Method, Univariate Method, Pattern Directions, Powell's Method, Simplex Method. Indirect Search Methods- Gradient of a Function, Steepest Descent (Cauchy) Method, Conjugate Gradient (Fletcher –Reeves) Method, Newton's Method, Marquardt Method, Quasi-Newton Methods, Davidon–Fletcher – Powell Method, Broyden–Fletcher –Goldfarb–Shanno Method, Test Functions

UNIT-V

Nonlinear Programming-Constrained Optimization Techniques: Introduction, Characteristics of a Constrained Problem, Direct Methods, Random Search Methods, Complex Method, Sequential Linear Programming, Basic Approach in the Methods of Feasible Directions, Zoutendijk's Method of Feasible Directions, Rosen's Gradient Projection Method, Generalized Reduced Gradient Method, Sequential Quadratic Programming. Indirect Methods-Transformation Techniques, Basic Approach of the Penalty Function Method, Interior Penalty Function Method, Convex Programming Problem, Exterior Penalty Function Method, Extrapolation Techniques in the Interior Penalty Function Method, Extended Interior Penalty Function Methods, Penalty Function Method for Problems with Mixed Equality and Inequality Constraints, Penalty Function Method for Parametric Constraints, Augmented Lagrange Multiplier Method, Checking the Convergence of Constrained Optimization Problems. Test Problems. Introduction to Geometric Programming, Integer Programming and Stochastic Programming.

Text Books

1.Singiresu S. Rao, Engineering Optimization Fourth Edition, John Wiley and Sons, 2009.

Reference Books

1. Luenberger, D.G., Introduction to Linear and Nonlinear Programming, Second Edn, Addison Wesley, 1984.
2. Fletcher, R., Practical methods of Optimization, John Wiley, 1980.
3. Stephen Boyd, Convex Optimization, Cambridge University Press, 2007

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
SONAR signal processing

Course Code: **EIRDS945** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Detection and Estimation Theory of Digital Signals: Some Basic Results from Probability Theory and Mathematical Statistics, Introduction to the Basic Concepts of Information Theory, The Optimum Receiving Theory of Weak Signal in Background Noise, Wiener Filtering, Matched Filtering and Adaptive Filtering for Stationary Random Signal, Kalman Filtering for Non-stationary Digital Signal, Parameter Estimation of Random Signal

UNIT-II

General Principles of Sonar Design: Determination of Sonar System Specifications, Design Procedure of Digital Sonar: the Sonar Equation, Ambient Noise, Radiated Noise from Underwater Target and Platform Noise, Reverberation,

UNIT-III

Sonar Processing: Sound Propagation in the Ocean and Underwater Acoustic Channel, Hydrophone Array and Beamforming, Calculation of Sonar System Gain, Gain Loss of a Sonar System in the Interface of Various Sub-systems,

UNIT-IV

Design of Digital Sonar: System Architecture of Digital Sonar, Parameter Selection of Programmable Digital Sonar, Pre-processing and FIR filtering, High Precision RAM Dynamic Beamforming and Optimum Spatial Filtering, Target Characteristic Analysis: LOFAR, DEMON and Adaptive Line Enhancer

UNIT-V

Implementation Methods of Various Functions of Digital Sonar: Precise Bearing for Target, Automatic Tracking and Multi-target Resolution, Moving Target Analysis: Pre-set Tracking, Fast Moving Target Tracking: Torpedo Alarming, Passive Ranging of Target Based on the Time Delay Estimation, Active Sonar Signal Capture and Analysis. Underwater Acoustic Communication and Adaptive Equalization of Underwater Acoustic Channel

Text Books

1. Qihu Li, Digital Sonar Design in Underwater Acoustics, Springer, New York, 2012

Reference Books

2. A.D.Waite, Sonar for Practising Engineers, 3/e Wiley publications, 2002
3. Richard P. Hodges, Underwater Acoustics, Wiley Publications, 2010

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
IC Design Laboratory

Course Code: **EIRDS911** Category: **PGC**

Credits : **2** No. of hours: **3 per week**
Department: **ECE**

Part-I: Full Custom IC Design (7 Sessions)

The following experiments shall be conducted using Cadence or Tanner Tools

Basics of Linux Operating System and Commands. Schematic, Symbol, Simulation, Layout, Design Rule Check, Parasitic Extraction, Post Layout Simulation, Layout vs Schematic Check of CMOS Inverter, NAND gates, NOR Gates, Full Adder, D-Flip Flop Circuits

Part-II: Semi Custom IC Design (7 Sessions)

The following experiments shall be conducted using Cadence Tools

Verilog Design Entry, Behavioral Simulation, Logic Synthesis, Post Synthesis Simulation, Back Annotation, Test Generation, Static Timing Analysis, Floorplanning, Placement, Special Routing, Detailed Routing, Final Layout, Parasitic Extraction, Post Layout Simulation of various Combinational Sequential Logic Circuits.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(DSSP) IX Semester
Advanced Digital Systems Laboratory

Course Code: **EIRDS912** Category: **PGC**

Credits : **2** No. of hours: **3 per week**
Department: **ECE**

This laboratory course shall be carried out in two 3-Hour sessions per week

Part – I: Statistical Digital Signal Processing Laboratory (12 Sessions)

Random Signal Generation, Bit Sequence Generation, Filtering Random processes, basic experiments on linear algebra. **Multirate Signal Processing:** Basic Operations, Decimation, Interpolation, Sampling Rate Conversion by arbitrary factor, Filter Bank Implementation. **Signal Modeling**: Modeling sequences as AR, MA, ARMA processes. Levinson Durbin Method. **Power Spectrum Estimation**: Non-parametric methods, parametric methods, Noise Subspace methods for frequency estimation. **Adaptive Filtering:** LMS algorithm, variants of LMS algorithms, RLS algorithm. Wavelet Transform. Building a digital communication system using DSP Processor Kits.

Part-II: Real-Time Operating System (2 Sessions)
Study of UCOS Real Time Operating System, Building a small real-time application using UCOS-II RTOS and porting it onto a 8086 microprocessor. System Level Test using Proteus System Level Simulator.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech X Semester
Project II

Course Code: **EIRDS011** Credits: **18** **Category:PPW**

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RFMW) VII Semester

Advanced Electromagnetics

Course Code: **EIRRM702** Category: **PGC**

Credits : **3** No. of hours: **8 per week**
Department: **ECE**

UNIT-I
Wave equations, propagation and properties: Introduction, Time-varying electromagnetic fields, Time-harmonic electromagnetic fields, Solution to the wave equation, TEM modes, TEM in lossy media, Polarization, Normal incidence-lossless media, Oblique incidence-lossless media, Lossy media, Reflection and transmission of multiple interfaces, Polarization characteristics on reflection.

UNIT-II
Auxiliary vector potentials, electromagnetic theorems and principles: Introduction, Vector potential F, Vector potentials A and F, Construction of solutions, Solution of inhomogeneous vector potential wave equation, Far-field radiation, Radiation and scattering equations, Duality theorem, Uniqueness theorem, Image theory, Reciprocity theorem, Reaction theorem, Volume equivalence theorem, Huygen's principle, Induction theorem.

UNIT-III
Rectangular cross-section waveguides and cavities: Introduction, Rectangular waveguide, Rectangular resonant cavities, Hybrid modes, Partially filled waveguide, Transverse resonance method, Dielectric waveguide, Stripline and microstrip lines, Ridged waveguide.

UNIT-IV
Circular cross-section waveguides and cavities: Introduction, Circular waveguides, Circular cavity, Radial waveguides, Dielectric waveguides and resonators.

UNIT-V
Spherical transmission lines and cavities: Introduction, Construction of solutions, Bi-conical transmission line, Spherical cavity.

Textbooks:

1. Balanis, C.A., "Advanced Engineering Electromagnetics", John Wiley & sons, 1989.

2. Kraus, J.D. and Fleisch, D.A., "Electromagnetics with Applications", McGraw-Hill, 1999.

3. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2nd Ed., Prentice-Hall of India, 1993.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIISemester

RF Components and Circuit Design

Course Code: **EIRRM703** Category: **PGC**

Credits : **3** No. of hours: **8 per week**

Department: **ECE**

UNIT-I

Introduction to RF and Microwave concepts and applications: Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.

UNIT-II

RF Electronics Concepts : Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency, Introduction to component basics, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching.

UNIT-III

Smith Chart and its Applications: Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart, Distributed circuit applications, Lumped element circuit applications.

UNIT-IV

RF and Microwave Amplifiers Small and Large Signal Design: Introduction, Types of amplifiers, Small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design, High-power amplifiers, Large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, Large signal design.

UNIT-V

Radio Frequency and Microwave Oscillator Design: Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

Text Books :

1. "Radio Frequency and Microwave Electronics", by Mathew M. Radmanesh, Person Education Inc., New Delhi.
2. "Microwave Engineering, Active and Non-reciprocal Circuits", by Joseph Helszain, McGraw Hill International Edition, 1992.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester
Antenna Analysis & Design

Course Code: **EIRRM801** Category: **PGC**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit - I

Antennas and Fundamental Parameters of Antennas: Introduction, Types of Antennas , Radiation Mechanism, Current Distribution on a Thin Wire Antenna, Historical Advancement, Multimedia, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Numerical Techniques, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna Vector Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friis Transmission Equation and Radar Range Equation, Antenna Temperature, Multimedia.

Unit –II

Radiation Integrals and Auxiliary Potential Functions: Introduction, The Vector Potential A for an Electric Current Source J, The Vector Potential F for a Magnetic Current Source M, Electric and Magnetic Fields for Electric (J) and Magnetic (M) Current Sources, Solution of the Inhomogeneous Vector Potential Wave Equation, Far-Field Radiation, Duality Theorem, Reciprocity and Reaction Theorems,

Unit - III

Linear Wire and Loop Antennas: Introduction, Infinitesimal Dipole, Small Dipole, Region Separation, Finite Length Dipole, Half-Wavelength Dipole, Linear Elements Near or on Infinite Perfect Conductors, Ground Effects, Computer Codes, Multimedia, Small Circular Loop, Circular Loop of Constant Current, Circular Loop with Non uniform current, Ground and Earth Curvature Effects for Circular Loops, Polygonal Loop Antennas, Ferrite Loop, Mobile Communication Systems Applications, Multimedia.

Unit - IV

Arrays: Linear, Planar, and Circular: Introduction, Two-Element Array, N-Element Linear Array: Uniform Amplitude and Spacing, N-Element Linear Array: Directivity, Design Procedure, N-Element Linear Array: Three-Dimensional Characteristics, Rectangular-to-Polar Graphical Solution, N-Element Linear Array: Uniform Spacing, Non uniform, Amplitude, Super directivity, Planar Array, Design Considerations, Circular Array, Multimedia.

Unit - V

Antenna Synthesis and Continuous Sources: Introduction, Continuous Sources, Schelkunoff Polynomial Method, Fourier Transform Method, Woodward-Lawson Method, Taylor Line-Source (Tschebyscheff-Error), Taylor Line-Source (One-Parameter), Triangular, Cosine, and Cosine-Squared Amplitude Distributions, Line-Source Phase Distributions, Continuous Aperture Sources, Multimedia.

Reference Books

1. Balanis, C.A., "Antenna Theory and Design", 3rd Ed., John Wiley & Sons. 2005
2. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2nd Ed., Prentice-Hall of India. 1993
3. Stutzman, W.L. and Thiele, H.A., "Antenna Theory and Design", 2nd Ed., John Wiley & Sons. 1998
4. Elliot, R.S., "Antenna Theory and Design", Revised edition, Wiley- IEEE Press. 2003
5. Garg, R., Bhartia, P., Bahl, I. and Ittipiboon, A., "Microstrip Antenna Design Handbook", Artech House.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester
Microwave Networks

Course Code:	**EIRRM821/EUREC832**	Category:	**PGE**
Credits : **3** Department: **ECE**		No. of hours:	**4 per week**

UNIT-I

Microwave Circuits: One port junction, Terminal voltages and currents in multi port junctions, Poynting's energy theorem, Normalized waves and scattering matrix, Properties of [S] matrix, Wave amplitude transmission matrix [A], Impedance matching techniques: Quarter-wave and Tapered line Impedance transformers, Two Port Networks analysis with Transmission matrices, S-Parameter and signal flow graphs

UNIT-II

Microwave Waveguide Components: Microwave junctions, Bends, Scattering matrix E and H plane tee junctions, Magic-T , Applications of Magic-T, Microwave propagation in ferrites, Principles of Faraday rotation, Gyrator, Isolator and Circulator,

UNIT-III

Waveguide Components, Mode transducers, Waveguide discontinuities, Terminations, Attenuators and Phase shifters, Rotary joints, Mechanical and gas type switches.

UNIT-IV

Microwave Passive Components: Wave meters, Attenuators, Directional coupler, Scattering matrix of directional couplers, Coaxial and Strip line components : Terminations, Connectors and Transitions, Attenuators and phase shifters, Transmission line discontinuations, DC Returns and blocks, Low pas filters, MICS.

UNIT-V

Microwave Resonators and Filters : Review of resonant circuits, Principles of microwave resonators, Field analysis of cavity resonators, Narrow band microwave filters, Wideband microwave filters, Some applications, Introduction to YIG filter, Scattering matrix of two-port gyrator networks.

Text Books :

1. R.E. Collins ,"Foundations of Microwave Engg", –, TMH,2001
2. P.A. Rizzi ,"Microwave Engineering", Pearson Education, 2007
3. Joseph Helszajn ,"Microwave Engineering - Non-reciprocal active and passive circuits",McGraw Hill, 1992.
4. M. Kulkarni ,"Microwave & Radar Engineering ",Umesh Publications,2003.
5. Gintton,EL," Microwave Measurements", Mc Graw Hill,1979
6.Sucher&Fox, "Microwave Measusrements", Vol.1, II, III,Inter science Publishers,Newyork,1963
7. Annapurna Das and Sisir K. Das ,"Microwave Engineering ",TMH, 2000.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester
Microwave Measurements

Course Code:	**EIRRM822**	Category:	**PGE**
Credits : **3** Department: **ECE**		No. of hours:	**4 per week**

UNIT-I

Introduction to Radio Frequency & Microwave Measurements Introduction Radio Frequency Band, microwave and millimeter wave. Power Measurement- High Power Measurement, calorimeter technique, Low power Measurement, bolometer technique, Very Low Power Measurement.

