Independent University, Bangladesh

Department of Electrical and Electronic Engineering
School of Engineering and Computer Science

Revised Curriculum

for

B.Sc. in Electronic and Telecommunication Engineering

2. List of Courses and Credit Distribution of UG ETE Syllabus:

Course Type	Course Code With Title	Cr.-Hs	Total Cr.-Hs
Foundation (41 Cr.)			
Communication Skills	ENG101 Listening and Speaking Skills	3	**9**
	ENG102 English Reading Skills	3	
	ENG105*Business English	3	
	ENG106 Advanced English Skills	3	
	ENG201 Introduction to English Literature	3	
Social Sciences	ANT101 Introduction to Anthropology	3	**6**
	SOC101 Introductory Sociology	3	
	HEA101 Health and Society	3	
	ECN200 Introduction to Economics	3	
	CMN201 Introduction to Communication	3	
	SOC202 Social Psychology	3	
Humanities	NCH101**National Culture and Heritage	3	**6**
	BPH101**Bangladesh Political History	3	
	BLA101**Bangla Literature and Arts	3	
	HST103 History & Civilization	3	
	AAT101 Art and Aesthetics	3	
	MUS101 Music Appreciation	3	
	FRN101 Elementary French I	3	
	PHL101 Introduction to Philosophy	3	
	PHL206 Philosophy of Religion	3	
Natural Sciences	PHY 111 Physics-I	3	**7**
	PHY 121 Physics-II	3	
	PHY 121L Physics Lab	1	
Computer Skills	CSC 121 Introduction to Computer Programming Language	3	**4**
	CSC 121L Lab for CSC121	1	
LFE	LFE201 Live-in-Field Experience	3	**3**
Numeracy	MAT 111 Mathematics-I	3	**6**
	MAT 121 Probability & Statistics for Science and Engineering	3	
Mathematics (9 Cr.)			
Mathematics	MAT 131 Mathematics-II	3	**9**
	MAT 213 Mathematics-III	3	
	MAT 221 Mathematics-IV	3	

Core (59 Cr.)			
Core	EEE 131 Electrical Circuit-I	3	**59**
	ETE 132 Introduction to Materials and Chemistry	3	
	EEE 211 Electrical Circuit-II	3	
	EEE 211L Electrical Circuit Lab	1	
	ETE 221 Electronics-I	3	
	EEE 225 Energy Conversion Engineering	3	
	ETE 231 Signals and Systems	3	
	ETE 232 Digital Logic Design	3	
	ETE 232L Digital Logic Design Lab	1	
	ETE 234 Electronics-II	3	
	ETE 234L Electronics Lab	1	
	ETE 235L Circuits, Signals and Systems Simulation Lab	1	
	ETE 312 Communication Engineering Fundamentals	3	
	ETE 312L Comm. Eng. Fundam. Lab.	1	
	ETE 313 Electromagnetic Fields and Waves	3	
	ETE 314L Numerical Technique Lab	1	
	ETE315L Electronic and Telecommunication Project Lab	1	
	ETE 316 Microprocessor and Interfacing	3	
	ETE 316L Microprocessor and Interfacing Lab	1	
	ETE 321 Computer Networks	3	
	ETE 321L Computer Networks Lab	1	
	ETE 324 Digital Signal Processing	3	
	ETE 324L Digital Signal Processing Lab	1	
	ETE334 Embedded Systems	3	
	ETE 413 Sensor and Instrumentation	3	
	ETE 413L Sensor and Instrumentation Lab	1	
	ETE 422 Ethics, Engineering Economics and Management	3	
Concentration (Compulsory) (Cr. 21)			
	ETE 323 Digital Communications	3	21
	ETE 323L Digital Communication Lab	1	
	ETE332 RF and Microwave Engineering	3	
	ETE333 Telecommunication Networks and Switching Systems	3	
	ETE335 Wireless Communications	3	
	ETE335L Wireless Comm. and Microwave Eng. Lab	1	

	ETE411 Optical Fiber Communications	3	
	ETE411L Optical Fiber Comm. Lab	1	
	ETE423 Network Operating System & Administration	3	
Concentration (Optional)(Cr. 9)			
Concentration (Optional)	Optional-1	3	**9**
	Optional-2	3	
	Optional-3	3	
Final Year Design Project (6 Cr.) / Internship			
Final Year Design Project	ETE 497 lnternship*		**6**
	*Can be taken as an optional course		
	ETE 400 Final Year Project	6	
Minimum Total Credit-Hours Required for Graduation			**145**

* (ENG101, ENG102 & ENG105) Or (ENG105, ENG106 & ENG201)

** Any one of three (NCH101, BPH101 & BLA101) is mendatory

Course List of Concentration (Optional)		
Group-A	**Telecommunications**	
	ETE 445 Antenna and Wave Propagation	3
	ETE 446 Satellite Communications	3
	ETE 448 Cryptography and Network Security	3
	ETE 451 Telecommunication Policy and Management	3
	ETE 452 Internet and Web Technology	3
	ETE 460 Special Topics in Telecommunications	3
Group-B	**Electronics**	
	ETE461 Power Electronics and Drives	3
	ETE 462 Control Systems	3
	ETE 463 Analog and Digital Integrated Circuits	3
	ETE 464 Nanotechnology	3
	ETE 465 Biomedical Signal Processing	3
	ETE 466 VLSI Design	3
	ETE 467 Optoelectronics	3

	ETE 469 Robotics and Mechatronics	3
	ETE 470 Biomedical Instrumentation	3
	ETE 471 Electrical Properties of Materials	3
	ETE 473 IC Fabrication Process Integration	3
	ETE 475 Special Topics in Electronics	3
Group-C	**Computer and Software Engineering**	
	CSE 476 Data Structures	3
	CSE 477 Algorithms	3
	CSE 478 Object Oriented Programming	3
	CSE 479 Database Management Systems	3
	CSE 480 Computer Graphics and Multimedia	3
	CSE 481 Software Engineering Concepts	3
	CSE 482 Software Project Management	3
	CSE 483 Software Testing and Reliability	3
	CSE 484 Intelligent System Engineering	3
	CSE 485 Parallel and Distributed Computing	3
	CSE 486 Digital Image Processing	3
	CSE 487 Numerical Methods	3
	CSE 490 Special Topics in Computer and Software Engineering	3

Note-1 (*): Students not exempted from ENG 101 and ENG 102 will have to take ENG 101, ENG 102 and ENG 105.
Note-2(*): Students exempted from ENG 101 and ENG 102 will have to take ENG 105, ENG 106, and ENG 201
Note-3(**): Students must take any one of the following NCH 101, BPH 101, & BLA 101 and any other course from the Humanities category to fulfil the requirements of taking six (6) credits.
Note-4(***): Additional one optional course (Optional-4) is needed for Internship students

Minor for ETE Students: (15 Cr.)
Students majoring in Electronic and Telecommunication Engineering will have Electrical and Electronic Engineering as their minor by default. However, they can change their minor by taking additional courses offered by other department.

3. Four year plan of the Courses in the trimesters with the Credit Distribution

Year	Trimester	Course Code	Course Title	Cr. hrs	Total hrs
1	Trimester -1	ENG 101	Listening and Speaking Skills	3	12
		MAT 111	Mathematics – I	3	
		PHY 111	Physics –I	3	
		HUM/SOC-1	Any one from Humanities/ Social Science Groups	3	
	Trimester-2	ENG 102	Listening and Speaking Skills	3	14
		MAT 121	Prob. & Stat. for Sci. and Engg.	3	
		PHY 121	Physics –II	3	
		PHY 121L	Physics Lab	1	
		CSC 121	Introduction to Computer Programming	3	
		CSC 121L	Computer Programming Lab	1	
	Trimester-3	ENG 105	Business English	3	12
		MAT 131	Mathematics - II	3	
		EEE 131	Electrical Circuit-I	3	
		ETE 132	Introduction to Materials & Chemistry	3	
2	Trimester-1	HUM/SOC-2	Any one from Humanities/ Social Science Groups	3	13
		HUM/SOC-3	Any one from Humanities/ Social Science Groups	3	
		MAT 213	Mathematics-III	3	
		EEE 211	Electrical Circuit-II	3	
		EEE 211L	Electrical Circuit Lab	1	
	Trimester-2	HUM/SOC-4	Any one from Humanities/ Social Science Groups	3	12
		MAT 221	Mathematics-IV	3	
		ETE 221	Electronics-I	3	
		EEE 225	Energy Conversion Engineering	3	
	Trimester-3	ETE 231	Signals and Systems	3	12
		ETE 232	Digital Logic Design	3	
		ETE 232L	Digital Logic Design Lab	1	
		ETE 234	Electronics-II	3	
		ETE 234L	Electronics Lab	1	
		ETE 235L	Circuits, Signals and Systems Simulation Lab	1	
3	Trimester-1	ETE 312	Communication Engineering Fundamentals	3	13
		ETE 312L	Communication Engineering Fundamentals Lab	1	
		ETE 313	Electromagnetic Fields and Waves	3	
		ETE 314L	Numerical Technique Lab	1	
		ETE 315L	Electronic and Telecom Project Lab	1	
		ETE 316	Microprocessor and Interfacing	3	

		ETE 316L	Microprocessor and Interfacing Lab	1	

3	Timester-2	ETE 321	Computer Networks	3	15
		ETE 321L	Computer Networks Lab	1	
		ETE 323	Digital Communication	3	
		ETE 323L	Digital Communication Lab	1	
		ETE 324	Digital Signal Processing	3	
		ETE 324L	Digital Signal Processing Lab	1	
		LFE 201	Live-in-Field Experience	3	
	Trimester-3	ETE 332	RF and Microwave Engineering	3	13
		ETE 333	Telecom. Networks and Switching Systems	3	
		ETE 334	Embedded Systems	3	
		ETE 335	Wireless Communication	3	
		ETE 335L	Wireless Communication and Microwave Engineering Lab	1	
4	Trimester-1	ETE 411	Optical Fiber Communications	3	14
		ETE 411L	Optical Fiber Communications Lab	3	12/15
		ETE 413	Sensor and Instrumentation	1	
		ETE 413L	Sensor and Instrumentation Lab	3	
		Optional-I	Anyone from Concentration (Optional) Group	1	
		Optional-2	Anyone from Concentration (Optional) Group	3	
		ETE 400	Final Year Design Project	1	
	Trimester-2	ETE 422	Ethics, Engineering Economics and Project Management	3	12
		ETE 423	Network Operating System and Admin.	3	
		Optional-3	Anyone from Concentration (Optional) Group	3	
		ETE 400	Final Year Design Project	2	
	Trimester-3	ETE 400	Final Year Design Project (contd.)	3	6/3
		ETE 497	Internship (can be taken as an optional course)	3	

4. Trimester wise credit & contact hour distribution

Year	Trimester	Credit Hours				Contact Hours			
		Theory	Lab	Tutorial	Total	Theory	Lab	Tutorial	Total
1st Year	1	12.0	0.0	0.0	12.0	12.0	0.0	12.0	24.0
	2	12.0	2.0	0.0	14.0	12.0	6.0	15.0	33.0
	3	12.0	0.0	0.0	12.0	12.0	0.0	12.0	24.0
2nd Year	1	12.0	1.0	0.0	13.0	12.0	3.0	13.5	28.5
	2	12.0	0.0	0.0	12.0	12.0	3.0	13.5	28.5
	3	9.0	3.0	0.0	12.0	9.0	9.0	13.5	31.5
3rd Year	1	9.0	4.0	0.0	13.0	9.0	12.0	15.0	36.0
	2	9.0	6.0	0.0	15.0	9.0	18.0	18.0	45.0
	3	12.0	1.0	0.0	13.0	12.0	3.0	13.5	28.5
4th Year	1	12.0	2.0	0.0	14.0	12.0	6.0	15.0	33.0
	2	9.0	3.0	0.0	12.0	9.0	12.0	15.0	36.0
	3	0.0	3.0	0.0	3.0	0.0	9.0	4.5	13.5
Total		**120.0**	**25.0**	**0.0**	**145.0**	**120.0**	**81.0**	**160.5**	**361.5**