UNIT-II

Frequency Measurement - Different Technique to measure frequency, Slotted Line Technique, maxima & minima, wavelength & frequency measurement. Impedance Measurement- Measurement of unknown load impedance of a transmission line, Slotted Line Technique to measure unknown impedance. Distortion & Frequency Translation Measurement- Different types of distortion occurred at microwave frequencies, Procedures for frequency translation.

UNIT-III

Detectors& Sensors: Definition of Detectors; Different type of microwave detectors functions and applications, Sensors Definition & working principle, applications, measurement of scattering parameters.

UNIT-IV

Vector Network Analyzer (VNA): Concept of vector network analyzer, Basic block diagram of vector network analyzer (VNA), Application of vector network analyzers. Scalar Network Analyzer (SNA): Definition of network analyzer, Difference between SNA&VNA, Basic block diagram Scalar Network Analyzer.

UNIT-V

Spectrum Analyzer: Basic block diagram of a spectrum analyzer, functions & applications of a spectrum analyzer. Time Domain Electrometer (TDR) & IC Technology: Introduction to Electrometer, Measurement of reflection coefficient using electrometer technique, Basic block diagram of a time domain electrometer.

Text Books:

1. G.H.Bryant,"Principles of Microwave Measurements"-,Peter Peregrinus Ltd.IEE,1993
2. D.Pozar," Microwave Engineering", 2nd Ed, John Wiley
3. T.S.Laverghetta-" Hand book on Microwave Testing",Artech House,1981
4. S.F.Adam-" Microwave Theory & Application"- Prentice Hall, Inc
5. A.E. Bailey, Ed." Microwave Measurements"- Peter Peregrinus Ltd,IEE,1985

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester
EMI and EMC Techniques

Course Code: **EIRRM823** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction, Natural and Nuclear sources of EMI / EMC: Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum

conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT-II

EMI from apparatus, circuits and open area test sites: Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross

talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT-III

Radiated and conducted interference measurements and ESD: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

UNIT-IV

Grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

UNIT-V

Cables, connectors, components and EMC standards: EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International

EMC standards.

Text Books:

1. Dr. V.P. Kodali, "Engineering Electromagnetic Compatibility",IEEE Publication, printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Wilium DuffG., and Donald RJ., Series on "Electromagnetic Interference and Compatibility", Vol.5, EMI Prediction and Analysis Technique, 1972.
3. Weston David. A., "Electromagnetic Compatibility, Principles and Applications", 2001.
4. Kaiser BE., "Principles of Electromagnetic Compatibility", Artech House,1987.
5. "Electromagnetic Interference and Compatibility IMPACT series", IIT Delhi, Modules1- 9.
6. C.R.Pal,"Introduction to Electromagnetic Compatibility", Ny, John Wiley, 1992,

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RFME) VIII Semester

Advanced Digital Signal Processing

Code: **EIRVD823/ EIRRM824** Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department:**ECE**

UNIT-I

Multirate Digital Signal Processing – Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Implementation of Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications of Sampling Rate Conversion, Digital Filter Banks Two-Channel Quadrature Mirror Filter Bank.

UNIT-II

Linear Prediction And Optimum Linear Filters - Random Signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations Wiener Filters for Filtering and Prediction.

UNIT-III

Adaptive Filters - Applications of Adaptive Filters, Adaptive Direct-Form FIR Filters-The LMS Algorithm, Adaptive Direct-Form FIR Filters-RLS Algorithms.

UNIT-IV

Power Spectrum Estimation – Basic Methods Estimation of Spectra from Finite-Duration Observations of Signals, Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation.

UNIT-V

Power Spectrum Estimation – Advanced Methods: Filter Bank Methods: Capon's method, Eigenanalysis Algorithms for Spectrum Estimation: Pisarenko Harmonic Decomposition Method, MUSIC algorithm, ESPIRIT algorithm, Eigen Decomposition method

Text Books

1. Digital Signal Processing : Principles, Algorithms and Applications - Proakis, J.Gard and D.G.Manolakis, Fourth Edition, PHI, 2006.

Reference Books

1. Monson Hayes, Statistical Digital Signal Processing, Wiley Student Edition, 2008
2. Manolakis, Vijay Ingle, Statistical and Adaptive Signal Processing by Artech Book House, 2009.
3. P.P. Vaidyanathan, Multirate systems and Filter banks, Prentice Hall, 1993
4. V. Oppenheim and R.W.Schafer, Discrete time Signal Processing, PHI 1994
5. S.J. Orfanidis, Optimum Signal Processing, McGraw Hill, 1989.
6. Wavelet Transforms: Introduction to Theory and Applications, Raghuveer M Rao, Ajit S, Bopardikar, Pearson Education 2000.
7. Insight into Wavelets, Ramachandran and Soman, Prentice Hall Publications, 2003

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RFME) VIII Semester

Advanced Microprocessors

Course Code: **EIRRM831** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

8086/8088 Hardware Specifications: Pinouts and pin functions, clock generator (8284A), bus buffering and latching, bus timing, ready and wait state, minimum mode vs maximum mode. **Memory Interface**: Memory devices, address decoding, 8088 and 80188 (8-bit) memory interface, 8086, 80186, 80286 and 80386 SX (16-bit) memory interface, 80386DX and 80486 (32-bit) memory interface, Pentium through Core2 (64-bit memory interface), Dynamic RAM

Unit-II

Basic I/O Interface: Introduction to I/O interface, I/O port address decoding, a programmable peripheral interface, 8254 programmable interval timer, 16550 programmable communication interface, analog to digital (ADC) and digital to analog (DAC) converters.

Unit-III

Interrupts: Basic Interrupt processing, hardware interrupts, expanding the interrupt structure, 8259A programmable interrupt controller, interrupt examples.

Unit-IV

Direct Memory Access and DMA Controlled I/O: Basic DMA operation, the 8237 DMA controller, shared bus operation, disk memory systems, video displays.

Unit-V

Bus Interface: The ISA bus, The peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the serial COM ports, the universal serial bus (USB), accelerated graphics port (AGP). Comparison of hardware architecture, memory management, register structure, system timing of 80186, 80188, 80286, 80386, 80486, Pentium, Pentium PRO, Pentium II, Pentium III, Pentium 4, CORE2 Microprocessors.

Text Book:

1. Barry B. Brey, The Intel Microprocessors, Architecture Programming and Interfacing, Eighth Edition, Pearson Education, 2009.

Reference Books:

1. Douglas V. Hall, Microprocessors and Interfacing, Second Edition, McGraw Hill Publications
2. Mohammed Rafiquzzaman, "Microprocessors and Microcomputer-Based System Design," 2nd Edition, Prentice Hall Publications
3. Walter A. Triebel Avtar Singh, 8088 and 8086 Microprocessors, The: Programming, Interfacing, Software, Hardware, and Applications, 4/E, Prentice Hall Publications, 2003.
4. Muhammad Ali Mazidi, Janice Mazidi, x86 PC: Assembly Language, Design, and Interfacing, The: International Edition, 5/E Pearson Education, 2010.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester
Fiber Optic Communications

Course Code: **EIRRM832** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Optic Fiber Waveguides : Step – Index Fiber, Graded – Index Fiber, Attenuation, Modes in Step-Index Fibers, Modes in Graded – Index Fibers, Pulse Distortion and Information Rate in Optic Fibers, Construction of Optic Fibers, Optic Fibers, Optic Fiber Cables.

UNIT-II

Light Sources and Detectors : Light-Emitting Diodes, Light-Emitting – Diodes Operating Characteristics, Laser Principles, Laser Diodes, Laser-Diode Operating Characteristics, Distributed – Feedback Laser Diode, Optical Amplifiers, Fiber Laser, Vertical-Cavity Surface-Emitting Laser Diodes, Principles of Photo detection, Photomultiplier, Semiconductor Photodiode, PIN Photodiode, Avalanche Photodiode.

UNIT-III

Couplers and Connectors: Principles, Fiber end Preparation, Splices, Connectors, Source Coupling, Distribution Networks and Fiber Components, Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Wavelength- Division Multiplexing, Fiber Bragg Gratings, Other Components : Attenuator, Circulator

and Polarization Controller.

UNIT-IV

Modulation, Noise and Detection: Light-Emitting-Diode Modulation and Circuits, Laser-Diode Modulation and Circuits, Analog-Modulation Formats, Digital-Modulation Formats, Optic Heterodyne Receivers, Thermal and Shot Noise, Signal-to-Noise Ratio, Error Rates, Modal Noise, Amplifier Noise, Laser Noise, and Jitter, Additional Noise Contributors, receiver Circuit Design.

UNIT-V

System Design and Fiber Optical Applications: Analog System Design, Digital System

Design, Applications of Fiber Optics .

Text Books :

1. Joseph. C. Palais, "Fiber Optic Communications", Pearson Education, Asia, 2002.
2. John Powers ,"Fiber Optic Systems" Irwin Publications, 1997
3. Howes M.J., Morgan, D.V ,"Optical Fiber Communication", John Wiely.1992
4. John M.Senior, "Optical Fiber Communication: Principles and Practice", Pearson Education, 2nd edition, 2006

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RFME) VIII Semester

Communication Networks

Course Code: **EIRDS823/EIRRM833/ EIRCM801** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit - I

Communication Networks and Services, Evolution of Network Architecture and Services, Future Network Architectures and Their Services, Key Factors in Communication Network Evolution. Applications and Layered Architectures - Examples of Protocols. Services and Layering. The OSI Reference Model. Overview of TCP/IP Architecture. Network Management Overview

Unit - II

Digital Transmission Fundamentals: Characterization of Communication Channels, Fundamental Limits in Digital Transmission, Line Coding, Modems and Digital Modulation, Properties of Media and Digital Transmission Systems, Error Detection and Correction. **Circuit-Switching Networks – Multiplexing**: Circuit Switches, the Telephone Network, Signaling, Cellular Telephone Networks

Unit - III

Peer-to-Peer Protocols and Data Link Layer - Peer-to-Peer Protocols - Peer-to-Peer Protocols and Service Models, ARQ Protocols and Reliable Data Transfer Service, Data Link Controls, Framing, HDLC Data Link Control. Medium Access Control Protocols and Local Area Networks, Medium Access Control Protocols, Multiple Access Communications, Random Access, Channelization, Local Area Networks. LAN Protocols, Ethernet and IEEE 802.3 LAN Standard, Wireless LANs and IEEE 802.11 Standard, LAN Bridges

Unit - IV

Packet-Switching Networks, Network Services and Internal Network Operation, Packet Network Topology Datagrams and Virtual Circuits, Routing in Packet Networks, Shortest-Path Routing, ATM Networks,

Unit – V

TCP-IP and ATM Networks - TCP/**IP**, the Internet Protocol, IPv6, User Datagram Protocol, Transmission Control Protocol, and Mobile IP, **ATM Networks,** ATM Signaling,

Text Books:

1. Leon Garcia Widjaja, Communication Networks, Tata McGraw Hill, 2000

Reference Books:

1. ATM fundamentals-N.N. Biswas,Advenrture books publishers,1998
2. Data Networks, Robert Gallagher, PHI Publications
3. Computer Networks, A.To down approach featuring the Internet Kurose Pearson Education.
4. Data Communications & Networking, Forozam 4th Edition TMH Publication.
5. An Engineering Approach to Computer Networking, S. Keshav, Pearson Education, 2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech VIII Semester

DSP Processors and Architectures

Code: EIRVD833/ EIRDS801/ EIRRM834 /EUREC835 Category: **PGE**
Credits: **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Review of Digital signal processing. ,the sampling process,Discrte time sequences, discrete fourier transform and FFT, Linear time –invariant systems, digital filters, decimation and Interpolation,analysys and design tool for DSP systems. **Computational accuracy IN DSP Implementations:** number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D conversion errors, DSP computational errors.D/A conversion errors, compensating filter.

UNIT-II

Architectures for Programmable DSP Devices : basic architectural features,DSP computational building blocks. Bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, speed issues, features for external interfacing. **Programmable Digital Signal Processors:** Introduction. Commercial Digital Signal Processing Devices. The Architecture of TMS320C54xx Digital Signal Processors. Addressing Modes of the TMS320C54xx Processors. Memory Spaces of TMS320C54xx Processors. Program Control. TMS320C54xx Instructions and Programming. On-Chip Peripherals. Interrupts. Pipeline Operation of the TMS320C54xx Processors

UNIT-III

Implementation of Basic DSP Algorithms: Introduction. The Q-notation. FIR Filters. IIR Filters. Interpolation Filters. Decimation Filters. PID Controller. Adaptive Filters. 2-D Signal Processing. **Implemenation of FFT Algortihms:** Introduction. An FFT Algorithm for DFT Computation. A Butterfly Computation. Overflow and Scaling. Bit-Reversed Index Generation. An 8-point FFT Implementation of TMS320C54xx. Computation of Signal Spectrum

UNIT-IV

Interfacing Memory and Parallel IO Peripherals to Programmable DSP Devices: Introduction. Memory Space Organization of the TMS320C54xx Devices. Memory and I/O Signals of the TMS320C54xx Devices. Memory Interface. Parallel I/O. Programmed I/O. Interrupts and I/O. Direct Memory Access (DMA).

UNIT-V

Interfacing Serial Converters to a Programmable DSP Device: Introduction. Synchronous Serial Interface between the DSP and an AIC. A Multi-channel Buffered Serial Port (McBSP). The McBSP Programming. A CODEC Interface Circuit. CODEC Programming. A CODEC-DSP Interface Example. **Applications:** Introduction. A DSP System. DSP Based Biotelemetry System. A Speech Processing System. An Image Processing System. A Position Control System for a Hard Disk Drive. DSP Based Power Meter

Text Books:

1. Digital Signal Processing- Avtar Singh and S. Srinivasan, Thompson Publications, 2004.

Reference Books:

2. Digital signal processors, Archtecture, programming and applications- B. venkata ramani and M. Bhaskar, TMH, 2004.
3. Sen. M. Kuo, Real-Time Digital Signal Processing: Implementations and Applications 2/e, Wiley Publications, 2006
4. Rulph Chassaing, Digital Signal Processing with C6713 and C6416 DSK, 2/e Wiley Publications, 2005
5. DSP processor fundamentals,Archtecture & Features-Lapsley et al. S. Chand & Co.2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) VIII Semester

Antennas Laboratory

Course Code: **EIRRM812** Category: **PGC**

Credits : **2** No. of hours: **6 per week**
Department: **ECE**

1) Study of microwave components
2) Measurement of attenuation characteristics
3) Measurement of frequency and wave length.
4) Measurement of Radiation pattern and gain of horn antenna.
5) Measurement of Radiation pattern and gain of different dipole antennas.
6) Measurement of unknown load impedance
7) Determination of Polarization of antennas.
8) Measurement of parameters of directional coupler
9) Verification of Reciprocity Characteristics of antennas.
10) Measurement of coupling factor of E-plane tee and H-plane Tee junction

.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) IX Semester
Computational Techniques in Electromagnetics

Course Code: **EIRRM901** Category: **PGC**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I Fundamental Concepts: Review of Maxwell's equations and boundary conditions, integral equations versus differential equations, radiation and edge conditions, modal representation of fields in bounded and unbounded media.

UNIT-II Green's Functions: Green's function technique for the solution of partial differential equations, classification of Green's functions, various methods for the determination of Green's functions including Fourier transform technique and Ohm-Rayleigh technique, dyadic Green's functions, determination of Green's functions for free space, transmission lines, waveguides, and microstrips.

UNIT-III Integral Equations: Formulation of typical problems in terms of integral equations: wire antennas, scattering, apertures in conducting screens and waveguides, discontinuities in waveguides and microstriplines; Solution of Integral equations: General Method of Moments (MoM) for the solution of integro-differential equations, choice of expansion and weighting functions, application of MoM to typical electromagnetic problems.

UNIT-IV Finite Element Method: Typical finite elements, Solution of two dimensional Laplace and Poisson's equations, solution of scalar Helmholtz equation.

UNIT-V Finite-difference Time-domain Method: Finite differences, finite difference representation of Maxwell's equations and wave equation, numerical dispersion, Yee's finite difference algorithm, stability conditions, programming aspects, absorbing boundary conditions.

References

1. Collin, R.E., "Field Theory of Guided Waves", 2nd Ed., Wiley-IEEE Press. 1991
2. Peterson, A.F, Ray, S.L. and Mittra, R., "Computational Methods for Electromagnetics", Wiley-IEEE Press. 1998
3. Harrington, R.F., "Field Computation by Moment Methods", Wiley- IEEE Press. 1993
4. Sadiku, M.N.O., "Numerical Techniques in Electromagnetics", 2nd Ed., CRC Press. 2001
5. Stutzman, W.L. and Thiele, H.A., "Antenna Theory and Design", 2nd Ed., John Wiley & Sons. 1998
6. Volakis, J.L., Chatterjee, A. and Kempel, L.C., "Finite Method for Electromagnetics", Wiley-IEEE Press. 2012
7. Taflov, A. and Hagness, S.C., "Computational Electrodynamics", 3rd Ed., Artech House.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Microwave Devices and Integrated Circuits

Course Code: **EIRRM902** Category: **PGC**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I
Microwave Transistors and FETs: Introduction, Microwave Bipolar Transistors, Heterojunction Bipolar Transistors, Junction Field Effect Transistors, Metal Semiconductor Field Effect Transistors, High electron mobility transistors, MOSFETs.

UNIT-II
Microwave O-type Tubes: High frequency limitations of conventional tubes, Reentrant cavities, Klystrons, Velocity modulation process, Bunching process, Output power and beam loading, Reflex Klystron, Velocity modulation, Power output and efficiency, Electronic admittance, Mode patterns, Slow wave structures, Traveling wave tube, Amplification process, Wave modes, Gain considerations.

UNIT-III
Microwave M-type Tubes: Introduction, Magnetron - types, Principle of operation of cylindrical magnetron, Hartee resonance condition, Pi-mode separation, Forward – Wave Crossed field amplifier, Backward – Wave Crossed field amplifier.

UNIT-IV
Microwave Solid State Devices: Classification, GUNN Effect Diodes, Ridley – Watkins – Hilsum (RWH) theory, Modes of operation, LSA Diode, Microwave generation and amplification, Applications, Read Diode, IMPATT diodes, TRAPATT diodes, Applications of IMPATT and TRAPATT diodes, PIN diode, Varactor diode, Parametric amplifiers, Tunnel diode.

UNIT-V
Microwave Integrated Circuits: Thick and thin film technology, Hybrid MIC's, Monolithic MIC technology, Analysis of Strip line and Microstrip Line: Method of conformal transformation, Charactetic parameters of Strip, Microstrip lines, Microstrip circuit design, Impedance transformers, Filters , Lumped constant microstrip circuits, Coupled Microstrip and Directional Coupler: Even and Odd Mode analyses, Theory of coupled microstrip directional coupler, Calculations for couples pair of Micro strips, Brach line couplers, Lumped Elements : Lumped elements for MIC's design and fabrication of Lumped elements, Circuits using lumped elements, Non Reciprocal Components: Non reciprocal components for MIC's, Microstrip on ferrimagnetic substrates, Microstrip circulators, Isolators and phase shifters, Design of microstrip circuits , High Power and low power circuits.

Text Books:

1. Samuel. Y. Liao,"Microwave devices and circuits", Pearson Edn., 2003.
2. M. Kulkarni ,"Microwave & Radar Engineering" , Umesh Publications,2004..
3. Annapurna Das and Sisir K. Das ,"Microwave Engineering", TMH, 2000.
4. GUPTA, KC, and Amarkijit singh, "Microwave Integrated circuits", Wiley Estern.2003
5. Leo Young, "Advances in Microwaves", Academic Press,1966
6. Jacob Millman, "Microelectronics",Tata McGrawhill ,2004

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Global Positioning Systems

Course Code: **EIRRM921** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Overview of GPS: Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

UNIT-II

GPS Signals: Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT-III

GPS coordinate frames, Time references : Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

UNIT-IV

GPS orbits and satellite position determination : GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination.

UNIT-V

GPS Errors: GPS error sources – clock error, Ionospheric error, Tropospheric error, multipath, Ionospheric error estimation using dual frequency GPS receiver.

Textbooks :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, "GPS – Theory and Practice", Springer – Wien, New York (2001).
2. G. Sasibhushana Rao ,"Global Navigation Satellite Systems"-Tata McgrawHill, New Delhi (2010)

Reference Books:

1. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol. I & Vol .II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
2. James Ba – Yen Tsui, "Fundamentals of GPS receivers – A software approach", John Wiley & Sons (2001).

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Phased Array Antennas

Course Code: **EIRRM922** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction to Array Antennas: basic Array Characteristics , Linear arrays-Patterns, Beam width, Side lobes, grating lobes, bandwidth, planar arrays-array coordinates, beam width, grating lobes

UNIT-II

Pattern characteristics of Linear and Planar Arrays : Array analysis, characteristics of linear and planer arrays, Scanning to end-fire, Thinned arrays

UNIT-III

Pattern Synthesis for Linear and Planar Arrays : Linear arrays and planar arrays with separable distributions, circular planar arrays

UNIT-IV

Adaptive Array Fundamentals: antenna null Rotation, electronic Null steering, constrained Power minimization, weak signal adaption,Side lobe canceller, the Davies beam former, multiple null formation

UNIT-V

Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory, Array size determination, Time-delay

Compression

Text books

1 Eli Brookner," Practical Phased Array Antenna Systems", Editor, Artech House, Boston , London

2. R.C. Hansen,"Phased Array Antennas", Wiley Series in Microwave and optical Engg, John Wiley & Sons Inc, Wiley- Interscience Publication

Reference Books :

1. Robert J. Mailloux,"Phased Array Antenna Hand Book" Artech House, Boston, London, 1994.

2. R. A. Monzingo and TW Miller, "Introduction to Adaptive Arrays", John Wiley and Sons,1980.

3. B Widrow and SD Stearns,"Adaptive Signal Processing", Prentice Hall,1985.

4. P.J.B. Clarricoats "Advanced Antenna Technology", Microwave Exhibitions & Publishers,1995.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Photonic Networks and Switching

Course Code: **EIRRM923** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Optical communications: Introduction to basic optical communications and devices. Optical multiplexing techniques - Wavelength division multiplexing, Optical frequency division multiplexing, time division multiplexing, code division multiplexing.

UNIT-II

Introduction to Optical Networks: need of optical networks, Conventional optical networks, SONET / SDH, FDDI, IEEE 802.3, DQDB, FCS, HIPPI etc. Multiple access optical networks, Topologies, Single channel networks, Multichannel networks, FTFR, FTTR, TTFR and TTTR, Single hop networks, Multihop networks, Multi access protocols for WDM networks- issues and some designs, Switched optical networks. Optical amplification in all-optical networks. All-optical subscriber access networks. Design issues.

UNIT-III

WAVELENGTH ROUTING NETWORKS : The Optical layer, Node Designs, Optical layer cost tradeoffs, Routing and wave assignment, Virtual topology design, wave length routing test beds, Architectural variations.

UNIT-IV

Optical switching: Motivation, Example of an optical switch using 2x2 coupler, Spatial light modulator, Relational and non-relational switching devices, Fundamental limits on optical switching elements, Switching Architectures, Free-space optical switching. Wavelength routed networks and other special topics. Soliton based networks, Optical networks management issues.

UNIT-V

Photonic Packet Switching-OTDM, Multiplexing and demultiplexing, Synchronization, Broadcast OTDM networks, Switch based networks, Access networks, Network architecture overview, Future Access networks Optical access network architectures and OTDM networks.

Text Books:

1. G. Keiser ,"Optical Fiber Communication", McGraw-Hill ,2010

Reference books

1. John M. Senior ,"Optical Fiber Communication ",3rd edition, Prentice Hall,2009
2. P.E Green.Jr,"Fibre Optical Networks", Prentice Hall.,1993

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Radar Signature Analysis and Imaging

Course Code: **EIRRM924** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Elements review of selected signal processing concepts and operations: Resolution, spatial frequency, Fourier transforms, sampling theorem and spectrum replication, vector representation of signals, data integration, correlation, components of a radar signal, amplitude models, clutter, noise model and SNR, jamming, Frequency models: the Doppler shift, spatial models, spectral model.

UNIT-II

Sampling and quantization of pulsed radar signals: domains and criteria for sampling radar signals, sampling in the fast time dimension, sampling in slow time: selecting the pulse repetition interval, sampling the Doppler spectrum, sampling in the spatial and angle dimensions, quantization, i/q imbalance and digital i/q.

UNIT-III

Introduction: Waveform matched filter, matched filtering of moving targets, the ambiguity function, the pulse burst waveform, frequency-modulated pulse compression waveforms, range side lobe control for fm waveforms, the stepped frequency waveform, phase-modulated pulse compression waveforms, Costas frequency codes.

UNIT-IV

Alternate forms of the doppler spectrum: Moving target indication (mti), pulse Doppler processing, dwell-to-dwell stagger, pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, mti for moving platforms: adaptive displaced phase center antenna processing.

UNIT-V

Detection fundamentals: radar detection as hypothesis testing, threshold detection in coherent systems, threshold detection of radar signals constant false alarm rate (cfar) detection, the effect of unknown interference power on false alarm probability, cell averaging cfar, the effect of varying pfa, analysis of cell-averaging cfar, ca cfar limitations

Textbook:
Mark A Richards, “Fundamentals of radar signal processing “, Tata McGraw Hill,2005.

References:
Merrill I. Skolink “Introduction to radar systems” 3rd edition, Tata McGraw hill publications,2003
Nathanson , “Radar Signal Principles”, Mcgraw hill publications,2009

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Smart Antennas for Mobile Communication

Course Code: **EIRRM931** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT-I

Applications of Antenna Arrays to Mobile Communications, : Performance Improvement, Feasibility, and System Considerations (Complete contents of reference 1)

Application of Antenna Arrays to Mobile Communications, Beam-Forming and Direction-of-Arrival Considerations (Complete contents of reference 2).

UNIT-II

Introduction to Smart Antennas: Spatial Processing for Wireless Systems, Key Benefits of Smart Antennas , Smart antenna introduction ,smart antenna configuration, SDMA, architecture of smart antenna systems.

UNIT-III

Smart antenna systems : The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Spatial Diversity, Diversity Combining, and Sectoring, Digital Radio Receiver Techniques and Software Radios for Smart Antennas, Transmission Beam forming.

UNIT-IV

Smart Antennas Techniques for CDMA : Non-Coherent CDMA Spatial Processors, Coherent CDMA Spatial Processors and the Spatial Processing Rake Receiver, Multi-User Spatial Processing, Dynamic Re-sectoring Using Smart Antennas, Downlink Beam forming for CDMA.

UNIT-V

CDMA System Range and Capacity Improvement Using Spatial Filtering: Range Extension in CDMA, Single Cell Systems with Spatial Filtering at the IS-95 Base Station, Reverse Channel Performance of Multi-cell Systems with Spatial Filtering at the Base Station, Reverse Channel Spatial Filtering at the WLL Subscriber Unit, Range and Capacity Analysis Using Smart Antennas – A Vector Based Approach.