Based on Lab Cr. (3Hrs/Wk)	Credits Distribution (%)				Contact Hours Distribution (%)		
	Theory	Lab	Tutorial		Theory	Lab	Tutorial
1 Cr.	82.76	17.24	0.00		33.20	22.41	44.40
1.5Cr	76.19	23.81	0.00		33.20	22.41	44.40

5. Summary of Courses for Individual Trimester

1st Year (Trimester-1)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ENG 101	Listening and Speaking Skills	3	3	0	3
MAT 111	Mathematics - I	3	3	0	3
PHY 111	Physics -I	3	3	0	3
HUM/SOC-1	Any one from Humanities/ Social Science Groups	3	3	0	3
Total		**12**	**12**	**0**	**12**

Total Hours/Week in 1st year Trimester-1: **L+T+P= 24**
Total Credits in 1st year Trimester-1: **C= 12**

1st Year (Trimester -2)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ENG 102	Listening and Speaking Skills	3	3	0	3
MAT 121	Prob. & Stat. for Sci. and Engg.	3	3	0	3
PHY 121	Physics -II	3	3	0	3
PHY 121L	Physics Lab	0	1.5	3	1
CSC 121	Intr. to Comp. Prog.	3	3	0	3
CSC 121L	Computer Programming Lab	0	1.5	3	1
Total		**12**	**15**	**6**	**14**

Total Hours/Week in 1st year Trimester-2: **L+T+P= 33**
Total Credits in 1st year Trimester-2: **C= 14**

1st Year (Trimester -3)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ENG 105	Business English	3	3	0	3
MAT 131	Mathematics - II	3	3	0	3
EEE 131	Electrical Circuit-I	3	3	0	3
ETE 132	Introduction to Materials & Chemistry	3	3	0	3
Total		**12**	**12**	**0**	**12**

Total Hours/Week in 1st year Trimester-3: **L+T+P= 24**
Total Credits in 1st year Trimester-3: **C= 12**

2nd Year (Trimester- 1)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
HUM/SOC-2	Any one from Humanities/ Social Science Groups	3	3	0	3
HUM/SOC-3	Any one from Humanities/ Social Science Groups	3	3	0	3
MAT 213	Mathematics - III	3	3	0	3
EEE 211	Electrical Circuit-II	3	3	0	3
EEE 211L	Electrical Circuit Lab	0	1.5	3	1
Total		**12**	**13.5**	**3**	**13**

Total Hours/Week in 2nd year Trimester-1: **L+T+P= 28.5**
Total Credits in 2nd year Trimester-1: **C= 13**

2nd Year (Trimester -2)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
HUM/SOC-4	Any one from Humanities/ Social Science Groups	3	3	0	3
MAT 221	Mathematics - IV	3	3	0	3
ETE 221	Electronics-I	3	3	0	3
EEE 225	Energy Conversion Engineering	3	3	0	3
Total		**12**	**12**	**0**	**12**

Total Hours/Week in 2nd year Trimester-2: **L+T+P= 24**
Total Credits in 2nd year Trimester-2: **C= 12**

2nd Year (Trimester -3)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 231	Signals and Systems	3	3	0	3
ETE 232	Digital Logic Design	3	3	0	3
ETE 232L	Digital Logic Design Lab	0	1.5	3	1
ETE 234	Electronics-II	3	3	0	3
ETE 234L	Electronics Lab	0	1.5	3	1
ETE 235L	Circuits, Signals and Systems Simul.Lab	0	1.5	3	1
Total		**9**	**13.5**	**9**	**12**

Total Hours/Week in 2nd year Trimester-3: **L+T+P= 31.5**
Total Credits in 2nd year Trimester-3: **C= 12**

3rd Year (Trimester -1)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 312	Communi. Engg. Fundamentals	3	3	0	3
ETE 312L	Communi. Engg. Fund. Lab	0	1.5	3	1
ETE 313	Electrom. Fields and Waves	3	3	0	3
ETE 314L	Numerical Technique Lab	0	1.5	3	1
ETE 315L	Electronic and Telecom Project Lab	0	1.5	3	1
ETE 316	Micropro. and Interfacing	3	3	0	3
ETE 316L	Microp. & Interfac. Lab	0	1.5	3	1
Total		**9**	**15**	**12**	**13**

Total Hours/Week in 3rd year Trimester-1: **L+T+P= 36**
Total Credits in 3rd year Trimester-1: **C= 13**

3rd Year (Trimester -2)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 321	Computer Networks	3	3	0	3
ETE 321L	Computer Networks Lab	0	1.5	3	1
ETE 323	Digital Communication	3	3	0	3
ETE 323L	Digital Communication Lab	0	1.5	3	1
ETE 324	Digital Signal Processing	3	3	0	3
ETE 324L	Digital Signal Processing Lab	0	1.5	3	1
LFE 201	Live-in-Field Experience	0	4.5	9	3
Total		**9**	**18**	**18**	**15**

Total Hours/Week in 3rd year Trimester-2: **L+T+P= 45**
Total Credits in 3rd year Trimester-2: **C= 15**

3rd Year (Trimester -3)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 332	RF and Microwave Engineering	3	3	0	3
ETE 333	Telecom. Networks & Switching Systems	3	3	0	3
ETE 334	Embedded Systems	3	3	0	3
ETE 335	Wireless Comm.	3	3	0	3
ETE 335L	Wireless Comm. & Microwave Engg. Lab	0	1.5	3	1
Total		**12**	**13.5**	**3**	**13**

Total Hours/Week in 3rd year Trimester-3: **L+T+P= 28.5**
Total Credits in 3rd year Trimester-3: **C= 13**

4th Year (Trimester -1)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 411	Optical Fiber Comm.	3	3	0	3
ETE 411L	Optical Fiber Comm. Lab	0	1.5	3	1
ETE 413	Sensor and Instrumentation	3	3	0	3
ETE 413L	Sensor and Instrument. Lab	0	1.5	3	1
Optional-1	Any one from Concentration (optional) group	3	3	0	3
Optional-2	Any one from Concentration (optional) group	3	3	0	3
Total		**12**	**15**	**6**	**14**

Total Hours/Week in 4th year Trimester-1: **L+T+P= 33**
Total Credits in 4th year Trimester-1: **C= 14**

4th Year (Trimester -2)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE 422	Ethics, Engr. Econ. and Manag.	3	3	0	3
ETE 423	Network Oper. System & Admin.	3	3	0	3
Optional-3	Any one from Concentration (optional) group	3	3	0	3
ETE 498 / Optional-4	Sr. Project / Optional-4 (For Intern group student)	0	4.5	9	3
Total		**9**	**13.5**	**9**	**12**

Total Hours/Week in 4th year Trimester-2: **L+T+P= 31.5**
Total Credits in 4th year Trimester-2: **C= 12**

4th Year (Trimester -3)

Course No	Course Title	Theory Hrs/Wk (L)	Tutorial Hrs/ Wk (T)	Lab Hrs/Wk (P)	Credit (C)
ETE498 /ETE497	Sr. Project (cont.) / Internship	0	4.5	9	3
Total		**0**	**4.5**	**9**	**3**

Total Hours/Week in 4th year Trimester-3: **L+T+P= 13.5**
Total Credits in 4th year Trimester-3: **C= 3**

6. Course Description:

Foundation Courses (41 Credits)

Communication Skills:

ENG 101: Listening and Speaking Skills (3 credits)
Listening for main ideas and specific information, getting meaning from context, identifying stressed words and reductions, listening for advice, directions understanding instructions, guessing meaning inferring, predicting, listening to lectures and note taking, listening to narratives and amusing anecdotes.
Speaking as social interaction, to obtain and give information, telephone conversations, introductions, greetings, partings, giving instructions, making complaints, apologies, giving directions, opinions and suggestions, expressing feelings and moods, attitudes and opinions. Classroom interaction, asking for clarification and giving explanations, descriptions, comparisons, analysis, and evaluations. Speeches, presentations, debates and discussions at seminars and conferences. Pronunciation with emphasis on intonation, stress patterns, paralinguistic features.

ENG 102: English Reading Skills (3 credits)
Micro-skills of reading- predicting, skimming and scanning, lexis/ vocabulary, sentence structures, text organization, sequence markers, cohesive ties and coherence, getting direct meaning and inferring, purposes and styles of writing, understanding graphic data, figurative language and rhetoric, understanding underlying themes and values, attitudes and ideologies, responding to reading- critical evaluation, note- making, paraphrasing, and summarizing. Reading and responding to newspapers, journals, magazine articles, periodicals and other texts on current affairs. Poetry and fiction. Using a dictionary, thesaurus, glossaries and strategies for reading textbooks for reference. In addition to class exercises, students are expected to read newspaper, journals, magazines, periodicals and textbooks on selected themes in gathering information and presenting a term-end paper as part of the course assessment apart from a written paper of two hours duration. Prerequisite ENG 101

ENG 105: Business English (3 credits)
This course is designed to give students a comprehensive view of communication its scope and importance in business, and the role of communication in establishing a favorable response outside the firm environment as well as an effective internal communications program. The various types of business communication media are covered. This course also develops an awareness of the importance of succinct written expression to modern business communication. By the end of this course, students should be able to: Understand and demonstrate the use of basic and advanced writing techniques that today's technology demands, including anticipating audience reaction, write effective and concise letters and memos, prepare informal and formal reports, proofread and edit copies of business correspondence, complete an accurate, complete resume and cover letter, conduct excellent interviews and complete follow-up employment correspondence, use career skills that are needed to succeed, such as using ethical tools, working collaboratively, observing business etiquette, and resolving workplace conflicts, plan successfully for and participate in meetings and conduct proper techniques in telephone usage, use e-mail effectively and efficiently, develop

interpersonal skills that contribute to effective and satisfying personal, social and professional relationships. Prerequisite: ENG 102

ENG 106: Advanced English Skills (3 credits)
Advanced skills in reading- Critical reading and responding, analysis and evaluation of texts styles, comparing different purposes and registers, writing critiques of articles, text books and reviews, reading scientific and technical articles, journals and research papers. Writing in response to reading, notes, summaries, term papers, seminar and workshop presentations, collaborative writing on wider topics.
Speeches and debates. Writing in narrative and expository modes. Writing research papers, abstracts, formulating thesis questions and statements, making bibliographic surveys, writing research questions for surveys and interviews, gathering and presentation of data, drawing conclusions, abbreviations and numbers, quotations, footnotes and references, bibliographies, tables, illustrations, editing and proofreading. Term paper mandatory. Prerequisite: ENG I 05

ENG 201: Introduction to English Literature (3 credits)
Reading and examination of works of poetry, prose, fiction and drama, with a view to developing the student appreciation and enjoyment of the use of rhetorical devices such as narration's point of view, imagery, overstatement, understatement, metaphor and other figures of speech, irony, allusion etc. and of technical details such as plot character and setting. The course also considers the critical evaluation of the meanings expressed by the literary works. Prerequisite: ENG I 06

Social Sciences:

ANT 101: Introduction to Anthropology (3 credits)
Definition and scope; Historical formation of anthropology; anthropology and colonialism; Major Subfields: Cultural Anthropology, Physical Anthropology, Linguistic Anthropology and Archaeology; Anthropology and other Disciplines; Theory and methods in anthropology; Core
Concepts: Culture, Marriage and Family, Kinship, Descent and Social Structure; Economic Systems, Political Systems; Applying Anthropolo gy: Applied Anthropology; Recent Trends in Anthropology: Changes and Direction.

SOC 101: Introductory Sociology (3 Credits)
Introductory Sociology is designed to acquaint the beginning students with the major concepts and theories. With a brief discussion of its history and contributions of the major sociologists the course introduces the students to the methodology of social research. The course then looks at the major concepts, like culture, groups, socialization, deviance and social control. The next section deals with social inequality in terms of social stratification, global inequality, and inequalities among ethnic groups, gender and of age. It then moves to the different institutions like, family, religion, education, economy, and government and politics. The next section deals with population, environment, urbanization and finally with collective behavior and social movements and social change.

HEA 101: Health and Society (3 credits)
This course aims to introduce students to an understanding of key sociological approaches to the analysis and understanding of health and society. The course covers concepts of health and disease, patterns of health and the social construction of disease. Special attention is given

to develop knowledge on theories central to the notion of health, including the social, cultural and institutional forces and context that play a role on health and health related practices. The purpose is to help establish a perspective that will enable the students to better understand the relationship between health and society as well as to provide skills and knowledge for research experiences. The course also provides an overview of the basic concepts of population studies that will help students develop their own demographic perspective, enabling them to understand some of the most important issues confronting the world. The course will use a combination of methods, such as lectures, debates, preparation of assignments by reviewing journal articles and presentation.

ECN 200: Introduction to Economics (3 credits)
Basic concepts of Economics. Distinction between Micro and Macro Economics. General view of price system: Demand and Supply. Elasticity of demand and supply. Consumer's behavior: Utility analysis, Inferior good and Giffen good. Market Structures: Perfect competition, Monopoly, Monopolistic competition and Oligopoly. Factors of Production: labor, land, capital and entrepreneur. Basic concepts of Macroeconomics. Circular flow of income, mixed economy, private and public sector economic interactions. Measuring domestic output: national income and the price level. Aggregate Expenditures Model. The Multiplier, net exports, and government. Aggregate demand and aggregate supply. Fiscal policy. Money and banking. Demand and supply of money. Money market equilibrium. Credit creation by banking system. Monetary policy. Some concepts of International Trade, exchange rate determination and economic development.

CMN 201: Introduction to Communication (3 credits)
The course aims to introduce the basic concepts, principles and processes of communication. It is designed for the students having little or no background in communication. It discusses the foundations of human communication and preliminaries to interpersonal,small group, public and media communication from a cultural perspective.

SOC 202: Social Psychology (3 credits)
This course examines how individuals' perceptions, belief systems, identities and behaviors form the orders of gender, age, race and placements: their roles within the institutions of family, work, religion and community. Various theories in social psychology are used to examine the issues of socialization, conformity and deviance, aggression and altruism, prejudice and discrimination, group interaction and dynamic, group productivity, satisfaction and motivation and leadership.

Humanities:

NCH 101: National Culture and Heritage (3 credits)
The aim of this course is to orient students with the various social, cultural, historical and political aspects of Bangladesh. Society, culture and heritage will be explored in five time period in this course. There will be some common issues across the time period as well. The time periods are:

1. Ancient and Mughal Bengal -Introduction to the course, Bengal under Munhall (cultural perspective)
2. Bengal during British Colonial Period- Bengal under British colonial rule (cultural and political perspectives)
3. Emergence of Bangladesh and its Nature and Culture

Bengali Nationalism and Emergence of Bangladesh (economic and cultural perspectives), Independence war, Delta River and culture, Major Ethnic Groups in Bangladesh

Bengali language and literature, Bengali art and music

4. Contemporary Bangladesh, Globalization, migration and Bangladesh, Rural society and Culture, Folk Festival and art, Changing class and Society, Urbanization and Urban class, Migration and Bangladesh Contemporary Religious radicalism and pluralism, NGO and Bangladesh , Gender dimensions in Bangladeshi society, Natural Disaster in Bangladesh
5. Cross-cutting time zones (CCTZ) Development: Agricultural and Industrialization, Education in Bangladesh: Historical overview, Hindu and Buddhist Dynasties and Muslim Conquest, Physical and Anthropological Geography.

BPH 101: Bangladesh Political History (3 credits)

Introduction, political conditions in ancient period and ruling dynasties, archaeological sites: Mahasthan , Mainamati, Paharpur, Wari Bateswar, Muslim conquest, of Bengal and political unification of Bengal, Bengal under the Sultans, Bengal under the Mughals, Foreign travellers in ancient and medieval period , idea of golden period, Coming of the Europeans and the political conditions in early 18th century, Battle of Palashi (1757) and the establishment of the rule of the rule of the English East India Company in Bengal. Permanent settlement and the extension of the company's rule over other parts of India, The Hindu society and the reform movements (19th century): Raja Rammohan Roy, Ishar Chandra Vidyasagar, The Muslim society and the reform movements : Hazia Shahriatullah, Titumir, Nawab Abdul Latif, Sayeed Amir Ali, Peasant movements in Bengal, Muslim separatism in the 19th century, Partition of Bengal 1905, Major politics events in Bengal and India (1905-1947), Economic backwardness of Bengal under British Colonial Rule. The Language Movement, 1952,

Movement for Autonomy in East Pakistan, Economic Disparity between the two wings of Pakistan, War of Liberation, 1971, Political Development since 1971.

BLA 101: Bangla Literature and Arts (3 Credits)

Introduction, concept of Art and culture, early Medieval Music: Songs of Siddhacharyas JoyDev, Baduchandi Das, Shri Chaitanya Dev, early Modem Music: Tappa; Brahma Sangeet, Swedeshi gan, Patriotic song, origin and Development of Bangla Language, origin and Development of Bangla Language, early Bangla Literature: Charyapada , first half of the 20th Century: Songs of Rabindronath Tagore, Group of Composers, Kazi Nazrul Islam, contemporary Music in Bangladesh (1947-1971): Abbasuddin Ahmed, Abdul Ahad, Samar Das, Altaf Mahmud , Abdul Latif, Khan Ataur Rahman, folk Music in Bangladesh: Bhatiali, Baul, Jari gan, Kavigaan , Pala gan, Puthi path and Sarigan, literature in the Medieval : Long Narrative Poems. Literature in the Medieval Period: Short Devotional Poems, Kabi Gan and Dobhashee Punthi., Origin of Bengali Painting:Punthi painting, Calligraphy, Gajir pata. Painting in the 19th Centuries first half of the 20th Centuries: Abanindranath Tagore, Nandalal Basu, Jamini Roy,Zainul Abedin, Qumrul Hasan, Saffiuddin Ahmed, S.M.Sultan. Contemporary Paintings since 1947 Mohammed Kibria, Aminul Islam, Novera Ahmed, Murtaza Baseer,Hamidur Rahman ,Devdas Chakravorty, Shahabuddin Ahmed, Jamal Ahmed. The First half of the 19th Century: Beginning of Written Prose, Main Trends in Bangla Literature in the second alf of the 19th Century. Trends in Bangla literature in the first half of the 20th Century with special reference to select writers. Folk art and Crafts: The Traffic art in Bangladesh (Rickshaw

Painting) Sara Chittra, Nakshi Kantha, Challchittra. Origin of Bengali Theatre, Bangladeshi Theatre, 1947- 1975. Main trends in poetry and fiction since 1971 with reference to select poets and novelists. Main trends in poetry and fiction since 1971 with reference to select poets and novelists. Essay and Essayist in contemporary Bangladesh.

HST 103: History & Civilization (3 credits)
Meaning, Growth and Spread of civilization The Ancient Near East: Mesopotamia- Egypt- The Hebrews- The Hittites Canaanites - Philistine - Phoenicians - Crete - Mycenea -The Classical World the Greeks and the Romans - The Medieval
Age: Christianity, Barbarian invasions, Feudalism, Manorial System, Growth of towns and Universities - Byzantine civilization and the formation of Russia - Early Culture in America: The Mayas, the Aztecs, the Incas - The Renaissance and the Reformation - Government and Societies in the Age of Absolutism - The Age of Explorations - The formation of Latin American - the Scientific and Industrial Revolutions - Consolidation of Europe's Global dominance - World War I - The Bolshevik Revolution in Russia.

AAT 101: Art and Aesthetics (3 credits)
Introduction, concepts and principle of Aesthetics; History of civilization; Introduction to Indian Mythology; People and Art; History of Paintings; Theory of Bengali Paintings ; Objectives of Bengali Paintings; Mughal Paintings; Bengali Paintings and Western Influence; Bangladeshi Painting in the pre- Liberian period 1947 — 1970; Bengali folk painting and craft, Impressionism, Expressionism and Modem Bangladeshi Paintings; Practical orientation to museum study; Post Modernism in Bengali paintings. Introduction to History of music; Early medieval Bengali music; Tune and lyrics of Bengali music (17th to mid-19th century). Bengali Folk songs, Contemporary Bangladeshi Music; Western influence in Bangladeshi Music; Introduction to Origin of Bengali Theatre; Genera of Bengali Theatre; Modem Theories and forms of Bengali Theatre; Conclusion.

MUS 101: Music Appreciation (3 credits)
Introduction; The origin of Bengali Music; Basic materials and properties of Bengali Music; Kirtan and other medieval Bengali Music; Musical instrument of Bengal; The renaissance of Bengali music, the music of humanism, the music of mannerism.
Folk and traditional Bengali Music; Lyric and aesthetics of Bengali Music; Tribal music of Bengal; Contemporary Bangladeshi music; mind and music; Conclusion.

FRN 101: Elementary French I (3 credits)
Letters of alphabet. Accents and their pronunciation. Definite and indefinite articles (feminine/masculine, singular/plural). Personal pronouns. Auxiliaries "to be" and "to have", verbs ending with '-er, in the present tense. Interrogative, negative form. Simple adjectives (descriptive, colors). Presenting oneself.

PHL 101: Introduction to Philosophy (3 credits)
Definition of philosophy. Functions of philosophy critical and constructive; its relation to religion and science. Philosophy and life; methods of philosophy: dogmatism, skepticism and criticism. Theories of the origin of knowledge: authoritarianism, empiricism, rationalism, critical theory and Kant, intuitionism; Idealism and realism. Criterion of truth: correspondence, coherence and pragmatic theories. Nature of mind: mind as substance; the concept of empirical self-, the organism and concrete view. Theories of mind-body relationship. The problem of value: the concept of intrinsic and extrinsic value: the three cardinal values--truth, beauty and goodness.

PHL 206: Philosophy of Religion (3 credits)
Students will be required to acquire a general knowledge of its fundamental teachings of the principal world-religions and their philosophical and psychological interpretations and implications

Natural Sciences:

PHY 111 Physics-I (Cr. 3)
Principles of Motion: Vectors review, Newton's Laws of motion, principles of conservation of linear momentum and energy, friction, elastic and inelastic collisions, projectile motion, uniform circular motion, simple harmonic motion, rotation of rigid bodies, angular momentum, torque, moment of inertia. Newton's Law of gravitation, potential energy. Stress and Strain: Stresses and strains, Modulii of elasticity, Poisson's ratio, relations between elastic constants, work done in deforming a body, bending of beams, fluid motion and viscosity, Bernoulli's Theorem, Stokes' Law, surface tension and surface energy, pressure across a liquid surface, capillarity. Heat and Thermodynamics*:* Temperature and Zeroth Law of thermodynamics, temperature scales, isotherms, heat capacity and specific heat capacity, Newton's Law of cooling, thermal expansion, First law of thermodynamics, change of state, Second Law of thermodynamics, Carnot cycle, efficiency, kinetic theory of gases, heat transfer. Optics: Theories of light; Interference of light: Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers; Diffraction: Diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and N-slits, diffraction grating; polarization: Production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction, Nicol prism, optical activity, Polarimeters. Sound Waves: Sound waves & their propagation, differential equation of wave motion, stationary waves, vibration in strings & columns, sound wave & its velocity, Doppler effect, beats, intensity & loudness, ultrasonic and its practical applications.

Suggested Texts & References:
1. M. W. Zemansky and R. H. Dutmann, Heat and Thermodynamics.
2. David Halliday and Robert Resnick, Physics for Science and Engineering, Volume I, John Willey & Sons Publishing.
3. M. T. Spranklins, Mechanical Properties of Matter.
4. Brizlal, Properties of Matter.
5. Brizlal, Optics.
6. E. Hecht, Optics.