References

1. T.S. Rappaport and J.C. Liberti, “Smart Antennas for Wireless Communications”, Prentice Hall, 1999
2. Tapan K Sarkar ,” Smart Antennas “,IEEE Press, Wiley Interscience,John Wiley & Sons Publications,2003
3. L.C.Godara “Applications of antenna arrays to mobile communications, Part I: Performance improvement, feasibility, and system considerations”, Proc. IEEE, vol. 85, no.7, pp.1031-1060, 1997
4. L.C. Godara, “Applications of antenna arrays to mobile communications, Part II: Beam forming and direction-of-arrival considerations,” Proc. IEEE, vol. 85, no.8, Pp.1193-1245, 1997.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Antennas and Propagation for Wireless Communication Systems

Course Code: **EIRRM932** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction to Wireless Communications: Concept of a wireless channel, system types, cellular system concept and networks, Traffic, Multiple Access schemes and Duplexing: FDMA,TDMA,CDMA: Available data rates.

UNIT-II

Antenna Arrays: Introduction, Linear and planar arrays, The uniform linear array, Yagi-Uda antennas, Monopole antennas, Corner reflectors, Parabolic reflector, Horn antenna, Loop antenna, Helical antenna, Patch antenna, Basic Propagation Model.

UNIT-III

Fixed Links: Terrestrial fixed links: Path profile, Tropospheric refraction, Obstruction loss, Diffraction over the objects of finite size, influence of clutter, Satellite Fixed Link: Tropospheric effects, Ionospheric effects, satellite earth station antennas.

UNIT-IV

Cells: Macro cells: Definition of parameters, empirical path loss model: Lee model, physical path loss model: The flat edge model, Shadowing, microcells: Physical model, propagation mechanisms of cell planning considerations, Pico cells: Physical models of indoor propagation with in buildings, models of propagation into buildings, multipath effects, ultra band indoor propagation.

UNIT-V

Mega cells: Shadowing and fast fading, Outdoor measurements, indoor measurements, Future development in wireless communication channel: Physical channel modeling , intelligent antennas.

Text books:

1. Simon R Saunders and A Aragon Zavala," Antennas and Wave propagation for Wireless communication systems", Second edition, Wiley Student Edition.

Reference books

1. Nathan Blaunstein, Christos G Christodoulou, "Radio Propagation and adaptive antennas for wireless communication links", John Wiley & Sons Inc.,Hoboken ,New Jersey(2007).

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
RF Receiver Design and Wireless applications

Course Code: **EIRRM933** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction to Wireless Systems: Classification of wireless systems; Design and performance issues: Choice of operating frequency, multiple access and duplexing, circuit switching versus packet switching, propagation, radiated power and safety; Cellular telephone systems and standards.

UNIT-II

Noise and Distortion in Microwave Systems: Basic threshold detection, noise temperature and noise figure, noise figure of a lossy transmission line; Noise figure of cascade systems: Noise figure of passive networks, two-port networks, mismatched transmission lines and Wilkinson power dividers; Dynamic range and inter-modulation

distortion.

UNIT-III

Microwave Amplifier Design: Comparison of active devices such as BJT, MOSFET, MESFET, HEMT, and HBT; Circuit models for FETs and BJTs; Two-port power gains; Stability of transistor amplifier circuits; Amplifier design using S-parameters: Design for maximum gain, maximum stable gain, design for specified gain, low-noise amplifier design, design of class-A power amplifiers.

UNIT-IV

Mixers: Mixer characteristics: Image frequency, conversion loss, noise figure; Devices for mixers: p-n junctions, Schottky barrier diode, FETs; Diode mixers: Small-signal characteristics of diode, single-ended mixer, large-signal model, switching model; FET Mixers: Single-ended mixer, other FET mixers; Balanced mixers; Image reject mixers.

UNIT-V

Switches: Devices for microwave switches: PIN diode, BJT, FET; Device models; Types of switches; Switch configurations; Basic theory of switches; Multi-port, broad-band and isolation switches. **Oscillators and Frequency Synthesizers:** General analysis of RF oscillators, transistor oscillators, voltage-controlled oscillators, dielectric resonator oscillators, frequency synthesis methods, analysis of first and second order phase-locked loop, oscillator noise and its effect on receiver performance.

Textbooks:

1. Pozar, D.M. “Microwave and RF Design of Wireless Systems”, John Wiley & Sons.2001
2. Gonzalez, G., “Microwave Transistor Amplifiers: Analysis and Design”, 2nd Ed., Prentice-Hall. 1997
3. Bahl, I. and Bhartia, P., “Microwave Solid State Circuit Design”, 2nd Ed., John Wiley & Sons. 2003
4. Chang, K., Bahl, I. and Nair, V., “RF and Microwave Circuit and Component Design for Wireless Systems”, Wiley Interscience. 2002
5. Rohde, U.L. and Newkirk, D.P., “RF/Microwave Circuit Design for Wireless Applications”, John Wiley & Sons. 2000
6. Larson, L.E., “RF and Microwave Circuit Design for Wireless Applications”, Artech House. 2006

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
RF and Microwave MEMs

Course Code: **EIRRM934** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT-I

Introduction: Introduction to wireless systems, personal communication systems, High frequency effects in circuits and systems.

UNIT-II

Transmission lines: Review of Transmission line Theory, terminated transmission lines, smith chart, impedance matching, Micro strip and Coplanar waveguide implementations, microwave network analysis, ABCD parameters, S parameters.

UNIT-III

Net works: Behavior of passive IC components and networks, series and parallel RLC circuits, resonant structures using distributed transmission lines, components and interconnects at high frequencies.

UNIT-IV

High frequency system design: Basics of high frequency amplifier design, device technologies, biasing techniques, simultaneous tuning of 2 port circuits, noise and distortion, Feedback systems, phase locked loops, LNA design, designs based on impedance match noise performance, linearity, noise and large signal performance, Power amplifier design, Various classes of power amplifiers, Oscillators, linear oscillators, tuned oscillators, negative resistance oscillators Systems aspects in wireless trans-receiver design.

UNIT-V

MEMS technologies and components for RF applications: RF MEMS switches, varactors, inductors and filters .Introduction to microwave antennas, definitions and basic principles.

Text books

1. DM Pozar ,'Microwave and RF Wireless Systems', New York;Wiley,2001.
2. VK Varadan, K.J. Vinoy, K.A. Jose,' RF MEMS and Their Applications',Wiley,2003

Reference Books:

1. TH Lee ,'The design of CMOS Radio Frequency Integrated Circuits', Cambridge University press, U. K, 2004.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Wireless Channels and UWB Radio

Course Code: **EIRRM941** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT-I

Overview of Wireless Communications :History **,** Wireless Standards: cellular, WiFi, Bluetooth, ZigBee, UWB, Wireless Channel Modeling : Path Loss and Shadowing Models Statistical Fading Models, Narrowband/Wideband Fading Models, Capacity of Wireless Channels**:** Capacity of Flat Fading Channels, Capacity of Frequency-Selective Channels, Performance of Digital Modulation :Fading Channel Performance, Doppler Spread, Diversity in Fading Channels: Receiver Diversity, Transmitter Diversity.

UNIT-II

Multiple Antenna and Space-Time Communications: Narrowband MIMO Model, Parallel Decomposition of MIMO Channel, MIMO Diversity Gain: Beam forming, Space-Time Modulation and Coding: ML detection, rank and determinant criteria, space-time trellis and block codes (Alamouti code; orthogonal designs; linear space-time codes; trellis space-time codes; linear interfaces :ZF, MMSE; nonlinear interfaces: ZF-V-BLAST, MMSE-V-BLAST, diagonal BLAST; iterative interface)**,** Frequency-Selective MIMO Communications**,** Smart Antennas,MIMO Channel Capacity.

UNIT-III

Multi-Carrier Modulation and OFDM: Data Transmission using Multiple Carriers**,** Multicarrier Modulation with Overlapping Sub channels**,** Mitigation of Subcarrier Fading: frequency equalization, pre coding, adaptive loading**,** OFDM: generation of subcarriers using the IFFT, guard time and cyclic extension, windowing, choice of OFDM parameters, OFDM signal processing, implementation complexity of OFDM versus single-carrier modulation, OFDM system model, channel modeling for OFDM systems, applications of OFDM (DAB, DVB, WLANs), Vector Coding, Challenges in Multicarrier Systems.

UNIT-IV

Adaptive modulation and Coding for Wireless Channels: Linear Block Codes, Convolutional Codes and Concatenated Codes**,** Turbo Codes and LDPC Codes**,** Coded Modulation, Coding with Interleaving**,** Unequal Error Protection, Adaptive Techniques**,** Variable-Rate Variable-Power MQAM: adaptive rate and power techniques, channel inversion with fixed rate, discrete-rate adaptation, exact versus, approximate bit error probability, channel estimation and error delay, Adaptive Coded Modulation, Adaptive Techniques in Combined Fast and Slow Fading.

UNIT-V

Ultra Wideband (UWB) Systems: Origin of UWB Technology, UWB signal generation: direct-sequence ,measurement of UWB signals, UWB in WLANS.

Text Books:

1 M. Ghavami, L. B. Michael, and R. Kohno, "Ultra Wideband Signals and Systems in Communication Engineering", John Wiley & Sons, Ltd., 2007.
2. D. Tse, and P.Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
3. R. A. Carrasco, and M. Johnston, "Non-Binary Error Control Coding for Wireless Communication and Data Storage", John Wiley & Sons, Ltd., 2005.

Reference Books

1. A. Goldsmith, "Wireless Communications", Cambridge: Cambridge University Press,2005.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Computer Communication Networks

Course Code: **EIRRM942** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Introduction: Internet, the network edge, the network core, network access and physical media, ISPS and internet backbones, delay and locs in packet switched networks, protocol layers and their service models, history of computer networking and the internet.

UNIT-II

Application layer: Principles of application layer protocols, the web and HTTP, file transfer (FTP), electronic mail in the internet, DNS, socket programming with TCP, socket programming with UDP.

UNIT-III

Building a simple web server: Content distribution. Transport layer Introduction and transport layer, services multiplexing and demultiplexing, connectionless transport UDP, principle of reliable data transfer. Connection oriented transport TCP, principles of congestion control, TCP congestion control. Network layer and routing Introduction and network service models, routing principles, hierarchical routing.

UNIT-IV

The Internet protocol: Routing in the internet, inside a router, 1PV6, multicast routing, mobility and the network layer. Link layer and local area networks Data link layer, error detection and correction technique. Multiple access protocols, LAN addresses. ARP, Ethernet, hubs, bridges and switches, wireless links, PPP.

UNIT-V

Asynchronous transfer mode (ATM): Frame relay, Physical layer, Analog and digital,

analog signals and digital signals, analog versus digital data rate limits. Transmission impairment, more about signals, guided media unguided media, circuit switching, telephone networks.

Text Books:

1. James F. Kurose, Keith W. Ross,"Computer networks", Pearson education, II edition, 2003.

Reference Books:

2.Behrouz A. Forouzan, "Data communication and networking", McGraw Hill, 3rd edition, 2004.

3. William Stallings, "Data and computer communication", Pearson education, 6th edition 2003.

ntegrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) 1X Semester
Multimedia Communication Technology

Course Code: **EIRRM943** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Multimedia communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS application QoS.

UNIT-II

Multimedia information representation: Introduction, digital principles, text, images, audio, video. Text and image compression: introduction, compression principles, text compression, image compression.

UNIT-III

Audio and video compression: introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1,MPEG-2, and MPEG-4.

UNIT-IV

Multimedia information networks: introduction, network performance parameters, throughput, networking delay, delay variance, error rate, quality of service.

UNIT-V

QoS: QoS perspectives, QoS processing, multimedia transmission, requirements, transmission over WANs, Multimedia Transmission over LANs, ATM networks, Wireless LANs ,Multimedia transport protocols: RTP and RTCP. Multimedia management protocols: H.323, SIP, SDP, SA.

Text books:

1.Fred Halsall, Multimedia Communications: Applications, Networks, Protocols, and Standards, Pearson Education, Asia, Second Indian reprint 2002.

2.Multimedia Information Networking, Nalin K. Sharda, PHI, 2003.

Reference Books:

1. Ralf Steinmetz, Klara Narstedt, “Multimedia Fundamentals: Vol 1-Media Coding and Content Processing”, Pearson Education, 2004.
2. Prabhat K. Andleigh, Kiran Thakrar, “Multimedia Systems Design”, PHI, 2004.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RFME) IX Semester
Radar Signal Processing

Course Code: **EIRDS932/EIRRM944** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I
Introduction: History and Applications of Radar, Basic Radar Functions, Elements of a pulsed radar, signal processing concepts and operations, basic radar signal processing. **Sampling and Quantization of Pulsed Radar Signals:** Domains and criteria for sampling radar signals, Sampling in the fast time domain, Sampling in the slow time: selecting the PRI, sampling the Doppler spectrum, sampling in the spatial and angle dimensions, quantization, I/Q imbalance and digital I/Q

Unit-II
Radar Waveforms: Introduction, The waveform matched filter, matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency modulated pulse compression waveforms, range sidelobe control for fm waveforms, the stepped frequency waveform, phase modulated pulse compression waveforms, costas frequency codes.

Unit-III
Doppler Processing: Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, Pulse pair processing, Additional Doppler processing issues, clutter mapping and moving target detector, MTI for moving platforms: Adaptive displaced phase center antenna processing.

Unit-IV
Synthetic Aperture Imaging: Introduction to the SAR fundamentals, Stripmap SAR data characteristics, Stripmap SAR image formation algorithms, Spotlight SAR data characteristics, The polar format image formation algorithm for spotlight SAR, Interferometric SAR, Other considerations.

Unit-V
Beamforming and Space-Time Adaptive Processing: Spatial Filtering, Space-Time signal environment, Space Time Signal modeling, processing the space-time signal, computational issues in STAP, reduced dimension STAP, Advanced STAP algorithms and analysis, Limitations to STAP.

Text Book

1. Mark Richards, Fundamentals of Radar Signal Processing, Tata McGraw Hill Publications

Reference Books

1. N. Levanon, and E. Mozeson, Radar Signals, Wiley-Interscience, 2004.
2. P. Z. Peebles, Radar Principles, John Wiley, 2004.
3. M. I. Skolnik, Introduction to Radar Systems, 3/e, Tata McGraw Hill, 2001.
4. M. I. Skolnik, Radar Handbook, McGraw Hill, New York, 1990.
5. D. K. Barton, Radar System Analysis and Modeling, Artech House, 2005.
6. F. E. Nathanson, Radar Design Principles, Prentice Hall India, 1999.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) IX Semester
Microwave Measurements Laboratory

Course Code: **EIRRM911** Category: **PGC**

Credits : **2** No. of hours: **3 per week**
Department: **ECE**

The following parameters are to be measured with X, S and Ku band microwave components.

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Directional Coupler Characteristics.
4. VSWR measurements.
5. Impedance, wavelength and frequency measurements.
6. Measurement of Scattering Parameters.
7. Measurement of attenuation Constant.
8. Coupling Measurement of H & E – Plane and magic-Tee Junctions
9. Measurement of dielectric constant.
10. Measurement of phase shift.
11. Circulators / Isolators

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(RF) IX Semester
MIC Design lab

Course Code: **EIRRM912** Category: **PGC**

Credits : **2** No. of hours: **3 per week**
Department: **ECE**

1. Design of Mixer
2. Design of low noise amplifier
3. Design of IF amplifier
4. Design of Power amplifier
5. Design of Microwave components and passive circuits

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VI1 Semester
Information Theory

Course Code: **EIRCM702** Category: **PGC**

Credits : **3** No. of hours: **8 per week**
Department: **ECE**

UNIT – I

Entropy, Relative Entropy, and Mutual Information

Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy, and Mutual Information, Markov Chains, Entropy Rate, Functions of Markov Chains, Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Shannon–Fano–Elias Coding.

UNIT – II

Channel Capacity and Differential Entropy

Symmetric Channels, Properties of Channel Capacity, Channel Coding Theorem, Fano's Inequality and the Converse to the Coding Theorem, Equality in the Converse to the Channel Coding Theorem, Hamming Codes, AEP for Continuous Random Variables, Relation of Differential Entropy to Discrete

Entropy, Joint and Conditional Differential Entropy, Relative Entropy and Mutual Information.

UNIT – III

Rate Distortion Theory

Quantization, Calculation of the Rate Distortion Function, Converse to the Rate Distortion Theorem, Characterization of the Rate Distortion Function, Computation of Channel Capacity and the Rate

Distortion Function, Universal Source Coding, Fisher Information and the Cramer–Rao Inequality.

UNIT – IV

Universal Source Coding and Kolmogorov Complexity

Universal Codes and Channel Capacity, Universal Coding for Binary Sequences, Arithmetic Coding, Models of Computation, Kolmogorov Complexity: Definitions and Examples, Kolmogorov Complexity and Entropy, Kolmogorov Complexity of Integers, Kolmogorov complexity.

UNIT – V

Inequalities in Information Theory
Basic Inequalities of Information Theory, Differential Entropy, Bounds on Entropy and Relative Entropy, Combinatorial Bounds on Entropy, Entropy and Fisher Information, Entropy Power Inequality and Brunn–Minkowski Inequality, Inequalities for Determinants, Inequalities for Ratios of Determinants

Text Books

1. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", Wiley Interscience, 2nd Edition, 2006.

Reference Books

1. Robert Gallager, "Information Theory and Reliable Communication", John Wiley & Sons.
2. R. J. McEliece, "The theory of information & coding", Addison Wesley Publishing Co., 1977.
3. T. Bergu, "Rate Distortion Theory a Mathematical Basis for Data Compression" PH Inc. 1971.
4. Special Issue on Rate Distortion Theory, IEEE Signal Processing Magazine, November 1998.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VII Semester
Modern Digital Communication Techniques

Course Code: **EIRCM703** Category: **PGC**

Credits : **3** No. of hours: **8per week**
Department: **ECE**

UNIT-I

Probability and Random Processes: Review of Probability and Random Variables, Random Processes: Basic Concepts, Gaussian and White Processes. **Digital Modulation in AWGN Baseband Channels:** Geometric Representation of Signal Waveforms, Binary Pulse Modulation, Optimum Receiver Design, M-ary Pulse Modulation, Probability of Error for M-ary Pulse Modulation, Symbol Synchronization

UNIT-II

Transmission through Bandlimited AWGN Channels: Transmission through Bandlimited Channels, Signal Design for Bandlimited Channels, Probability of Error for Detection of Digital PAM, System Design for Channel Distortion

UNIT-III

Transmission of Digital Information via Carrier Modulation: Amplitude Modulated Digital Signals, Phase Modulated Digital Signals, QAM Signals, Frequency Modulated Digital Signals Comparison of Modulation Methods

UNIT-IV

Information Theory and Coding: Uncertainty, Information and Entropy, Source-Coding Theorem, Discrete Memory less channels, Mutual Information, Channel Capacity, Channel-Coding theorem, Linear Block Codes, Cyclic Codes, Convolutional Codes, Maximum Likelihood Decoding of Convolutional Codes, Trellis – Coded Modulation

UNIT-V

Spread- Spectrum Modulation: Introduction, Pseudo-Noise Sequences, A Notion of Spread Spectrum, Direct-Sequence Spread Spectrum with Coherent Binary Phase-Shift Keying, Signal Space Dimensionality and Processing Gain, Frequency Hop Spread Spectrum.

Text Books

1. Proakis, Salehi, Fundamentals of Communication Systems, Pearson Education, 2005
2. Proakis, Salehi, Communication System Engineering, Prentice Hall Publications, 2002
3. Communication Systems by Simon Haykin, 4th Edition, 2001

Reference Books

1. Proakis, Digital Communications 5/e Tata Mcgraw Hill Publications, 2010
2. Simon Haykin, Communication Systems 4/e Wiley Publications, 2001
3. Upamanyou Madhow, Fundamentals of Digital Communication, Cambridge University Press 2008
4. Lee, Mesherschimdt, Digital Communication, BSP Publications / Springer Link Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Communication Networks

Course Code: **EIRCM801**/ EIRDS823/EIRRM833 Category: **PGC**

Credits : **3** No. of hours: **4 per week**

Department: **ECE**

Unit - I

Communication Networks and Services: Evolution of Network Architecture and Services, Future Network Architectures and Their Services, Key Factors in Communication Network Evolution. Applications and Layered Architectures - Examples of Protocols. Services and Layering. The OSI Reference Model. Overview of TCP/IP Architecture.

Unit - II

Digital Transmission Fundamentals: Characterization of Communication Channels, Fundamental Limits in Digital Transmission, Line Coding, Modems and Digital Modulation, Properties of Media and Digital Transmission Systems, Error Detection and Correction. **Circuit-Switching Networks - Multiplexing**, Circuit Switches, the Telephone Network, Signaling, Cellular Telephone Networks

Unit - III

Peer-to-Peer Protocols and Data Link Layer: Peer-to-Peer Protocols - Peer-to-Peer Protocols and Service Models, ARQ Protocols and Reliable Data Transfer Service, Data Link Controls, Framing, HDLC Data Link Control. Medium Access Control Protocols and Local Area Networks, Medium Access Control Protocols, Multiple Access Communications, Random Access, Channelization,

Unit – IV

Local Area Networks: LAN Protocols, Ethernet and IEEE 802.3 LAN Standards, Wireless LANs and IEEE 802.11 Standards, LAN Bridges

Packet-Switching Networks: Network Services and Internal Network Operation, Packet Network Topology Data grams and Virtual Circuits, Routing in Packet Networks, Shortest-Path Routing, ATM Networks

Unit – V

TCP-IP and ATM Networks: TCP/**IP** Architecture, the Internet Protocol, IPv6, User Datagram Protocol, Transmission Control Protocol, and Mobile IP, ATM Networks**,** ATM Signaling.

Text Books:

1. Communication Networks- Alberto Leon- Garcia, Indra Widjaja, TMH, 2000 Second Edition.

Reference Books:

1. ATM fundamentals-N.N. Biswas,Advenrture books publishers,1998
2. Data Networks, Robert Gallagher, PHI Publications
3. Data Communications & Networking, Forozam 4th Edition TMH Publication.
4. An Engineering Approach to Computer Networking, S. Keshav, Pearson Education, 2000

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester

Random Processes

Course Code: **EIRCM821** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT 1

Probability space: Introduction to probability, Sample space, field, _-field, Borel set, Probability space, joint, conditional and total probabilities, independence, Bayes' theorem.

Random Variable: Definition of random variable, Continuous and discrete random variable. Probability mass function and Probability density function, Cumulative distribution function, Basic distribution functions- binomial, uniform, exponential and normal. Properties of these distribution functions.

UNIT 2

Random Vector: Definition of random vector, joint statistics. Independent events and conditional probability. Conditional distributions, Sum and transformation of random variables.

Characteristic Function: Expectation, variance, moments, characteristic function, moment generating function, covariance and correlation, conditional expectation, Fundamental Theorem of expectation.

UNIT 3

Random process: Definition of random process, IID process, Poisson process, properties of Poisson process, Markov process, birth-death process, Wiener process.

UNIT 4:

Response of processes to LTI systems: Random processes as inputs to Linear Time Invariant (LTI) systems; power spectral density, Gaussian processes as input to LTI systems, white Gaussian noise.

UNIT 5:

Convergence: Markov and Chebyshev inequalities, weak and strong law of large numbers, Central Limit Theorem. Convergence of random sequences- almost sure convergence, convergence in probability, convergence in mean

Stationary: -Stationary and ergodic process – point-wise ergodic theorem, Ergodic decomposition, Karhunen – Loeve expansion.

TEXT BOOKS:

1. Athanasios Papoulis, S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes, TMH

2. Henry Stark, John W Woods, Probability and Random Processes with Application to Signal Processing, 3/e, Pearson Education India

References:

1. Geoffrey Grimm, Probability and Random Processes, 3rd edition, 2001, Oxford University Press
2. V. Krishnan, Probability and Random Processes, 2006, John Wiley & Sons 5. Albert Leon Garcia, Probability and Random Processes for Electrical Engineering, 1993, Prentice Hall
3. Dr. Kishor S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, John Wiley and Sons, New York, 2001.
4. Kingsbury N., Random Processes [Connexions Web site]. January 22, 2004.
5. Gray, R. M. and Davisson L. D., an Introduction to Statistical Signal Processing

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Multicarrier Communications

Course Code: **EIRCM822** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit-I

Characteristics of Multipath Fading Channels – Introduction to Multicarrier Techniques, Rayleigh and Ricean Fading Channels, Multipath Delay Profile, Frequency Selective and Frequency Nonselective Fading channels, Spaced-Time Correlation function, Time Selective and Time Nonselective Fading channels.

Unit-II

OFDM Characteristics - Origin of OFDM, Single Carrier Versus OFDM Comparison, use of Discrete Fourier Transform, Insertion of Cyclic Prefix for current form of OFDM, Radio channel Model, Bit Error rate of CPSK based and DPSK based OFDM system in Rayleigh Fading Channels, Bit Error Rate in Frequency Selective and Time Selective Rayleigh Fading Channels, Optimum number of Subcarriers and Optimum length of Guard Interval.

Unit-III

Synchronization – Pilot-Assisted DFT Window Timing/ Frequency Offset Estimation method, Principle of DFT window Timing Estimation and its performance, Pilot-Assisted DFT Window Timing Synchronization and Subcarrier Recovery method, Time domain Pilot-Assisted DFT Window Timing Synchronization and Subcarrier Recovery method, Frequency domain Pilot-Assisted Subcarrier Recovery method.

Unit-IV

Modulation and Coding - Convolutional Encoding/Viterbi Decoding, Symbol Interleaved Coded OFDM scheme, Bit Interleaved Coded OFDM scheme, Applications of OFDM to Wireless Networks.

Unit-V

Combination of OFDM and CDMA – Channel Model, DS-CDMA System, DS-CDMA Transmitter and Receiver, MC-CDMA System, MC-CDMA Transmitter and Receiver, Bit Error rate Analysis for DS-CDMA and MC-CDMA systems.

Text Book:

1. Shinksuke Hara and Ramjee Prasad, Multicarrier Techniques for 4G Mobile Communications, Artec House, 2003.

Reference Books:

1. OFDM Wireless LANs: A Theoretical and Practical Guide, John Terry, Juha Heiskala, December, 2001. ISBN: 0672321572
2. Multicarrier Digital Communications Theory and Applications of OFDM, Ahmad R. S. Bahai j Burton R. Saltzberg j Mustafa Ergen Multi-Carrier and Spread Spectrum Systems From OFDM and MC-CDMA to LTE and WiMAX, K. Fazel Ericsson GmbH, Germany and S. Kaiser, Second Edition, Wiley Publications

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Multirate Signal Processing

Course Code: **EIRCM823** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

UNIT-I

Fundamentals of Multirate Theory: The sampling theorem - sampling at sub nyquist rate, Basic Formulations and schemes.

Basic Multirate operations- Decimation and Interpolation - Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation.

UNIT-II

Maximally decimated filter banks: Polyphase representation - Errors in the QMF bank- Perfect

Reconstruction (PR) QMF Bank - Design of an alias free QMF Bank

Perfect reconstruction (PR) filter banks

Paraunitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary

UNIT-III

QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property- Quantization Effects: - Types of quantization effects in filter banks. - Coefficient sensitivity effects, dynamic range and scaling.

UNIT-IV

Cosine Modulated filter banks

Cosine Modulated pseudo QMF Bank-Design of pseudo QMF Bank, Efficient Polyphase structures, Deeper properties of cosine matrices, cosine modulated perfect reconstruction system.

UNIT-V

Multirate Filter Bank Theory and Related Topics

Block filters, LPTV Systems and Multirate Filter Banks, unconventional Sampling Theorems.

Text Books:
1. P.P. Vaidyanathan. “Multirate systems and filter banks.” Prentice Hall. PTR. 1993.
2. N.J. Fliege. “Multirate digital signal processing.” John Wiley 1994.