PHY 121 Physics-II (Cr. 3)
Electricity and Magnetism: Electric charge, Coulomb's Law, electric field & flux density, electric potential, capacitors. Magnetic field, Biot-Savart Law, Ampere's Law, electromagnetic induction, Faraday's Law, Lenz's Law, self inductance and mutual inductance, magnetic properties of matter, diamagnetism, paramagnetism and ferromagnetism. Gauss's law and its application, electric scalar potential, conductors and dielectrics in static electric field, flux density- boundary conditions, Special theory of relativity. Quantum Physics: Mass-energy relation. Quantum theory, Photoelectric effect, x-rays, Compton effect, De Broglie matter wave concept, dual nature of matter and radiation, Heisenberg uncertainty principle. Atomic model, Bohr's postulates, electron orbits and electron energy, Rutherford nuclear model, isotopes,

isobars and isotones, radioactive decay, half-life, alpha, beta and gamma rays, nuclear binding energy, fission and fusion' fundamentals of solid state physics, lasers, holography. (Pre-requisite: PHY 111)

Suggested Texts & References:

1. David Halliday and Robert Resnick, Physics for Science and Engineering, Volume II, John Willey & Sons Publishing.
2. Arthur Baiser, Concept of Modern Physics, McGraw-Hill Higher Education.
3. Subrahmanyam N et al, Atomic and Nuclear Physics, S Chand & Co Ltd, India.
4. B. L. Theraja, A Text Book of Electrical Technology, S Chand & Co Ltd, India.

PHY 121L Physics Lab (Cr. 1)
Lab works based on PHY 111 & PHY 121

Computer Skills:

CSC 121 Introduction to Computer Programming Language (Cr. 3)
Introduction to problem solving for programming (i.e., "how to think about solving the problem" including techniques such as pseudo-code or flowcharts); Syntax and program structure, including C/C++ identifier rules, Primitive data types and declarations, Operations on its (including mod), doubles (including truncation), and Booleans; String objects and basic String methods, Basic input with Scanner, including validating input; Basic input/output file processes, Conditional execution with if, else if, and else; Basic looping, including for and while loops; Static methods and method invocation; arrays and linked list; arrays of primitive types and Strings including the following topics: declaration, initialization, assignment, traversal, and methods; Basics of identifying and fixing errors.

Suggested Texts & References:

1. Robert W Sebesta, Concepts of Programming Languages, Pearson Education.
2. John Hubbard, Schaum's Outline of Programming with C++.
3. Tony Gaddis, Starting Out with C++, Dreamtech Press, New Delhi.
4. Stephen Prata, C++ Primer Plus, Techmedia.
5. Deitel and Deitel, How to C++ Program, Prentice Hall India Limited
6. Hennefeld, J., Baker, L., and Burchard, C, Using C++: An Introduction to Programming,
   (latest edition),Brooks/Cole: Thomson Learning Inc.
7. Herbet Schildt, Teach Yourself C++, Osborne McGraw-Hill Publishing Company.
8. Frank L Friedman and Elliot B Koffman, Problem Solving, Abstraction and Designing Using C++, Addison-Wesley.
9. E Balagurusamy, Programming in ANSI C, Tata McGraw-Hill Publishing.
10. Steve Holzner, C Programming, PEEEr Norton Computing.

CSC 121L Lab for CSC 121 (Cr. 1)
Lab works based on CSC 121.
LFE:

LFE 201: Live-in-Field Experience (3 credits)

The course is intended to expose the students to experience life in the cross-cultural situation obtained in the country, and to the practice of the field survey method. It is usually offered during the semester break in the winter.

Numeracy:

MAT 111 Mathematics-I (Cr. 3)
Differential Calculus: Functions, Limits. Continuity and differentiability. Tangent and normal lines. Techniques of differentiation, Successive differentiations. Rates of change, related rates. Rolle's theorem. Mean value theorem. Taylor series and Maclaurine series. L'Hospitals rule. Maximum and minimum, points of inflexion, curve sketching. Partial differentiation. Vectors and Co-ordinate Geometry: Coordinates systems, polar coordinates, transformation of coordinates. Circles, conics, equations of parabola, ellipse and hyperbola in Cartesian and polar coordinates. Parametric equations. Vectors, dot and cross-products with applications. Lines and planes in three dimensions. Integral Calculus I: Indefinite integrals and definite integrals. Fundamental Theorem of calculus Integration by substitution. Integration by parts. Integration by successive reduction. Partial fractions.

Suggested Texts & References:

1. Howard Anton, IrlBivens, Stephen Davis, Calculus, John Wiley & Sons.
2. Swokpwski Eary W., Calculus 6thEdition, Boston, PWS Publisher.
3. Robert, T.Smith, Calculus –McGraw Hill.
4. Das, B. C. & B. N. Mukherjee, Differential Calculus, U. N. Dhur and Sons
5. Calculus, Ron Larson and Bruce H. Edwards.

MAT 121 Probability & Statistics for Science and Engineering (Cr. 3)
Discrete and continuous variables; probability concepts; discrete and continuous distributions; Binomial, Poisson, Normal, Exponential distributions; Moments and moment generating functions; joint probability distributions; sampling distributions; confidence intervals; least-square regression; hypothesis testing; analysis of variance; Markov process, Monte-Carlo simulation.(Prerequisites: MAT 111)

Suggested Texts & References:

1. Walpole, Myers, Myers, and Ye, Probability & Statistics for Engineers & Scientists, Pearson Education.
2. Devore J. L., Probability and Statistics for Engineering and Sciences, 4th ed., Duxbry Press ITP.

Mathematics (9 Credits)

MAT 131 Mathematics-II (Cr. 3)
Integral Calculus II: Improper integrals. Beta function and Gamma function. Area under a plane curve in Cartesian and polar coordinates. Average value of a function. Area of the region enclosed by two curves in Cartesian and polar coordinates. Arc lengths of curves in Cartesian and polar coordinates, arc lengths of curves defined by parametric equations. Volumes of solids of revolution by disk/washer method and shell method. Area of surface of revolution. Trapezoidal rule. Simpson's rule. Ordinary Differential Equations I: Definition and classification of differential equations. Formation of differential equations. Solution of first order differential equations by various methods. Solutions of linear equations of second and

higher order with constant coefficients. Solution of homogeneous linear equations and their applications. Method of undetermined coefficients, method of variation of parameters. Matrices and Determinants: Matrices. Types of matrices. Algebra of matrices. Determinants. Solution of linear systems. Matrix inversion. Cramer's rule. Eigenvalues and eigenvectors. (Prerequisites: MAT 111)

Suggested Texts & References:

1. Bhub Dev Sharma, Differential Equation, Revised Edition, New Delhi, Kader and Ramnath.
2. M. D. Raisinghania, Ordinary and Partial Differential Equation, S. Chand.
3. I A N Sneddon, Elements of Partial Differential Equation, Dover Publications.
4. Ross Shepley L, Differential Equations, 3rd Edition,NewYork, John Wiley and Sons.
5. J. M. Kar, Partial Differential Equation.
6. Burden Richard & J. Douglas Faires, Numerical Analysis, Canada, Thomson.
7. A. R. Vasishtha, vipinVasishtha, Numerical Analysis.

MAT 213 Mathematics-III (Cr. 3)

Vector spaces: Subspaces, Linear combinations, Span, Linearly dependence and independence. Basis and dimension of vector space. Rank of a marix. Vector calculus: Differentiation and integration of vector functions and applications. Multiple integrals. Line, surface and volume integrals. Gradient, divergence and curl . Green's theorem, Gauss's theorem, Stoke's theorem and applications. Numerical Methods: Newton -Raphson method, Basic concepts of computational linear algebra, Numerical methods for ordinary differential equations.
Ordinary Differential Equations II: Power series, interval of convergence. Series solution of ordinary differential equations, Bessel functions and Legendre polynomials.
(Prerequisites: MAT 131)

Suggested Texts & References:

1. A. F. M. Abdur Rahman and P. K. Bhattacharjee, Analytic Geometry and Vector Analysis.
2. Khosh Mohammad, Analytic Geometry and Vector Analysis.
3. Howard Anton ,Calculus, John Wiley & Sons.
4. Earl W. Showkowskey, Calculus, PWS Publisher.
5. Spiegel Murray R, Vector Analysis, Schaum Outline Series.
6. Raisinghania M.D, Vector Analysis.
7. BhuDev Sharma, Differential Equation, Revised Edition, New Delhi, Kader and Ramnath.
8. M. D. Raisinghania, Ordinary and Partial Differential Equation, New Delhi, S. Chand.
9. I A N Sneddon, Elements of Partial Differential Equation, Dover Publications.
10. Ross Shepley L, Differential Equations, 3rd Edition,NewYork, John Wiley and Sons.
11. J. M. Kar, Partial Differential Equation.

MAT 221 Mathematics-IV (Cr. 3)

Complex Variables: Complex number systems. General functions of a complex variable. Limits and continuity of functions of a complex variable. Complex differentiation and Couchy-Riemann equations. Mapping by elementary functions. Contour integration. Cauchy's integral theorem. Cauchy's integral formula. Taylor's and Laurent's theorem. Singular points. Residues. Cauchy's residue theorem. Laplace Transforms: Definition. Laplace transforms of some elementary functions. Inverse Laplace transforms. Laplace transforms of derivatives. Convolutions. The unit step function. Periodic functions. Solutions of differential

equations by Laplace transform. Fourier Analysis: Periodic functions, Trigonometric series, Real and complex form of Fourier series. Fourier sine and cosine series, Finite transforms. Fourier integral. Fourier transforms. Partial Differential Equations: Introduction. Linear and non-linear first order equations. Standard forms. Linear equations of higher order. Boundary value problems. (Prerequisites:MAT213)

Suggested Texts & References:

1. Murray R. Spiegel, Theory and problems of Laplace Transforms.
2. Murray R. Spiegel, Fourier Analysis with applications to boundary value problem.
3. R J Beerends, HG Ter, Fourier and Laplace Transforms.
4. P. P. G. Dyke, An introduction to Laplace transforms and Fourier Series.
5. M. L. Khanna, Functions of a Complex Variable, New Delhi, Jai Prakash.
6. James Ward Brown and Ruel V. Churchill, Complex Variable and Applications. McGraw Hill.
7. Spigel Murray R, Complex variables, Singapore, McGraw Hill.

Core courses (59 Credits)

EEE 131 Electrical Circuits–I (Cr. 3)

DC circuit variables and elements: Charge & current, Voltage, power& energy, voltage source, current source, independent and dependent sources, types of resistors, color coding and standard resistor values, conductance, thermistors, photoconductive cell, varistors. Basic laws: Ohm's law, nodes, branches and loops. Series DC circuits: series resistors, series circuits, power distribution in a series circuit, voltage sources in series, Kirchhoff's voltage law, Voltage division in a series circuit, voltage regulation and the internal resistance of voltage source. Parallel DC circuits: parallel resistors, parallel circuits, power distribution in a parallel circuit, Kirchhoff's current law, current divider rule, voltage sources in parallel, open and short circuits. Series-Parallel networks, current sources in parallel and in series. Method of analysis: branch-current analysis, nodal analysis, mesh analysis including super node and super mesh. Wye-Delta and Delta-Wye transformation. Circuit theorems: Thevenin's, Norton's and Superposition theorems, maximum power transfer theorem, Millman's theorem, Substitution theorem and reciprocity theorem, linearity property, source transformation. RC transient: charging and discharging phase, initial conditions, instantaneous values, Thevenin Equivalent: time constant=$R_{th}C$, capacitors in series and in parallel, energy stored by a capacitor, stray capacitance. RL transient: Magnetic Field, inductance, induced voltage, the storage phase and the release phase, Thevenin equivalent: time constant=L/R_{th}, inductors in series and in parallel, steady state conditions, energy stored by an inductor. Magnetic variables & circuits: Flux, permeability and reluctance, magnetizing force, magnetic field strength, magnetic potential, flux density, magnetization curve, hysteresis, Ampere's circuital law, series, parallel and series-parallel magnetic circuits. DC circuit analysis using PSPICE.

Suggested Texts & References:

1. Robert L. Boylestad, "Introductory Circuit Analysis", Prentice-Hall.
2. Charles Alexander and Mathew Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill.
3. J. W. Nilsson and S. Riedel, "Electric Circuits", Prentice Hall.
4. W. H. Hayt, J. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", McGraw-Hill.
5. J. D. Irwin, "Basic Engineering Circuit Analysis", Wiley.

6. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", Wiley.
7. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", Wiley.
8. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", Wiley.

ETE 132 Introduction to Materials and Chemistry (Cr. 3)

This is an introductory course in materials science and physical chemistry. Topics include: fundamentals of atomic structure, quantum mechanical atom, Atomic spectrum of hydrogen and the Bohr model for electron orbits and energy levels, quantum numbers. Electronic configuration, periodic table, valence. the nature of bonding, valence shell electron pair repulsion theory for predicting molecular geometry, Sources of the Metallic Elements, Metallurgy Periodic table and period classification of elements with their properties, Transition elements and coordination chemistry, application of valence bond theory to coordination compounds, crystal structure and defects, the laws of chemical thermodynamics (including a discussion of enthalpy and entropy), reaction equilibrium, and phase equilibrium. Chemical formulas and equations, oxidation and reduction. Gas laws, ideal gas equation, kinetic theory of gases. Thermochemistry, chemical kinetics and chemical equilibria.These basic principles provide the foundation for an exploration of structure-property relationships in solids, metals, semiconductors, superconductors/ceramics, composites and polymers, States of matter, Thermochemistry , Different gas laws & kinetic theory of gases, stoichiometry, chemical equilibrium, environmental chemistry with emphasis on mechanical properties.

Atoms and aggregates of atoms, 16 classification of solids, crystal structure, . Fundamentals of crystal structure, the free-electron theory of metals and the band theory of solids which leads to the concepts of a semiconductor, carrier statistics, doping, and band structure. Applications of semiconductor materials important to electronic and photonic technologies. Outstanding properties of metals, electrical conduction in metals. Mobility and Conductivity, Matthiessen's rule, Wiedemann-Franz-Lorenz law, Hall Effect, Work function, electron emission. Magnetic properties of materials: Magnetic moment, magnetization and relative permittivity, different types of magnetic materials, origin of ferromagnetism and magnetic domains.

Suggested Texts & References:

1. D. Ebbing, "General Chemistry", Houghton Mifflin Co., London.
2. S.Z Haider, "Introduction to Modern Inorganic Chemistry", Friends International, Dhaka.
3. M. M. Haque and M. A. Nawab, "Physical Chemistry", Student Publications, Dhaka.
4. R. H. Morrison and R. N. Boyd, "Organic Chemistry", Prentice - Hall.

EEE 211 Electrical Circuits–II (Cr. 3)

AC circuits fundamentals: Sinusoidal ac voltage characteristics and definitions, sinusoidal waveform, phase relations, Average value, Effective (rms) values of voltage, power, instantaneous current, voltage and power. Phasors: rectangular form and polar form. Conversion between forms.Complex quantities: impedance, admittance, reactance, conductance, susceptance. Single phase ac circuits: Resistive circuit, inductive circuit, capacitive circuit. Series and parallel RL, RC and RLC circuits, phasor diagram, impedance and admittance diagram, vector diagram and string diagram. AC power: real, reactive and apparent power, power factor, power factor correction, the power triangle. Sinusoidal analysis: Nodal and mesh analysis in ac circuits. AC circuit theorems: Thevenin's, Norton's and Superposition theorems, maximum power transfer theorem.Transient analysis: RLC circuits, 2nd order transient. Resonance in ac circuits: Series and parallel resonance, resonant frequency

in series resonant circuit and in parallel resonant circuit, quality factor, bandwidth, selectivity. Passive filter circuits: Low-pass, High-pass, Band-pass and Band-stop filters, frequency response and Bode plot. Magnetically coupled circuits: mutual inductance, impedance matching, isolation and displacement, networks with magnetically coupled coils. Polyphase systems: three phase circuits, Y-connected source, Y-connected sourve with Y-connected load, wye-delta system, delta-connected source, delta-delta, delta-wye three phase systems, three-phase power calculation, unbalanced three phase four wire Y-connecetd load and unbalanced three phase three wire Y-connected load. AC circuit analysis using PSIM and MATLAB. (Prerequisite: EEE 131)

Suggested Texts & References:

1. Robert L. Boylestad, "Introductory Circuit Analysis", Prentice-Hall.
2. Charles Alexander and Mathew Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill.
3. Russell M Kerchner and George F Corcoran, “Alternating Current Circuits”, Toppan Printing Co. Ltd.
4. J. W. Nilsson and S. Riedel, "Electric Circuits", Prentice Hall.
5. J. D. Irwin, "Basic Engineering Circuit Analysis", Wiley.
6. R. C. Dorf and J. A. Svoboda, "Introduction to Electric Circuits", Wiley.
7. D. E. Johnson, J. R. Johnson, J. L. Hilburn and P. D. Scott, "Electric Circuit Analysis", Wiley.
8. R. E. Thomas and A. J. Rosa, "The Analysis and Design of Linear Circuits", Wiley.

EEE 211L Electrical Circuit Lab (Cr. 1)
Lab works based on EEE 131 & EEE 211.

ETE 221 Electronics–I (3 Cr.)
P-N Junction: Intrinsic and extrinsic semiconductors, doping, p-type and n-type semiconductors, majority and minority carriers, principle of p-n junction. Diode Circuits*:* P-N junction diode, barrier potential, breakdown voltage, current-voltage characteristics of a diode, simplified DC and AC diode models; application of diode circuits: half wave and full wave rectifiers, rectifiers with filter capacitor, Zener diode, avalanche and Zener breakdown, different clamping and clipping circuits. Other diodes: Schottky diode, tunnel diode, varactor diode, optical diode, PIN diode. Bipolar Junction Transistor (BJT): Construction and physical operation of BJT, BJT as a switch, BJT characteristics and regions of operation, biasing of BJT, study of load lines and Q point, BJT amplifier circuits: study of a common base, common emitter and common collector amplifier circuits, r-parameters and h-parameters; multistage transistor amplifier circuits ; Darlington pair, small signal analysis of BJT. Field-Effect-Transistor (FET): Construction and physical operation of JFET, pinch-off voltage and current-voltage relationship, JFET biasing circuits, FET Amplifier: CS, CD, and CG configurations. Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Structure and physical operation of MOSFET, threshold voltage, body effect, current-voltage characteristics, MOSFET as a switch, biasing of MOSFET, single–stage MOS amplifiers, MOSFET small signal model and analysis, different types of other MOSFET. Electronic circuit analysis using simulation software e.g. PSIM. (Prerequisite: EEE 131)

Suggested Texts & References:

1. Robert L. Boylestad, "Electronic Devices and Circuit Theory", Edition, Prentice-Hall.
2. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press.
3. Albert P. Malvino, Electronic Principles, Tata McGraw-Hill, New Delhi.

4. J. Millman and C. Halkias, Integrated Electronics, Tata-McGrewHill.
5. Thomas L. Floyd, Electronics Devices, Pearson Education Asia.
6. David A. Bell, "Electronic Devices and Circuits", Oxford University Press.

EEE 225 Energy Conversion Engineering (Cr. 3)

DC generator: Types, no-load voltage characteristics, emf equation, principle of DC generators, types of windings, winding table, build-up of a self excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation, armature reaction, losses and efficiency, parallel operation of Dc generators. DC motor: operating principle, classification, losses and efficiency, separately excited DC motor, permanent magnet DC motor, two and four-quadrant operation of DC motors; starting and speed regulation, Torque, counter emf, speed, torque-speed characteristics, speed control by converter and chopper, crane, traction and hoist application of DC motor, choice of DC motors for different applications. Transformer: single phase transformer, types of transformers, Ideal transformer- transformer ratio; actual transformer- working principle, construction and cooling, equivalent circuit, no-load and load vector diagrams, voltage regulation, short circuit and open circuit tests, losses and efficiency. Parallel operation; determination of transformer constants and polarity. Three phase operation of single-phase transformer; Open Delta and Scott connections, harmonics in polyphase transformers, induction voltage regulators; Autotransformers: three phase and single phase. Power transformers: bushing, cooling, tap changing and parallel operation. (Prerequisite: EEE 211)

Suggested Texts & References:

1. Charles I Hubert, "Electric Machines, Theory, Operation, Application, Adjustment and Control", Macmillan Publishing Company.
2. A.F. Puchstein, T.C. Lioyd, and A.G. Conrad, "Alternating-Current Machines", John wiley& sons.
3. A E Fitzgerald, Charles Kingsley, Stephen D Umans, "Electric Machinery", Mc-Graw-Hill Higher Education.
4. Stephen J Chapman, "Electrical Machinery and Power System Fundamentals", McGraw-Hill Higher Education.
5. Irving L. Kosow, "Electric Machinery and Transformers", Prentice- Hall.
6. Denis O'Kelly, "Performance and Control of Electrical Machines", Mc-Graw Hill Book Company.
7. K Karsai, D Kereny, L Kiss, "Studies in Electrical and Electronic Engineering, Large Power Transformers", Elsevier.

ETE 231 Signals and Systems (Cr. 3)

Classification of signals and systems: signal classification, basic operation on signals, elementary signals, representation of signals using impulse function, systems classification. Properties of Linear Time Invariant (LTI) systems: the convolution sum for discrete-systems, Convolution integral for continuous-time systems, properties of linear time-invariant systems, Impulse response, Frequency response, Systems described by differential equation, homogenous and particular solution and difference equations, linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems: Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response - convolution integral, determination of system properties; state variable - basic concept, state equation and time domain solution. Frequency domain analysis of LTI systems: Fourier series- properties, Gibbs phenomenon, Discrete-time Fourier series, Matrix representation, representation of periodic signals by

harmonic components, continuous and discrete-time filtering, sinusoidal steady-state response, harmonic representation, system response, frequency response of LTI systems; Fourier transformation- properties, system transfer function, system response and distortion-less systems. Applications of time and frequency domain analysis: solution of analog electrical and mechanical systems, decimation and interpolation. Zero-order hold and first-order hold, digital processing of continuous time signals, band-pass sampling. Laplace transformation: definition, properties, region of convergence, analysis of LTI systems, solution of differential equations, application of Laplace transform in network analysis, relation between Fourier transform & Laplace transform, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application. Stability of discrete-time systems. Modeling & analysis of signals and systems using MATLAB. (Prerequisite: MAT 221)

Suggested Texts & References:

1. A.V. Oppenheim and A. S. Willsky, "Signals and Systems", Prentice-Hall.
2. B. P. Lathi, "Linear Systems and Signals", 1st ed., Oxford University Press.

ETE 232 Digital Logic Design (Cr. 3)

Number systems Codes and Digital Arithmetic: Representation of different number systems, their conversion and mathematical operations. Different coding system- ASCII, BCD, gray and excess-3 code. Binary addition, subtraction, multiplication and division, Hexadecimal addition and subtraction, BCD addition, Logic System design: Different logic operations, logic gates and their truth tables, Boolean algebra, De Morgan's laws and its applications. Simplification and design of logic circuit using Boolean method and Karnaugh map method, Implementation of logic circuit using various logic gates, universal gates and alternative logic symbols, designing of parity circuit for error checking. Latch and Flip-flops: Introduction to latch and FFs, NAND and NOR latch, Types of flip-flops-SR, JK, Master slave, T and D type flip-flops and their characteristic tables, triggering of flip-flops; applications of flip-flop. Combinational logic circuit: Design procedure of full adder and parallel adder, 2's complement adder and subtractor, BCD adder. Design and analysis of different encoder, decoder, multiplexer, demultiplexer and code converter circuits. Counters and Registers**:** Classification of counters, Synchronous and asynchronous counter design and analysis, ring counter, Johnson counters, ripple counter and parallel counter with parallel load. Classification of registers-SISO, SIPO, PISO and PIPO registers and their applications. Digital IC logic families: Concepts of TTL, DTL, RTL, ECL, MOS and CMOS logic and their characteristics, operation and applications. Memory Units: Various memory devices and their operations, characteristics and operations of RAM, ROM, EPROM and EEPROM, Expanding memory size. Interfacing Device: Digital to Analog (D/A), Analog to Digital (A/D) converters and their applications. Digital circuit design and analysis using simulation software e.g. PSPICE or PSIM. (Prerequisite: ETE 221)

Suggested Text & References:

1. Ronald J. Tocci, Neal S. Widmer and Gregory L Moss, "Digital Systems: Principles and Applications", Pearson.
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill.
3. M. Morris Mano, "Digital Logic and Computer Design", Prentice Hall.