Reference Books:
1. Sanjit K. Mitra. “Digital Signal Processing: A computer based approach.” McGraw Hill. 1998.
2. R.E. Crochiere. L. R. “Multirate Digital Signal Processing”, Prentice Hall. Inc.1983.
3. J.G. Proakis. D.G. Manolakis. “Digital Signal Processing: Principles. Algorithms and Applications”, 3rd Edn. Prentice Hall India, 1999.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Stochastic Processes And Queueing Theory

Course Code: **EIRCM824** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit1:

Random Variables: Introduction, Discrete Random Variables, Continuous Random Variables, Expectation of a Random Variable, Jointly Distributed Random Variables, Moment Generating Functions, The Distribution of the Number of Events that Occur, Limit Theorems, Stochastic Processes, **Conditional Probability and Conditional Expectation:** Introduction, The Discrete Case, The Continuous Case, Computing Expectations by Conditioning, Computing Probabilities by Conditioning, Some Applications: List Model, Random Graphs

Unit-2:

Markov Chains ,Introduction, Chapman–Kolmogorov Equations, Classification of States, Limiting Probabilities, Some Applications, Mean Time Spent in Transient States, Branching Processes, Time Reversible Markov Chains, Markov Chain Monte Carlo Methods, Markov Decision Processes, Hidden Markov Chains

Unit-3:

Continuous-Time Markov Chains Introduction, Continuous-Time Markov Chains, Birth and Death Processes, The Transition Probability Function Pij(t), Limiting Probabilities, Time Reversibility, Uniformization, Computing the Tansition Probabilities.

Unit4:

The Exponential Distribution and the Poisson Process, Introduction, the Exponential Distribution, The Poisson Process, Generalizations of the Poisson Process.

Unit-5:

Queuing Theory: Introduction, Preliminaries, Exponential Models, Network of Queues, The System M/G/1, Variations on the M/G/1, The Model G/M/1, A Finite Source Model, Multiserver Queues

Text Books:

1. Sheldon M. Ross "Introduction to Probability Models', Elsevier, 10th edition

Reference Books:

1. R. W. Wolf, Stochastic Modeling of Queues, Prentice Hall, 1989.
2. J. Walrand, an Introduction to Queueing Networks, Prentice Hall, 1988.
3. E. Cinlar, Introduction to Stochastic processes, Prentice Hall, 1975.
4. S. Karlin and H. Taylor, A First course in Stochastic Processes, 2nd edition, Academic Press, 1975.
5. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007
6. D. Gross and C.M. Harris, "Fundamentals of Queueing Theory", Wiley Student
7. edition, 2004
8. A.O. Allen, "Probability, Statistics and Queueing Theory with Computer Applications", Elsevier, 2nd edition, 2005.
9. K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd edition, 2002.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Simulation Of Communication Systems & Networks

Course Code:	**EIRCM831**	Category:	**PGE**
Credits : **3**		No. of hours:	4 **per week**
Department: **ECE**			

UNIT 1

Simulation And Modeling Methodology

Basic Concepts of Modeling, Performance Evaluation Techniques, Error Sources in Simulation, Validation, Introduction to Deterministic Signals and Systems, Linear Time-Invariant Systems, Frequency-Domain Representation. Sampling and Interpolation.

UNIT 2

Representation Of Signals And Systems In Simulation

Introduction to Deterministic Signals and Systems, Linear Time-Invariant Systems, Frequency-Domain Representation, Lowpass-Equivalent Signals and Systems, Sampling and Interpolation, Characterization of Linear Time-Invariant Systems Using the Laplace Transform, Representation of Continuous Systems by Discrete Transfer Functions, Fourier Analysis for Discrete-Time Systems.

UNIT 3

Simulation Of Random Variables And Random Process

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND a ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

UNIT 4

Estimation Of Performance Measures

Estimation of Signal-to-Noise Ratio, Estimating Performance Measures for Digital Systems, Performance Characterization for Digital Systems and Run-Time Implications, The Monte Carlo Method, Tail Extrapolation, Importance Sampling, Quasianalytical (Semianalytic)

UNIT 5

Modeling Of Communication Systems: Transmitter And Receiver

Information Sources, Formatting/Source Coding, Channel Coding, Demodulation and Detection, Multiplexing / Multiple Access, Multipath Fading, Methodology for Simulating Communication Systems Operating over Fading Channels

Text Books:

1. M.C.Jeruchim,Philip Balaban and K.Sam Shanmugam, "Simulation of communication systems", Plenum Press,New York,2nd Edition,2002.
2. A.M.Law and W.David Kelton, "Simulation Modeling and analysis", Mc Graw Hill Inc., New York, 1991

References:

1. J.F.Hayes, "Modeling and Analysis of Computer Communication networks, Plenum Press, New York, 1984
2. Jerry Banks and John S.Carson, Discrete-event system Simulation", Prentice Hall, Inc., New Jersey, 1984

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
(ELECTIVE)
Estimation and Detection Theory

Course Code: **EIRDS822 /EIRCM832** Category : **PGE**

Credits : **3** No. of hours: **4 per week**

Department: **ECE**

UNIT-I

Minimum Variance Unbiased Estimation: Introduction, summary, unbiased estimators, minimum variance criterion, existence criteria and finding minimum variance unbiased estimator, extension to a vector parameter. **Cramer-Rao Lower Bound:** Introduction, Summary, estimatory accuracy considerations, cramer-rao lower bound, general crlb for signals in white Gaussian noise, transformation of parameters, extension to a vector parameter, vector parameter CRLB.

UNIT-II

Linear Models: Introduction, summary, linear model examples. **Best Linear Unbiased Estimators:** Introduction, Summary, Definition of BLUE, Finding BLUE, Extension to a vector parameter. **Maximum Likelihood Estimation:** Introduction, summary, finding the MLE, Properties of the MLE, MLE for transformed parameters, extension to vector parameter. Signal Processing examples.

UNIT-III

Least Squares: Introduction, the least squares approach, linear least squares, order-recursive least squares, sequential least squares, constrained least squares. Bayesian Philosophy: General Bayesian estimators, Linear Bayesian estimators. **The Bayesian Philosophy:** Introduction, Summary, Prior Knowledge and estimation, choosing a prior pdf, properties of the Gaussian pdf, Bayesian linear model. **General Bayesian Estimators:** Introduction, Summary, Risk functions, minimum mean square error estimators, maximum aposteriori estimators, performance description, signal processing examples.

UNIT-IV

Introduction: Detection Theory in Signal Processing. The Detection Problem. The Mathematical Detection Problem. Hierarchy of Detection Problems. **Summary of Important PDFs. Statistical Decision Theory -** Neyman-Pearson Theorem. Receiver Operating Characteristics. Irrelevant Data. Minimum Probability of Error. Bayes Risk. Multiple Hypothesis Testing. Neyman-Pearson Theorem. Minimum Bayes Risk Detector - Binary Hypothesis. Minimum Bayes Risk Detector - Multiple Hypotheses.

Unit-V

Deterministic Signals: Matched Filters. Generalized Matched Filters. Multiple Signals. Linear Model. Signal Processing Examples. Reduced Form of the Linear Model. **Random Signals -** Estimator-Correlator. Linear Model, Estimator-Correlator for Large Data Records. General Gaussian Detection. Signal Processing Example. Detection Performance of the Estimator-Correlator.

Text Books

1. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol.1: Estimation Theory, Pearson Education, 1993.
2. Steven M. Kay, Fundamentals of Statistical Signal Processing – Vol.2: Detection Theory, Pearson Education, 1998

Reference Books

1. H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd Ed., Springer-Verlag, 1994.
2. H. L. Van Trees, Detection, Estimation and Modulation Theory, Parts 1 and 2, John Wiley Inter-Science.
3. E. L. Lehman, Testing Statistical Hypothesis, John Wiley, 1986.
4. M. D. Srinath, P. K. Rajasekaran and R. Vishwanathan, An Introduction to Statistical Signal Processing with Applications, Prentice-Hall, 1996.
5. Todd K. Moon, Wynn C. Stirling, Mathematical Methods and Algorithms for Signal Processing, Prentice Hall,1999

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Multimedia Compression Techniques

Course Code:	**EIRCM833**	Category:	**PGE**
Credits : **3**		No. of hours:	**4 per week**
Department: **ECE**			

Unit I

Introduction: Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Text-Images-Graphics-Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Lossy & Lossless Compression techniques – Overview of source coding-Information theory & source models vector quantization theory: LGB algorithm– Evaluation techniques – Error analysis and Methodologies.

Unit II

Text Compression: Compaction techniques – Huffman coding – Adaptive Huffman Coding –Arithmatic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

Unit III

Audio Compression: Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering -. Predictive techniques – DM- PCM- DPCM: Optimal Predictors and Optimal Quantization- Formant and CELP Vocoders – Application to speech coding – G.722 – Application to audio coding – MPEG audio- progressive encoding for audio – Silence compression- speech compression techniques.

Unit IV

Image Compression: Contour based compression – Transform Coding – JPEG Standard – Subband coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW- SPIHT coders – JPEG 2000 standards - JBIG- JBIG2 standards. Basic subband coding

Unit V

Video Compression: Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and Compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

Text Books

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Solomon, “Data Compression, The complete reference”, Springer Verlag New York INC, 2nd edition 2001.

Reference Books

1. Peter Symes, “Digital Video Compression”, McGraw Hill Pub., 2004.
2. Mark Nelson, “Data compression”, BPB Publishers, New Delhi, 1998.
3. Mark S.Drew, Ze-Nian Li, “Fundamentals of Multimedia” PHI, 1st Edition, 2003
4. Yun A Shi, Huifang Sun, “Image & Video compression for Multimedia Engineering, Fundamentals, Algorithms & Standards, CRC Press, 2003.
5. Watkinson,J.Compression in video and audio, Focal press,London.1995
6. Jan Vozer,Video compression for multimedia,AP profes,NewYork,1995.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) VIII Semester
Soft Computing

Course Code: **EIRCM834** Category: **PGE**

Credits : **3** No. of hours: **4 per week**
Department: **ECE**

Unit- I

Introduction to Neuro-Fuzzy and Fuzzy Sets – Neural Networks, Neuro-Fuzzy and Soft Computing Characteristics, Set-theoretic operations, MF Formulation and Parameterization, Fuzzy Union, intersection and Complement.

Unit – II

Fuzzy Systems - Fuzzy relations, Fuzzy If-Then rules, Fuzzy Reasoning, Fuzzy models.

Unit – III

Regression and Optimization – Least Squares Estimator, Geometric Interpretation of LSE, Recursive Least-Squares Estimator, Descent Methods, The Method of Steepest Descent, Newton's Methods, Nonlinear Least-squares problem, Genetic algorithms.

Unit – IV

Neural Networks – Back propagation for Recurrent Networks, Hybrid Learning Rules, Back propagation Multilayer Perceptrons, Modular Networks.

Unit – V

Neuro-Fuzzy Modeling – Adaptive Neuro-Fuzzy Interference Systems, Neuron functions for adaptive Networks, Neuro-Fuzzy Spectrum, and Neuro-Fuzzy control.

Text Book:

1. Jang J.S.R.,Sun C.T and Mizutani E - Neuro Fuzzy and Soft computing Prentice hall New Jersey,1998

Reference Books:

1. Timothy J.Ross:Fuzzy Logic Engineering Applications.John Wiley & Sons,England,2004.
2. Laurene Fauseett: Fundamentals of Neural Networks. Prentice Hall India, New Delhi, 1994.
3. George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall Inc., New Jersey, 1995

Integrated Dual Degree Program B.Tech (ECE) + M.Tech (CS) VIII Semester

Communication Engineering Laboratory

Code:	**EIRCM812**	Category:	**PG Lab**
Credits:	**2**	No. of hours:	**6 per week**

This lab shall be carried out using MATLAB/Simulink Tools using Communication Blockset, Communication Systems Toolbox, Signal Processing Blockset, Signal Processing toolbox

1. Generation of Continuous and Discrete Random Variables: Uniform Disributed, Gaussian Rayleigh, Rician, Binomial, Poisson, Exponential, arbitrary distribution
2. Generation of random processes with specific power spectral density. Computation of autocorrelation function and power spectra of arbitrary sequences
3. Monte carlo simulation of communication systems based on binary PAM, binary orthogonal, Quaternary PAM signaling schemes
4. Signalling over Bandlimited Channels: Sinc, raised cosine signaling, duobinary, modified duobinary signaling. Impulse response and frequency response of bandlimited ideal and nonideal filters Zero Forcing, MMSE, Decision Feedback and other advanced equalizer designs
5. Monte Carlo simulation of carrier modulated PAM, PSK, FSK, QAM, DPSK systems and their spectral analysis
6. Channel Coding and Decoding: Implementation of linear block codec, convolutional codec, turbo codec and LDPC codec. Monte carlo simulation of uncoded and uncoded simulation system.
7. Generation and Demodulation of OFDM signals. Modem design issues
8. Implementation of Bit and Carrier recovery methods
9. Spread Spectrum Communication Systems: Generation of PN sequences: m –sequences using LFSR, Gold Codes, Kasami Codes and correlation characteristics. Monte carlo simulation of DS spread spectrum system (Bit error rate vs SNR) with processing gain of 10 and partial band interference. Monte carlo simulation of Frequency hopping spread spectrum system.

Text Books:

1. Proakis, Salehi, Modern Communication Systems using MATLAB 3/e Cengage Publications, India.
2. K. Ramachandran, Communication System Modeling, University Press, India
3. Yang, MATLAB / Simulink for Digital Communication, A-Jin Publishing

Reference Books:

1. Proakis, Salehi, Communication Systems Engineering, Prentice Hall Publications, India
2. Proakis, Salehi, Fundamentals of Communication Systems, Pearson Education, India
3. Proakis, Salehi, Digital Communications 5/e, Mc Graw Hill Publications
4. Madhow, Fundamentals of Digital Communication, Cambridge University Press, India

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester

Optical Communications

Course Code: **EIRCM901** Category: **PGC**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT I

Solution to Maxwell's equation in a circularly symmetric step index optical fiber, linearly polarized modes, single mode and multimode fibers, concept of V number, graded index fibers, total number of guided modes (no derivation), attenuation mechanisms in fibers, dispersion in single mode and multimode fibers, dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr effect, self phase modulation, combined effect of dispersion and self phase modulation.