ETE 232L Digital Logic Design Lab (Cr. 1)

Lab works based on ETE 232

ETE 234 Electronics–II (Cr. 3)
Operational Amplifiers (Op-Amp): Properties of ideal OP-Amps, non-inverting and inverting amplifiers, integrators, differentiator, summer, subtractor, voltage follower and other applications of Op-Amp circuits, Differential and common mode amplifier, CMRR.
Comparator circuits: zero crossing detector, voltage level detector, Schmitt trigger, application of different comparator circuits. DC imperfections: input bias and offset current, offset voltage, null circuits, slew rate, drift, open loop & closed loop gain and frequency response of Op-Amps. Active Filters: Different types of active butter-worth filters and specifications, realization of first, second and third order low, high filters using Op-amps, wideband and narrowband active band-pass filters, notch filters, application of active filters. Feedback Amplifier: Different kinds of controlled circuits, properties of feedback, feedback amplifiers with different topologies, stability, PLL. Stability and Oscillators: Oscillator operation, Barkhausen criteria, signal generators, sinusoidal oscillators: phase shift oscillator, RC, LC oscillator, Wein-bridge oscillator, crystal oscillators. Relaxation oscillator: square wave generator, timer circuit design. Multivibrators: Astable, monostable and bi-stable multivibrators. Power Amplifiers: Untuned Class A, B,C, D, AB amplifiers, tuned class B and C amplifiers, push-pull amplifiers and their design, efficiency calculation of power amplifiers. (Prerequisite: ETE 221)

Suggested Texts & References:
1. Robert F. Coughlin and Robert S. Villanoucci, "Introductory Operational Amplifier and Linear Integrated Circuits", Prentice-Hall.
2. Albert P. Malvino, Electronic Principles, Tata-McGraw-Hill.
3. J. Millman and C. Halkias, Integrated Electronics, Tata-McGrewHill.
4. Robbert L. Boylestad, Electronics Devices and Circuit Theory, Prentice Hall.
5. David A. Bell, Electronic Devices and Circuits, Prentice Hall.

ETE 234L Electronics Lab (Cr. 1)
Lab works based on ETE 221 & ETE 234.

ETE 235L Circuits, Signals and Systems Simulation Lab (Cr. 1)
Simulation laboratory based on EEE 131, EEE 211, ETE 221 and ETE231 theory courses. Students will verify the theories and concepts learned in the above mentioned courses using simulation software like PSIM, PSpice, Matlab and Labview. Students will also perform specific design of electronic circuits theoretically and by simulation.

ETE 312 Communication Engineering Fundamentals (3 Cr.)
Introduction to communication systems: Basic principles, Fundamental elements, message source, bandwidth requirements, transmission media types. Information theory: Measurement of information, error free communication over noisy channel, channel capacity. Noise: External and internal noise, characteristics of various types of noise, noise calculation, signal to noise ratio and noise figure. Analog modulation and demodulation: Amplitude modulation (AM)—introduction, DSB-FC, DSB-SC, SSB, and VSB: spectral analysis of each type, envelope and synchronous detection; Angle modulation: Frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM; Transmitter & Receiver: AM and FM transmitters, super heterodyne radio receiver, performance parameters of a radio receiver. Sampling and Pulse Modulation: Sampling theorem, signal reconstruction, aliasing, natural and flat-top sampling, quantization, quantization noise, non-uniform quantization, signal to quantization error ratio; Pulse Amplitude Modulation (PAM), Pulse

Width Modulation (PWM), and Pulse Position Modulation (PPM); Pulse Code Modulation (PCM), differential PCM, delta modulation (DM), and Adaptive DM; μ -law and A-law companding. Binary Modulated Bandpass Signaling: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), differential PSK (DPSK), Frequency Shift Keying (FSK), Minimum Shift Keying (MSK) principle, bandwidth requirements, detection, noise performance; Principles of digital data transmission: Simple digital communication system, line coding, pulse shaping, scrambling, Error detection and correction schemes. Multiplexing: Frequency Division Multiplexing (FDM), FDM hierarchy, Time Division Multiplexing (TDM) and TDM digital hierarchy (T1 & E1 carrier system), Space division multiplexing, Code Division Multiplexing, Wavelength Division Multiplexing (WDM). Communication system design: design parameters, channel selection criteria and performance simulation. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. (Prerequisite: ETE 231)

Suggested Texts & References:

1. Jhon G. Proakis and MasoudSalehi, “Fundamentals of Communication Sytems”, Pearson.
2. S. Haykin, "Communication Systems", Wiley.
3. Taub and Schilling, "Principles of Communication Systems", McGraw-Hill.
4. G. Kennedy, "Electronic Communication Systems", McGraw-Hill.
5. B. Carlson, "A Communication Systems", McGraw-Hill.
6. Roody and Coolen, "Electronic Communication", Prentice Hall.

ETE 312L Communication Engineering Fundamentals Lab (1 Cr.)
Lab works based on ETE 312

ETE 313 Electromagnetic Fields and Waves (Cr. 3)
Brief review of scalar and vector fields, gradient, divergence and curl operators. Static electric fields: Basics of Maxwell's equations; electromagnetic waves and its propagation, Poynting vector, transmission of electromagnetic waves through wave guides. Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Postulates of electrostatics, the physical laws for discrete and continuously distributed charges, capacitance- electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries, Laplace and Poisson’s equations in different co-ordinate systems, electric boundary conditions. Steady electric current: Ohm's law, continuity equation, Joule's law, resistance calculation. Static Magnetic Fields: Postulates of magnetostatics and applications, Magnetic vector potential. Theoretical analysis of magnetic fields. Ampere’s Circuital law, Biot-Savart law, Faraday’s Law, magnetic dipole, magnetization, magnetic field intensity and relative permeability, magnetic energy, magnetic forces, torque, Inductance of different geometries and magnetic boundary conditions. Time varying electromagnetic fields and related theory: Electromagnetic induction, physical significance of equations supporting electromagnetic waves such as - differential and integral forms, boundary conditions, potential functions; time harmonic fields. Wave equations in source-free region, electromagnetic energy and vector, solution of uniform, time-harmonic plane wave motion, phase and group velocity. Wave impedance, polarization. Plane wave in loss less media-, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media- low-loss dielectrics, good conductors; instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization. (Prerequisite: MAT 213)

Suggested Texts and References:

1. Fawwaz T. Ulaby, "Electromagnetics for Engineers", Pearson Education, Inc.
2. William H. Hayt, Jr., Engineering Electromagnetics, Tata McGraw-Hill.
3. S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", Wiley.
4. David M. Pozar, Microwave Engineering,Wiley.
5. Joseph F. White, High Frequency Technique: An Introduction to RF and Microwave Engineering, Wiley.
6. Paul, R. Karmel, Introduction to Electromagnetic and Microwave Engineering, Wiley.
7. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall.
8. D.K. Cheng, 'Fields & Waves Electromagnetics', Prentice Hall.

ETE 314L Numerical Technique Lab (Cr. 1)
Laboratory on numerical techniques using computer solution of differentiation and integration problems, transcendental equations, linear and non-linear differential equations, nonlinear coupled equations, partial differential equations and Schrodinger equation as an example. (Prerequisite: MAT 213)

ETE 315L Electronic and Telecommunication Project Lab (Cr. 1)
Project based laboratory work on electronic and telecommunication topics. Students will design and implement projects, based on their learning on electronic and telecom courses. Students will also have to perform a final presentation on the project at the completion of the project work. (Prerequisite: ETE 234)

ETE 316 Microprocessor and Interfacing (Cr. 3)
Introduction to microprocessors. Intel 8086 microprocessor: Architecture, addressing modes, instruction sets, system design and interrupt. The programmer's model of a microprocessor: writing assembly language programs. The hardware model of a microprocessor: synchronous and asynchronous busses. Interfacing concepts: programmable peripheral interface, programmable timer, serial communication interface, programmable interrupt controller, keyboard and display interface, I/O Organization, address decoding, static and dynamic memory interfacing, direct memory access. Direct I/O for simple peripherals. I/O support devices: PIAs, ACIAS. Interrupt-driven I/O: interrupt vectors, interrupt handlers, DMA controllers. Standard microcomputer busses: VME, EISA, SCSI and others. Laboratory interfacing experiments using 8-bit and 16-bit hardware, assembly language software, real-time kernels and operating systems. (Prerequisite: ETE 232)

Suggested Texts & References:

1. M. Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", Prentice Hall.
2. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", Gloence McGraw Hill.
3. J. P. Hayes, "Computer Architecture and Organization", McGraw-Hill.
4. W. Stallings, "Computer Organization and Architecture", Prentice Hall.
5. D. A. Patterson, J. L. Hennessy, P. J. Ashenden J. R. Larus and D. J. Sorin, "Computer Organization and Design: The Hardware/Software Interface", Morgan Kauffmann.

ETE 316L Microprocessor and Interfacing Lab (Cr. 1)

Lab works based on ETE 316

ETE 321 Computer Networks (Cr. 3)
Introduction to computer networks, Uses of Computer Networks, network features criteria including physical structure, Basic Network components, line configuration, Network topology, transmission mode, Network Media, categories of networks- LAN, MAN, WAN, Internetworks. Protocols and standards, layered network architecture, Reference models: OSI reference model, TCP/IP reference model, their comparative study; ATM Reference Model, Functions of the Layers of different models, Network Protocols working at different layers. Physical layer concepts: Overview of data, signal, transmission& transmission, Transmission Impairments, Performance issues, Circuit Switching, packet switching and virtual circuit switching concepts, Virtual Circuit and Datagram, Circuit switching: time division & space division switch, TDM bus; Data Link Layer Design Issues, Framing: Character Count, Byte Stuffing, Bit Stuffing, flow control, flow control Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, High-level Data Link Control (HDLC). Point to point protocol, Error Control: Types of errors, error detection & correction methods: Cyclic Redundancy Check, Parity Bit Checking, and Hamming Code; The Medium Access Control Sub-layer, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Controlled Access; FDDI, token bus, token ring; Reservation, polling, concentration; MAC Layer Addressing. Network Hardware Components, Internet: brief history, internet today, Internet and TCP/IP; Switching and Internetworking devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; IP Addressing: Classful IP Addressing, Subnetmask, CIDR, Private IP Address, Public IP Address, Subnetting, VLSM etc; Routing: techniques, static vs. dynamic routing, routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Network Layer Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols. Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol. Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets. Traditional Ethernet, fast Ethernet. Quality of service: techniques to improve QoS; DNS, SMTP, SNMP, FTP, HTTP & WWW; Network Security: Cryptography, user authentication, security protocols in internet, Firewalls. Wireless LAN: IEEE 802.11; Introduction to blue-tooth & VLAN's. Overview of networking and communication software. (Prerequisite: ETE 312)

Suggested Texts & References:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH.
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI.
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng and Akhtar, Network for Computer Scientists & Engineers, OUP.
5. Black, Data & Computer Communication, PHI.
6. Miller, data Communication & Network, Vikas.

ETE 321L Computer Networks Lab (Cr. 1)
Lab work based on EEE 321

ETE 324 Digital Signal Processing (Cr. 3)
Discrete Fourier transforms: properties of DFT, linear convolution of sequences using DFT, computation of DFT. Fast Fourier transforms (FFT): Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT. Z-transforms: definition, region of

convergence, inversion, basic properties, solution of difference equations, relation of z-transform to discrete time Fourier transform, applications of Z-transforms, relation between Z-transform and DFS. Filter structure: Basic structures of FIR & IIR systems, direct & transposed forms, solution of difference equations of digital filters, block diagram representation of linear constant-coefficient difference equations. Design of IIR filter: Analog filter approximations – Butterworth and Chebyshev, design of IIR digital filters from analog filters, design examples: analog-digital transformations. Design of FIR filter: Characteristics of FIR Digital filters, frequency response, design of FIR digital filters using window techniques, frequency sampling technique, comparison of IIR & FIR filters. Power spectrum estimation and Implementation of DSP algorithm. Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion, multirate system and filter bank. Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, multiport memory, VLSI Architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5X- Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Registrar, Index Registrar, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On- chip registers, On-chip peripherals. Wavelet signal processing. Digital signal processing using MATLAB.
(Prerequisite: ETE 231)

Suggested Texts & References:

1. John G. Proakis, Dimitris G. Manolakis, and Dimitris Manolakis, *Digital Signal Processing*, Prentice Hall.
2. Vinay K. Ingle, and John G. Proakis, *Digital Signal Processing Using MATLAB*, Thomson, Bookware Companion Series.
3. P. P. Vaidyanathan, *Multirate Systems and Filter Banks*, Prentice Hall.
4. Alan V. Oppenheim, Ronald W. Schafer, "Digital Signal Processing" Prentice Hall.
5. Robert J. Schilling and Sandra L. Harris, "Fundamentals of Digital Signal Processing using Matlab", Thomson.
6. B. Venkataramani and M. Bhaskar "Digital Signal Processors – Architecture, Programming and Applications", TATA McGraw Hill.
7. Andreas Antoniou, "Digital Signal Processing", TATA McGraw Hill.
8. M H Hayes, "Digital Signal Processing", Schaum's Outlines, TATA Mc-Graw Hill.

ETE 324L Digital Signal Processing Lab (Cr. 1)

Lab works based on ETE 324.

ETE 334 Embedded Systems and Real Time Interfacing (Cr. 3)

This course focuses on the design of microcontroller based embedded systems. It includes embedded system concepts and microcontroller features. Microcontroller's architecture & assembly language programming, programming in C, system components, I/O interfacing in typical applications such as seven segment LED and LCD display, ADC, DAC and interfacing of different types of sensors. A lab accompanies the lecture where real life design concepts are investigated and implemented by PIC microcontrollers such temperature controller, digital ammeters, digital voltmeters, digital weight machine, DC motor controllers etc. (Prerequisite: ETE 316)

Suggested Texts & References:

1. Mazidi, Mckinlay, and Causey, 'PIC Microcontroller and Embedded Systems'.
2. C.M. Krishna & Kang G. Shan, 'Real-Time Systems'' McGraw Hill International.

ETE 413 Sensor and Instrumentation (Cr. 3)
Introduction: Applications, functional elements of a measurement system and classification of instruments. Measurement of electrical quantities: Current and voltage, power and energy measurement. Current and potential transformer. Transducers: mechanical, electrical and optical. Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque. Sensors in Drilling for Hydrocarbons. Basic elements of dc and ac signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization. Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation. (Prerequisite: ETE 234)

ETE 413L Sensor and Instrumentation Lab (Cr. 1)
Lab works based on ETE 413.

ETE 422 Ethics, Engineering Economics and Management (Cr. 3)
Engineering Ethics: Personal, organizational and corporate standards of behavior expected of professionals. Code of conduct and Ethics and their internal enforcement. Common practices, Occupational crime. Codes of. professional rights. Disciplinary codes. A Balanced Look at the Law; Preservation of integrity of the profession. Prevention of exploitation of client. Moral Issues, Moral dilemmas, moral autonomy; Engineer's responsibility for Safety and Risk. Assessment of Safety and Risk. Reducing Risk, Risk-Benefit Analysis. Confidentiality, Conflicts of Interest, Intellectual Property Rights (IPR), Plagiarism. Moral Leadership, Engineers as Managers, Employee Rights, Discrimination in the Workplace, Racism, Sexism. Consulting Engineers, Engineers as Expert Witnesses; Environmental Ethics, Computer Ethics. National Society of Professional Engineer's (NSPE) Ethical code. Industry-wide Standards.

Economics: Fundamental concepts in microeconomics and macroeconomics. Basic elements of consumer choice, demand and supply, product ion and cost, market structure. National income accounting, growth, unemployment and inflation, money and interest rate. Fiscal policy and monetary policy, economic growth and development, comparative advantage, foreign exchange and balance of payments, globalization.

Management: Meaning and importance of Management; Evolution of Management thoughts; Managerial decision making; Environmental impact Accounting treatment of price level changes; on management; Corporate social responsibility, Planning; Setting objectives; Implementing plans; Organizing; Organization design, Managing change; Directing; Motivation; Leadership; Managing work groups; Controlling: principles, process and problems and Managers in changing environment. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Martin, Wayne Vaught, & Robert C. Solomon Ethics Across the Professions, A Reader for Professional Ethics, Edited by Clancy. Oxford University Press
2. Donald G. Newnan, Engineering Economic Analysis, Oxford University Press
3. Charles E. Harris, Michael S. Pritchard, Engineering Ethics: Concepts and Cases, Cengage Learning
4. Arnold, R.A, Economics, Thomson South-Western.
   Boys, W. and Melvin, Michael: Fundamentals of Economics, Houghton Mifflin Company.

Concentration (Compulsory) (Cr. 21)

ETE 323 Digital Communications (Cr. 3)
Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection, calculation of error probability of ASK, BPSK, BFSK, and QPSK. Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off. Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes; encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram, decoding using Viterbi algorithm. (Prerequisite: ETE 312)

ETE 323L Digital Communications Lab (Cr. 1)
Lab work based on ETE 323.

ETE 332 RF and Microwave Engineering (Cr. 3)
RF & Microwave Systems: Introduction to Radio Wave and Electromagnetic Spectrum. RF and Microwave Generators using semiconductor devices, and vacuum tube devices such as magnetron, klystron, gyrotron, TWT; Plane wave equations and their solutions. Microwave Tubes: Transit time effects. Velocity modulation, Klystron amplifier, multicavity Klystron amplifier, reflex Klystron oscillator, magnetron, test wave tube (TWT) amplifier, backward Wave Oscillator (BWO).Transmission line theory: High frequency transmission lines, coax, microstrip, stripline based transmission lines; Smith chart, impedance matching techniques and applications. Waveguides: Wave-guide components, cavity resonators, parallel plane, rectangular, coaxial wave-guides, antennas radiation patterns, waveguide junctions. Microwave circuit theory: S-parameters, ABCD matrices, equivalent circuits, and signal flow graphs; Passive Microwave devices: Power dividers, Directional couplers, Microwave tuners, Phase shifters, Filters; Passive microwave circuits and components: matching networks and microwave resonators; Active Microwave devices: Receiver, Detectors, Mixers, Filters, RF and Microwave amplifiers, and Oscillators; RF and Microwave antenna & propagation. Antennas: Antennas & radiation, Hertzian dipole, long antennas analysis, antenna arrays, introduction to antenna array design, rhombic & slot antenna, frequency independent and log-periodic antennas, V-antenna, introduction to microstrip antenna. Radar: Introduction, Operating Principle of Radar with Block Diagram, RADAR equation, LORAN, SONAR, ILS, GCA radar beacon, CW radar, TR, ATR tubes duplexer and application of radar. Radar Receivers, Radar Transmitting System, Radar Applications. (Prerequisite: ETE 312)

Suggested Texts & References:

1. David M. Pozar, Microwave Engineering, John Wiley & Sons, Inc.
2. Robert E Collin, Foundations of Microwave Engineering, IEEE Press.
3. Joseph F. White, High Frequency Techniques: An Introduction to RF and Microwave Engineering, Wiley-IEEE Press.
4. Devendra K. Misra, Radio-Frequency and Microwave Communication Circuits: Analysis and Design, Wiley-Interscience.

ETE 333 Telecommunication Networks and Switching Systems (Cr. 3)
Architecture, technology, operation, and application of telecommunication networks including digital telephony, access networks, fiber optic networks, Public switched data networks, FDDI and integrated services networks. ISDN: architecture, ISDN interfaces, ISDN services; DSL technology, Cable modem, SONET. Frame Relay, Asynchronous Transfer Mode (ATM), SONET/SDH and Switched Multimegabit Data Services; Protocol modeling and verification techniques; ATM LANs, Design and analysis of networks for voice, data, and video applications. Network design; functional grouping, reference points, protocol architecture, numbering, addressing, BISDN, DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service. Introduction to switching systems, elements of switching systems, Different types of switching, SPC and digital signaling and switching techniques, switching network configuration, design of switching centers, principles of cross bar switching. Telephone network organization, Practical signaling system switching network design, Subscriber loop systems, switching hierarchy and routing, transmission plan, Charging and numbering plans, Time and space switching, Combination switching. Introduction to signaling, Signaling techniques: signaling classifications, in channel signaling, common channel signaling, signaling system 7, component of SS7 network, SS7 protocol architecture. (Prerequisite: ETE321)

Suggested Texts & References:

1. Tele communication switching system and networks - ThyagarajanViswanath, PHI.
2. Advanced electronic communications systems - Wayne Tomasi, PHI.
3. Digital telephony - J. Bellamy, John Wiley.
4. Data Communications & Networks - Achyut. S.Godbole, TMH.
5. Data Communication & Networking - B.A. Forouzan, TMH.
6. Telecommunication switching, Traffic and Networks - J E Flood, Pearson Education.

ETE 335 Wireless Communications (Cr. 3)
Introduction: Trend of mobile wireless, standard bodies, spectrum allocation, spectrum efficiency considerations; cellular concept, evolution and fundamentals; Analog and digital cellular systems; Cellular Radio System and Capacity Enhancement: Cell design concept, Frequency reuse and its application for different types of cell design, co-channel interference and adjacent channel interference, cell splitting, sectoring and zone-cell concept. Mobile Radio Propagation: Propagation characteristics, large scale path loss, small scale path loss, models for radio propagation, Doppler effect, antenna at cell site and mobile antenna. Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, traffic and channel assignment. Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate. Diversity Techniques: Concept of diversity branch and signal paths, diversity types: time, frequency and spatial diversity, Alamouti space-time block coding; carrier to noise and carrier to interference ratio performance. GSM Architecture: GSM, specifications for cellular telephony, Difference between GSM and other types of Cellular Mobile Communication system, GSM Architecture, Functions of MSC, BSC, BTS and other functional blocks (subsystems and parts) of a GSM system, Situations and Techniques of Handover in GSM; GPRS and EDGE. Spread Spectrum Communications: Basic of spread spectrum communications, generation of pseudo noise sequences, properties of M-sequences, direct sequence spread spectrum, processing gain, jamming margin, frequency hopping spread spectrum. CDMA in mobile communication systems: Introduction, logical channels for forward and reverse links, basic transmitter and

receiver schemes in CDMA system, RAKE receiver, Joint Detection of CDMA signals, basic properties of a CDMA mobile system, description of IS-95 system, reverse link power control schemes. Multi-carrier communications: Orthogonal FDM (OFDM), OFDM transceivers. Special issues of OFDM - cyclic prefix, timing offset, frequency offset, synchronization, peak to average power ratio problem. Multiple antenna systems: Basic concept, Capacity of SISO, SIMO, MISO and MIMO systems, spatial multiplexing (SM) scheme, SM detection techniques, diversity combining techniques. Advanced Wireless Systems: W-CDMA, CDMA2000, HSPA, LTE, WiMax, 4G and beyond 4G wireless communication. (Prerequisite: ETE312)

Suggested Texts & References:

1. T. S. Rappaport, "Wireless Communications: Principles and Practice," Prentice Hall.
2. Vijay K. Garg, "Wireless Communications and Networking," Morgan Kaufmann (Elsevier)
3. William C. Y. Lee, "Wireless & Cellular Telecommunications," McGraw Hill.
4. Jochen Schiller, "Mobile Communications", Pearson Education
5. William Stallings, "Wireless Communications and Networks", Pearson Education.
6. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", Pearson Education.
7. UweHansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer.
8. C.K.Toh, "AdHoc Mobile Wireless Networks",Pearson Education.

ETE 335L Wireless Communications and Microwave Engineering Lab (Cr. 1)
Lab work based on ETE 332 and ETE 335.