UNIT II

Optical sources - Laser diode - Principles of operation and characteristics, Optical emission from semiconductor, semiconductor injection laser and its characteristics, injection laser to fiber coupling, Non-semiconductor laser, narrow line width and wavelength – tunable laser, mid-infrared and far infrared lasers, LED- Principles of operation and characteristics, LED power and efficiency, LED structures.

UNIT III

Optical detectors - pn detector, pin detector, avalanche photodiode - Principles of operation, concepts of responsivity, sensitivity and quantum efficiency, noise in detection, typical receiver configurations (high impedance and trans-impedance receivers).

UNIT IV

Coherent systems - Homodyne and heterodyne systems, coherent systems using PSK, FSK, ASK and DPSK modulations, related noise effects, performance degradation induced by laser phase and intensity noise, degradation due to fiber dispersion, degradation induced by nonlinear effects in fiber propagation.

UNIT V

Optical amplifiers - semiconductor amplifier, rare earth doped fiber amplifier (with special reference to erbium doped fibers), Raman amplifier, Brillouin amplifier - principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain and noise dependencies, intermodulation effects, saturation induced crosstalk, wavelength range of operation.

Text books:

1.Gerd Keiser: Optical Fiber Communications (3rd Ed.), McGraw Hill, 2000.
2.John Senior: `Optical Fiber Communications', Second Edition, PHI, 1992.

References:

1.Leonid Kazovsky, Sergio Benedetto and Alan Willner : `Optical Fiber Communication Systems', Artech House, 1996.
2.Silvello Betti, Giancarlo De Marchis and Eugenio Iannone: `Coherent ptical Communications Systems', John Wiley, 1995.
3.Govind P. Agrawal: Fiber-Optic Communication Systems (3rd Ed.), John Wiley & Sons, 2002
4.John Gowar: Optical Communication Systems (2nd Ed.), Prentice Hall, 1993
5.C. DeCusatis: Fiber Optic Data Communication, Technological Trends and Advances, Academic Press, 2002
6.Karminvov & T. Li: Optical Fiber Telecommunications, Vol A&B, Academic Press 2002
7.William Shieh and Ivan Djordjevic: OFDM for optical communications, Academic Press, 2009
8.Stephen B Alexander: Optical communication Receiver Design, IEE, 1997

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Wireless Communications

Course Code: **EIRCM902** Category: **PGC**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

Unit-I
Introduction: Communication systems, The physical layer, datalink layer. **Propagation and Noise:** Introduction, Free space propagation, Terrestial propagation-Physical models, Terrestial propagation-statistical models, Indoor propagation, local propagation effects with mobile radio, Channel classiciation, Noise and interference, Link calculations, Theme example-wireless local area networks.

Unit-II
Modulation and Frequency Division Multiple Access: Introduction, modulation, linear modulation schemes, pulse shaping, complex representation of linear modulated and bandpass systems, signal space representation of digitally modulated signals, nonlinear modulation techniques, frequency division multiple access, practical issues, comparison of modulation strategies for wireless communications, channel estimation and tracking, receiver performance. Theme example – Orthogonal Frequency Division Multiplexing.

Unit-III
Coding and Time Division Multiple Access: Introduction, Sampling, Why follow sampling and coding, shannon's information theory, speech coding, error control coding, convolutional codes, maximum likelihood decoding of convolutional codes, viterbi algorithm, interleaving, noise performance of convolutional codes, turbo codes, comparison of channel coding strategies for wireless communications, RF moldulation, baseband processing for channel estimation and equalization, time division multiple access, Theme examples-GSM, Joint equalization and decoding, random access techniques.

Unit-IV
Spread spectrum and code division multiple access: Introduction, direct sequence modulation, spreading codes, the advantages of cdma for wireless, code synchronization, channel estimation, power control, FEC coding and CDMA, Multiuser detection, CDMA in a cellular environment, frequency hopped spread spectrum. Theme Examples – IS95, GPSS, Bluetooth, WCDMA, WiFi

Unit-V
Diversity, Capacity and Space Division Multiple Access: Introduction, Space diversity on receive techniques, multiple input multiple output antenna systems, mimo capacity for known channel at the receiver, singular value decomposition of the channel matrix, space-time codes for mimo wireless communications, differential space time block codes, space division multiple access and smart antennas. Theme Examples- BLAST architectures, VBLAST, STBC, Keyhole channels. Overview of wirelesss architectures.

Text Book

1. Simon Haykin, Michael Moher, Modern Wireless Communications, Prentice Hall publications, 2005.

Reference Books

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press
2. William Stallings, Wireless Communications and Networks, Pearson Education
3. Theodre Rappaport, Wireless Communications, Principles and Practice, Pearson Education.
4. John.G.Proakis, Digital Communications, Fifth Edition, McGraw Hill Publications
5. Simon Haykin, Communication Systems, Fourth Edition, Wiley Publications.
6. David Tse, Viswanath, Fundamentals of Wireless Communications, Cambridge University Press

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester

Markov Modeling & Queuing Theory

Course Code: **EIRCM921** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT – I

Stochastic Processes: Renewal Processes - Reward and Cost Models, Poisson Process; Point Processes;

UNIT – II

Regenerative Processes; Renewal Theorems. Markov Models: Discrete Time Markov Chain - Transition Probabilities, Communication Classes.

UNIT – III

Irreducible Chains; Continuous Time Markov Chain - Pure-Jump Continuous-Time Chains, Regular Chains, Birth and Death Process, Semi-Markov Processes.

UNIT – IV

Single Class & Multi-class Queuing Networks: Simple Markovian queues; M/G/1 queue; G/G/1 queue; Open queuing networks; Closed queuing networks; Mean value analysis; Multi-class traffic model; Service time distributions; BCMP networks; Priority systems.

UNIT – V

Time Delays and Blocking in Queuing Networks: Time delays in single server queue; Time delays in networks of queues; Types of Blocking; Two finite queues in a closed network; Aggregating Markovian states.

Text Books

1. Ronald W. Wolff, Stochastic Modeling and the Theory of Queues, Prentice-Hall International, Inc, 1989.
2. Peter G. Harrison and Naresh M. Patel, Performance Modeling of Communication Networks and Computer Architectures, Addison-Wesley, 1992.

Reference Books

1. Gary N. Higginbottom, Performance Evaluation of Communication Networks, Artech House, 1998.
2. Anurag Kumar, D. Manjunath, and Joy Kuri, Communication Networking: An Analytical Approach, Morgan Kaufman Publ. 2004.
3. D. Bertsekas and R. Gallager, Data Networks, Prentice Hall of India, 2001.
4. Ross, K.W., Multiservice Loss Models for Broadband Telecommunication Networks, Springer-Verlag, 1995.
5. Walrand, J., an Introduction to Queuing Networks, Prentice Hall, 1988.
6. Cinlar, E., Introduction to Stochastic processes, Prentice Hall, 1975.
7. Karlin, S. and Taylor H., A First course in Stochastic Processes, 2nd edition Academic press, 1975.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester

Global Tracking and Positioning Systems

Course Code: **EIRCM922** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT I

Overview Of Gps

Introduction, The origins of surveying, Development of Global surveying techniques, History of Global Positioning System, Space segment, Control Segment, User Segment.

UNIT II

Reference Systems

Introduction, Coordinate Systems, Time systems, Orbit description, Orbit determination, Orbit dissemination, Signal Structure, Signal Processing.

UNIT III

Surveying With Gps

Data acquisition, Data combinations, Atmospheric effects, Relativistic effects, Antenna phase center offset and variation, Multipath, Surveying with GPS- Introduction, Planning a GPS survey, Surveying procedure, In situ data processing.

UNIT IV

Mathematical Models For Positioning

Point positioning, Differential positioning, Relative positioning, Kinematic relative positioning

UNIT V

Applications Of GPS

General uses of GPS, Attitude determination, Airborne GPS for photo-control, Interoperability of GPS, Installation of control networks, GPS modernization, GPS augmentation, GNSS, Hardware and software improvements.

Text books:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "Global Positioning System: Theory and Practice", 5th revised edition, Springer Wein, New York, 2001.
2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons, NewYork, 1995.

Reference Books:

1. B.Parkinson, J.Spilker, Jr. (Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
2. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
3. L.Adams, "The GPS - A Shared National Asset”, Chair, National Academy Press, Washington, DC, 1995

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Spread Spectrum And CDMA Systems

Course Code: **EIRCM923** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT I
Fundamentals of Spread Spectrum
Introduction to spread spectrum communication, pulse noise jamming, low probability of detection, direct sequence spread spectrum, frequency-hopping and time-hopping spread spectrum systems, correlation functions, spreading sequences maximal-length sequences, gold codes, Walsh orthogonal codes- properties and generation of sequences Synchronization and Tracking: delay lock and tau-dither loops, coarse synchronization- principles of serial search and match filter techniques.

UNIT II
Performance Analysis of SS system
Performance of spread spectrum system under AWGN, multi-user Interference, jamming and narrow band interferences Low probability of intercept methods, optimum intercept receiver for direct sequence spread spectrum, Error probability of DS-CDMA system under AWGN and fading channels, RAKE receiver

UNIT III
Capacity, Coverage and multiuser detection
Basics of spread spectrum multiple access in cellular environments, reverse Link power control, multiple cell pilot tracking, soft and hard handoffs, cell coverage issues with hard and soft handoff, spread spectrum multiple access outage, outage with imperfect power control, Erlang capacity of forward and reverse links. Multi-user Detection -MF detector, decorrelating detector, MMSE detector. Interference Cancellation: successive, Parallel Interference Cancellation, performance analysis of multiuser detectors and interference cancellers.

UNIT IV
CDMA Systems
General aspects of CDMA cellular systems, IS-95 standard, Downlink and uplink, Evolution to Third Generation systems, WCDMA and CDMA-2000 standards, Principles of Multicarrier communication, MCCDMA and MC-DS-CDMA.

UNIT V
Applications
Selected examples on current and future commercial applications of spread spectrum such as global positioning system, mobile communications, digital broadcasting, wireless LAN.

Text books:
1. R. L. Peterson, R. Ziemer and D. Borth, “Introduction to Spread Spectrum Communications,” Prentice Hall.
2. A. J. Viterbi, “CDMA - Principles of Spread Spectrum Communications,”Addison-Wesley.

References:
1. Vijay K. Garg, Kenneth Smolik, Joseph E. Wilkes, Applications of CDMA in Wireless/Personal Communications, Prentice Hall.
2. S. Verdu, “Multiuser Detection”, Cambridge University Press.
3. M. K. Simon, J. K. Omura, R. A. Scholts and B. K. Levitt, “ Spread Spectrum Communications Handbook”, McGraw- Hill.
4. Cooper and McGillem, “Modern Communications and Spread Spectrum” McGraw- Hill.
5. J. G. Proakis, “Digital Communications,” McGraw Hill, 4th Ed.
6. S. Glisic and B. Vucetic, “Spread Spectrum CDMA Systems for Wireless Communications,” Artech House,

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Advances In Fiber Optics And Photonics

Course Code: **EIRCM924** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT I

Waveguide Couplers

Coupling of beams to planar guides-prism, grating couplers. Theory of beam couplers and design. Waveguide couplers and mode converters, Filters.

UNIT II

Optical Integrated Circuit

Microfabrication techniques in optical integrated circuits – Guide evaluation and measurement. Pattern fabrication. Passive waveguide devices-Functional devices.

UNIT III

Semiconductor Integrated Optic Devices

Integrated semiconductors laser:- Gas heterostructure lasers, DFB lasers, modulators, Epitaxial detectors and electro absorption detectors, active switches, Optolectronic integrated circuits. Development trends.

UNIT IV

Applications Of Optical Integrated Circuits

Optical switches, A/D converters, RF spectrum analysers, convolvers and correlators. Integrated optic sensors. Optical inter connectors.

UNIT V

Applications Of Photonic Switching

High speed data transmission systems, Clock distribution, all optical fiber communication systems: Clock extraction & dispersion compensation, WDM systems, optical exchange systems: Time division & wavelength division switching, Power mixing & Frequency division switching, Space switches

Text Books

1. Hiroshi Nishihara, Masamitsu Haruna, Toshiaki Suhara, Optical Integrated Circuits, McGraw-Hill, New York, 1992.
2. B.Saleh, Fundamental of Photonics, John Wiley, New York, 1991.

References Books:

1. Tamir.T. (ed) Integrated optics, Vol. 7, Topics in applied Physics, Springer Verlag, New York, 1975.
2. Tamir.T. (ed) Guided wave Optoelectronics, Springer Verlag, Berlin, 1990.
3. Buckman. AB, Guided Wave Photonics, Saunders College publishing, New York, 1992.
4. Photonic Switching, Technology & Sensors, Vol. 13, OSA publishing, 1987.
5. H. Kawaguchi, Bistabilities and Non-linearities in Laser Diodes, Artech house Inc, Norwood, 1994.
6.Sueta and Okoshi, Fundamental of Ultra fast & Ultra Parallel Opto Electronics, John Wiley & Sons, New York, 1996.9.K. Tada and Hinton. H.S, Photonic Switching II, Springer Verlag, Berlin, 199

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Network Management

Course Code: **EIRCM931** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

Unit – I

Fundamentals Of Computer Network Tehnology

Network Topology, LAN, Network node components -Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards

Unit – II
Osi Network Management
OSI Network management model-Organizational model-Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

Unit – III
Internet Management (Snmp)
SNMP-Organizational model-System Overview, The information model, communication model-Functional Model, SNMP proxy server, Management information, protocol remote monitoring

Unit – V
Broadband Network Management
Broadband network s and services, ATM Technology-VP, VC, ATM Packet, Integrated service, ATMLAN Emulation, Virtual Lan.ATM Network Management-ATM Network reference model, integrated local management Interface.ATM Management Information base, Role of SNMD and ILMIin ATM Management, M1, M2, M3, M4 Interface.ATM Digital Exchange Interface Management

Unit – IV
Network Management Applications
Configuration management, Fault management, performance management, Event Corelation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management

Text Books:
1. Mani Subramanian, “Network Management Principles and practice ", Addison Wesly New York, 2000.
2. Salah Aiidarous, Thomas Plevayk, “Telecommunications Network Management Technologies And Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.

Reference Books:
1. Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
High Speed Switching Architecture

Course Code: **EIRCM932** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT – I

High Speed Network

Introduction-LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of BISDN,SDH multiplexing structure, ATM standard, ATM adaptation layers

UNIT – II

Lan Switching Technology

Switching concepts, switch forwarding techniques, switch path control, LAN switching, cut through

Forwarding, store and forward, virtual LANs

UNIT – III

Atm Switching Architecture

Switch models, blocking networks- basic-and-enhanced banyan networks, sorting networks-merge sorting, rearrange able networks-full-and-partial connection networks, non -blocking networks-Recursive network construction, comparison of non-blocking network, switches with deflection routing-shuffle switch, tandem banyan

UNIT – IV

Queues in ATM Switches

Internal Queuing-Input, output and shared queuing, multiple queuing networks-combined input, output and shared queuing -performance analysis of Queued switches

UNIT – V

IP Switching

Addressing model, IP Switching types-flow driven and topology driven solutions, IP over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

Text books:

1. Achille Pattavina, Switching Theory: Architectures and performance in Broadband ATM Networks, John Wiley & Sons Ltd., New York.1998.

2. Christopher Y Metz, Switching protocols & Architectures, McGraw Hill Professional publishing, new York.1998.

Reference Books:

1. Ranier Handel, Manfred N Huber, Stefan Schrodder,ATM Networks-concepts,protocols,applications,3rd Edition, Adisson Wesley, New York, 1999.

2.TCP/IP Illustrated Volume 1, 2nd Edition, W.Richard Stevens, Kevin R.Fall, Pearson Education, 2012

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Communication Network Security

Course Code: **EIRCM933** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

Unit – I

Data Encryption – Security Attacks, Security Mechanisms, Symmetric Cipher Model, Substitution Techniques, Steganography, AES Structure, Multiple Encryption and Triple DES, Cipher Block chaining Model, Pseudorandom Number generation using a Block Cipher.

Unit – II

Public Key Cryptography and RSA – Principles of Public-Key Cryptosystems, RSA Algorithm, EIGamal Cryptosystem, Elliptic Curve Cryptography, Pseudorandom number generation based on an Asymmetric Cypher.

Unit – III

Cryptographic Data Integrity Algorithms – Cryptographic Hash Functions and its Applications, Hash functions based on Cipher Block chaining, Secure Hash Algorithm, Message Authentication functions and Message Authentication Codes, Security of MACs, HMAC, DAA, CMAC, Authenticated Encryption, Pseudorandom number generation Using Hash Function and MACs.

Unit – IV

Transport Layer Security – Web Security issues, Secure Sockets Layer, Transport Layer Security, HTTPS, IEEE Wireless LAN Security, Wireless Transport Layer security, WAP End-to-End Security.

Unit – V

IP Security – IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites.

Text Book:

1. Cryptography and Network Security: Principles and Practice, William Stallings, Fifth Edition, Prentice Hall, 2011

Reference Books:

1. Elements of Computer Security, David Salomon, Springer

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Space Time Coding & Mimo Systems

Course Code: **EIRCM934** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT – I

Information theoretic aspects of MIMO

Review of SISO communication - MIMO channel models - Classical i.i.d. and extended channels - Frequency selective and correlated channel models - Capacity of MIMO channels - Ergodic and Outage Capacity - Capacity bounds - Influence of channel properties on capacity.

UNIT – II

MIMO Diversity and Spatial Multiplexing

Space Time Diversity Aspects - Sources and types of diversity - analysis under Rayleigh fading – Diversity and Channel knowledge - MIMO Spatial multiplexing - Space Time receivers - ML - MMSE - ZF – Sphere decoding - BLAST receivers - DMG tradeoff in MIMO systems.

UNIT – III

Space Time Block Codes

Alamouti's code for two transmit antennas - Comparison with dual-branch receive diversity STBC based on real/complex orthogonal designs - Code Design Criteria for quasi-static Channels (Rank, Determinant and Euclidean Distance) - Orthogonal Designs - Generalized Orthogonal Designs - Quasi-Orthogonal Designs - Performance Analysis.

Representation of STTC- shift register, generator matrix, state-transition diagram, trellis

UNIT – IV

Space Time Block Codes

Representation of STTC- shift register, generator matrix, state-transition diagram, trellis

UNIT – V

Space Time Trellis Codes

Diagram - Code construction. Delay diversity as a special case of STTC- Performance Analysis.

Text Books:
1. B.Vucetic and J. Yuan, Space-Time Coding, John Wiley, 2003.
2. A. Paulraj, R. Nabar and D. Gore, “Introduction to Space Time Wireless Communications”, Cambridge University press.

Reference Books:
1. E.G. Larsson and P. Stoica, “Space-Time Block Coding for Wireless Communications”, Cambridge University press.
2. H. Jafarkhani, “Space-Time Coding: Theory and Practice”, Cambridge University press
3. D. Tse and P. Viswanath, “Fundamentals of Wireless Communication”, Cambridge University press.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Spectrum Analysis

Course Code: **EIRCM941** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT-I

Power Spectral Density - Energy Spectral Density of Deterministic Signals, Power Spectral Density of Random Signals, Properties of Power Spectral Densities. Spectral Estimation.

UNIT-II

Non Parametric Methods - Periodogram and correlogram methods, Blackman – Tukey method, Barlet, Welch and Daniell methods, Window design considerations.

UNIT-III

Parametric Methods for rational spectra – Introduction, Covariance structure of ARMA Processes, Yule-Walker method for estimating AR parameters. MA and ARMA signals, Multivariate ARMA signals.

UNIT-IV

Parametric methods for line spectra - Models of sinusoidal signals in noise, Nonlinear least squares method, high order Yule-Walker method, Min-Norm method, Pisarenko and MUSIC ESPRIT method.

UNIT-V

Filter Bank Methods – Filter Bank Interpretation of the Periodogram, Refined Filter Bank Methods: Slepian Baseband Filters, RFB method for High resolution Spectral Analysis and RFB method for Statistically Stable Spectral Analysis, Capon method.

Text Book:

1. Introduction to Spectral Analysis – P. Stoica & R. Moses, Prentice Hall, 1997

Reference Book:

1. Modern Spectral Estimation Theory & Applications - Steven M. Kay, Prentice Hall, 1999.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Wavelet Transforms And Its Applications

Course Code: **EIRCM942** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

UNIT – I

Fourier and Sampling Theory: Generalized Fourier theory, Fourier transforms Short- time (windowed) Fourier transform, Time-frequency analysis, and Fundamental notions of the theory of sampling. Theory of Frames: Bases, Resolution of unity, Definition of frames, Geometrical considerations and the general notion of a frame, Frame projector, Example – windowed Fourier frame.

UNIT – II

Wavelets: The basic functions, Specifications, Admissibility conditions, Continuous wavelet transform (CWT), discrete wavelet transform (DWT). The multi-resolution analysis, MRA axioms, Construction of an MRA from scaling functions - the dilation equation and the wavelet equation, Compactly supported orthonormal wavelet bases - Necessary and sufficient conditions for orthonormality

UNIT – III

Regularity and selection of wavelets: Smoothness and approximation order -Analysis in Soboleve space, Criteria for wavelet selection with examples.

UNIT – IV

Splines: Cardinal B-spline MRA, Sub band filtering schemes, compactly supported orthonormal wavelet bases. Wavelet decomposition and reconstruction of functions in $L^2(R)$. Fast wavelet transform algorithms - Relation to filter banks, Wavelet packets – Representation of functions, Selection of basis.

UNIT – V

Biorthogonality and biorthogonal basis, Biorthogonal system of wavelets - construction, The Lifting scheme.

Text Books:

1. Stephen G. Mallat, “A wavelet tour of signal processing” 2nd Edition Academic Press.
2. M. Vetterli, J. Kovacevic, “Wavelets and subband coding” Prentice Hall Inc

Reference Books:

1. .Gilbert Strang and Truong Q. Nguyen, “Wavelets and filter banks” 2nd Edition Wellesley- Cambridge Press.
2. Gerald Kaiser, “A friendly guide to wavelets” Birkhauser/Springer International Edition
3. L. Prasad and S. S. Iyengar, “Wavelet analysis with applications to image processing” CRC Press.
4. J. C. Goswami and A. K. Chan, “Fundamentals of wavelets: Theory, Algorithms and Applications” Wiley-Interscience Publication, John Wiley & Sons.
5. Mark A. Pinsky, “Introduction to Fourier Analysis and Wavelets” Brooks/Cole Series in Advanced Mathematics.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech(CS) IX Semester
Network Routing Algorithms And Protocols

Course Code: **EIRCM943** Category: **PGE**

Credits : **3** No. of hours: **4per week**
Department: **ECE**

Unit - I

Shortest path and Widest Path Routing Algorithms – Bellman-Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of Bellman-Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Catching, Widest Path Computation with Candidate Path Catching, Widest path Algorithms- Bellman-Ford and Dijkstra's approach, k-Shortest Paths algorithm.

Unit – II

Routing Protocols – Distance Vector Routing protocol, Link State Routing protocol, Path Vector Routing Protocol, Link Cost.

Unit – III

IP Routing – Static Routes, Routing Information Protocol Version 1 and Version 2, Interior Gateway Routing Protocol, EIGRP, Route Redistribution.

Unit – IV

IP Traffic Engineering – IP Network Traffic, TCP Throughput, Bandwidth-Delay Product, Router Buffer Size, Traffic Engineering, Link Weight Determination Problem.

Unit - V

Routing in the PSTN - Hierarchical Routing, Dynamic Nonhierarchical Routing, Dynamically Controlled Routing, Dynamic Alternate Routing, Real-Time Network Routing, Maximum allowable Residual Capacity routing.

Text Books:

1. Network routing Algorithms, Protocols and Architectures, Deepankar Medhi and Karthikeyan Ramasamy, Morgan Kaufmann Publishers, CA, 2007.
2. Routing in Communication Networks, M.Steen Strub, Prentice Hall International, New York, 1995.

Reference Books:

1. High Speed Networks TCP/IP and ATM Design principles, Prentice Hall, New York, 1998.
2. TCP/IP Illustrated Volume 1, 2nd Edition, W.Richard Stevens, Kevin R.Fall, Pearson Education, 2012.

Integrated Dual Degree Program B.Tech (ECE) + M.Tech (CS) IX Semester

Network Design and Simulation Laboratory

Code:	**EIRCM911**	Category:	**PGC Lab**
Credits:	**2**	No. of hours:	**3 per week**

This lab shall be carried out using Linux/ OPNET/ Network Simulator 2 Tools

Phase-I: These experiments shall be conducted in a linux environment
Internetworking devices, how TCP/IP protocols work, Exercises with Linux commands, Exercises with diagnostic tools, Exercises on port numbers, Network interface exercises, ARP exercises, Exercises with ICMP and ping, Exercises with IP address and subnets mask, Configuring a bridge or router, Exercises on Cisco IOS, A simple bridge experiment. A simple router experiment, RIP exercises, Routing experiments with ICMP, OSPF exercise, Static routing experiment, Traceroute experiment, UDP exercises, Path MTU discovery exercise, Exercises with FTP and TFTP, Exercises on TCP connection control, Exercise on TCP interactive data flow, Exercise on TCP bulk data flow, Exercises on TCP timers and retransmission, HTTP exercises, DHCP exercises, NTP exercises, Socket programming exercises

Phase-2: These experiments shall be conducted using OPNET modeler software
Ethernet, Switched LANs, Network Design, ATM, RIP: Routing Information Protocol, OSPF, Border Gateway Protocol (BGP), TCP, Queuing Disciplines

Introduction to network simulation using ns2 and nam tools

Text Book:

1. Shivendra S. Panwar, TCP/IP Essentials, A Lab Based Approach, Cambridge University Press, India
2. Larry Peterson, Emad Aboelela, Network Simulation Laboratory Manual, Elsevier Publications, India
3. Gopi, Introduction to Network Simulator ns2, Springer Publications

Reference Book:

1. Douglas E. Comer, Internetworking with TCP/IP, Prentice Hall Publications Vol-1, Vol-2
2. Larry Peterson, Computer Networks, 5/e, Elsevier Publications, India

Integrated Dual Degree Program B.Tech (ECE) + M.Tech (CS) IX Semester

Modern Communication Engineering Laboratory

Code:	**EIRCM912**	Category:	**PGC Lab**
Credits:	**2**	No. of hours:	**3 per week**

This lab shall be carried out using MATLAB/C6713 DSK/ Fiber Optic Trainers other communication equipment and tools

Phase-I: These experiments shall be conducted using MATLAB/ C6713 DSK
Sinusoidal Waveform Generation, Input and Output with DSK, FIR filter implementation, IIR filter implementation, FFT implementation, DTMF generation and detection, PSK Modulation and Demoduation, QAM transmitter and receiver implementation with equalizer, symbol and carrier recovery, OFDM modulation and demodulation with DSK

Other experiments on Software Defined Radio, Fiber Optic Networks, Antennas, Microwaves, Telecommunicaiton equipment like SONET, SDH, ATM etc. Multimedia Processing experiments.

Text Books:

1. Proakis, Vijay K. Ingle, Digital Signal Processing using MATLAB 3/e, Cengage Publications, India
2. Rulph Chassaing, Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK 2/e, Wiley Publications, India
3. Sen M. Kuo, Real Time Digital Signal Processing 2/e, Wiley Publications, USA
4. Steve A. Tretter, Communication System Design using DSP Algorithms, Springer Publications, India
5. Thad Welch, Real Time Digital Signal Processing, CRC Press, USA
6. Digital Media Processing, DSP Algorithms using C, Elsevier Publications, India