ETE 411 Optical Fiber Communications (Cr. 3)
Overview of optical fiber communications, optical fibers: Geometrical-optics description, wave propagation, dispersion in single-mode fibers, dispersion induced limitations, fiber losses, nonlinear optical effects, fiber manufacturing; Optical transmitters: basic concepts, light-emitting diodes, semiconductor lasers, control of longitudinal modes, laser characteristics, transmitter design; optical receivers: basic concepts, common photodetectors, receiver design, receiver noise, receiver sensitivity, sensitivity degradation, receiver performance; Lightwave systems: system architecture, power budget and rise-time budget, long-haul systems, sources of power penalty, computer-aided design; optical amplifiers: Basic concept, SOA, Raman amplifiers, EDFA, system applications; Dispersion management; multichannel systems: WDM lightwave systems, WDM components, system performance issues; soliton and coherent lightwave systems, CO-OFDM; optical networks; introduction to simulation tools e.g. MATLAB and OptiSystem. (Prerequisite: ETE312)

Suggested Texts & References:

1. Govind P. Agrawal, Fiber-Optic Communication Systems, John Wiley & Sons, Inc.
2. Gerd Keiser, Optical Fiber Communications, McGraw-Hill.
3. John M. Senior, "Optical Fiber Communications - Principles and Practice, Prentice Hall.
4. Leonid Kazovsky, Optical Fiber Communication Systems, Artech House Publishers.
5. A. J. Rogers, Understanding Optical Fiber Communications, Artech House Publishers
6. Clifford Headley, GovindAgrawal, Raman Amplification in Fiber Optical Communication Systems, Academic Press.

7. Le Nguyen Binh, Optical Fiber Communications Systems: Theory and Practice with MATLAB and Simulink Models; CRC Press.
8. T. Okoshi, K. Kikuchi, Coherent Optical Fiber Communications, Springer.

ETE 411L Optical Fiber Communications Lab (Cr. 1)
Lab work based on ETE 411.

ETE 423 Network Operating System and Administration (Cr. 3)
Introduction to the basics of networking and operating systems. The operating systems include the Microsoft OS family, the UNIX/Linux operating system family, and IBM's operating system family. Topics include the evolution and overview of operating systems, operating system principles, interfaces (GUI, command line, and API), command processors and utilities, file systems, access control, processes, programming and scripting, user accounts and authentication.
Network performance issues. Network simulation and optimization. Network operations including Planning, configuration of server and client workstations, control and maintenance. Network administration, Network management, database and tools (analysis, data modeling, relational databases, logical design, normalization, user interfaces, query processing including SQL, database administration, security, and performance evaluation). Capacity planning. Network security and integrity. (Prerequisite: ETE 321)

Suggested Texts & References:
1 The Practice of System and Network Administration by Thomas A Limoncelli, Chritina J Hogan, and Strata R Chalup, Pearson Education.
2 Network Management Fundamentals, Alexander Clemm, Cisco Systems, Inc.
3 Network Design: Management and Technical Perspectives, Second Edition, Teresa C. Piliouras, Auerbach Publications.
4 U. D. Black, "Computer Networks: Protocols Standard and Interfaces", 5th ed., Prentice Hall, 1987.

ETE 497 Internship (Cr. 3)
Internship/industrial attachment will be in field of ETE under the guidance of a supervisor, and the duration will be at least one month. Student must submit a report within the time specified. (Prerequisites: Earned minimum 100 credits)

ETE 498 Senior Project (Cr. 6)
Senior project/Thesis will be in field of ETE, under the guidance of a supervisor, and the duration will be at least two semesters. Student must write report, and defend research before the examination committee. A minimum grade of C is required as the passing grade for this course. (Prerequisites: Earned minimum 100 credits)

Concentration (Optional)

Group A: Telecommunications

ETE 445 Antenna and Wave Propagation (Cr. 3)
Review of electromagnetic theory: Vector potential, Solution of wave equation, retarded case, Hertizian dipole. Antenna characteristics: Radiation pattern, Beam solid angle,

Directivity, Gain, Input impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture, Vector effective length, Antenna temperature.Wire antennas: Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication, Two-element Array, Uniform Array, Polynomial representation, Array with non-uniform Excitation-Binomial Array. Aperture Antennas: Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Slotantenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector,Corner Reflector, Common curved reflector shapes, Lens Antenna. Special Antennas: Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna-Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas. Antenna Measurements: Radiation Pattern measurement, Gain and DirectivityMeasurements, Anechoic Chamber measurement.Calculation of Great Circle Distance between any two points on earth, Ground Wave Propagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction, Wave propagation in complex Environments, Tropospheric Propagation, Tropospheric Scatter. Ionospheric propagation: Structure of ionosphere, Sky waves, skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects of earth's magnetic fields, Faraday rotation, Whistlers. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. E. C. Jordan and Balmain, Electromagnetic waves and Radiating Systems, Pearson Education / PHI.
2. A.R.Harish, M.Sachidanada, Antennas and Wave propagation, Oxford University Press.
3. John D. Kraus, Ronald J Marhefka and Ahmad S Khan, Antennas for all Applications, Tata McGraw-Hill Book Company.
4. G. S. N. Raju, Antenna Wave Propagation, Pearson Education.
5. Constantine A. Balanis, Antenna Theory Analysis and Design, John Wiley.
6. R. E. Collins, Antenna and Radio wave propagation, McGraw-Hill series.
7. W. L Stutzman and G. A. Thiele, Antenna analysis and design, John Wiley.

ETE 446 Satellite Communications (Cr. 3)

Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications. Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance. Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification. Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example. Intermodulation, Calculation of C/N. Satellite Switched TDMA Onboard processing, DAMA, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods. Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation

Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, Pearson Publications.
3. Satellite Communications : Design Principles – M. Richharia, BS Publications.
4. Satellite Communication - D.C Agarwal, Khanna Publications.
5. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI.
6. Satellite Communications – Dennis Roddy, McGraw Hill.

ETE 448 Cryptography and Network Security (Cr. 3)

OSI Security Architecture, Classical Encryption techniques, Cipher Principles, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Evaluation criteria for AES, AES Cipher, Triple DES, Placement of Encryption Function, Traffic Confidentiality. Key Management, Diffie-Hellman key Exchange, Elliptic Curve Architecture and Cryptography. Introduction to Number Theory, Confidentiality using Symmetric Encryption, Public Key Cryptography and RSA. Authentication requirements, Authentication functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm, Secure Hash Algorithm, RIPEMD, HMAC Digital Signatures, Authentication Protocols, Digital Signature Standard Authentication Applications: Kerberos, X.509 Authentication Service, Electronic Mail Security, PGP, S/MIME - IP Security, Web Security. Intrusion detection, password management, Viruses and related Threats, Virus Counter measures, Firewall Design Principles, Trusted Systems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Prentice Hall of India.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill.
3. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Pearson Education.

ETE 451 Telecommunication Policy and Management (Cr. 3)

The course provides students with a framework to analyze and interpret governmental policies on telecommunications at the local, state, national, and international levels. Review the history of telecommunication evolution in Bangladesh, the objectives of Bangladesh telecom policy and the concept and evolution of Universal Service. Factors that led to the privatization of BTTB, proliferation of Mobile Phone and WiMAX Operators Bangladesh Telecommunication Act. Current and evolving issues with Internet, VoIP and Broadband. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Houston H. Carr and Charles A. Snyder, 'The Management of Telecommunications', McGraw-Hill.
2. Gerald W. Brock, Harvar, 'Telecommunication Policy for the Information Age: From Monopoly to Competition' University Press.
3. Patricia Aufderheide and Guilford, 'Communications Policy and the Public Interest'.

4. The World Bank's "Telecommunications Regulation Handbook" (http://www.infodev.org/content/library/detail/842)

ETE 452 Internet and Web Technology (Cr. 3)
The Internet, Introduction to Creating Web Pages, web designing concepts, Hyper Text Transfer Protocol, Hypertext Markup Language (HTML), Server Side Includes (SSI), Cascading Style Sheets (CSS), Adding Advanced Content to Web Pages, Introducing Perl and CGI, Creating HTML Forms with Perl and CGI, Add Java Applets, Add JavaScript, Java Servelet, Java Server Pages (JSP), Publish Web Pages, JavaScript, Active Server Pages (ASP), Server Side Scripting with PHP. Development of Dynamic Web Pages using ASP/PHP/JSP with Back End Database (MS SQL Server/Access), XML; Wikis, Blogs, Web 2.0, Facebook, Tweeter, LinkedIn, and other Social networking software. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1 Zhang, Yanchun, Series Editor, Web Information Systems Engineering and Internet Technologies Book Series, Springer.
2 Aldo Bongio, Piero Fraternali, Marco Brambilla, Sara Comai, Maristella Matera, Designing Data-Intensive Web Applications, Morgan Kaufmann.
3 Joel Sklar, Principles of Web Design, Cengage Learning.
4 Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide to (X)HTML, StyleSheets, and Web Graphics, O'Reilly Media, Inc

ETE 460 Special Topics in Telecommunications (Cr. 3)
Special topics related to Telecommunications. (Prerequisite: Earned minimum 100 credits)

Group-B Electronics

ETE 461 Power Electronics and Drives (Cr. 3)
Power semiconductor devices: power diodes, power transistors, thyristors (GTOs), control characteristics of power devices, ideal characteristics, characteristics of practical devices, switch specifications. Power diodes: general purpose diode, fast recovery diode, Schottky diodes, silicon carbide diodes. Series connected diodes, parallel- connected diodes, diodes with RC and RL loads, diodes with LC and RLC loads. Power diode rectifiers: single-phase half wave rectifier, single phase full wave rectifier, single phase full wave rectifier with RL load, multiphase star rectifiers, three phase bridge rectifiers, three phase bridge rectifier with RL load, comparison of diode rectifiers. Power transistors: MOSFET - steady state characteristics, switching characteristics, MESFET, IGBTs, SITs. Power supplies: Single Phase and Three Phase Controlled rectifiers, Design of Trigger circuits, Switch mode regulators: Boost, Buck, Buck-Boost and Cuk regulators, AC voltage regulator, Power factor correction: Vienna rectifier.Inverters: Gate drives Circuits, Single-phase and three-phase inverter (180-degree conduction and 120-degree conduction). Voltage control of single-phase inverters: single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation, modified sinusoidal pulse width modulation, phase-displacement control. Voltage control of three-phase inverters: sinusoidal PWM, 60-degree PWM, third-harmonic PWM, Space vector modulation, comparison of PWM techniques. Voltage and current source inverters, Resonant pulse inverter, Series inverter, PWM inverter. Multilevel inverter. Motor speed control: DC motor drives, Induction and Synchronous motor drives, Switched reluctance and brushless motor drives, SCR motor speed controller. Industrial applications: Solid State Transformer

(SST), Induction heater. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Muhamed H. Rashid, "Power Electronics: Circuits, Devices and Application", Prentice Hall.
2. N. Mohan, T. M.Undeland, W. P.Robbins, "Power Electronics: Converters, Applications and Design", Wiley.
3. M. D.Singh, K. B. Khanchandani, "Power Electronics", McGraw-Hill.
4. B. K. Bose, "Modern Power Electronics", Prentice Hall.
5. Sen, "Power Electronics", McGraw-Hill.

ETE 462 Control Systems (Cr. 3)

Systems without feedback. The exponential Fourier series and negative frequency. Transient responses to the delta, step and ramp functions and their graphical interpretations. Electrical systems. First, second, and higher order. Under-damped, overdamped and critically damped R-L-C circuits. Multiple-loop circuits and solution to delta, step, and ramp inputs with series-parallel, node voltage and loop current methods. Op-amp circuits for PID controllers. Mechanical systems. Translational and rotational, with mass, springs and dampers. Mechanical systems with gear. Higher order with multiple degrees of freedom. Mechanical– electrical analogies. Alternative approaches and systems: Non-linear and chaotic systems, fuzzy systems and neural networks. Closed loop or feedback control systems. Block diagrams. Implementation with integrators. Poles, zeros, and stability. Signal flow graph and Mason's gain formula. Routh's criterion. Root locus. Second, third, and higher order systems. Break-in and break away points. Angles of asymptotes and real-axis intercept. P, PI, PD, and PID controller. Ziegler-Nichols method for determination of constants. Frequency analysis. Lead, lag, and lag-lead compensators and their Bode plots and polar plots. Gain margin and phase margins. Multivariable systems. State variables and equations for electrical and mechanical systems. Applications of eigenvalues, observability, and controllability. Linear control system design by state feedback. Programmable logic controllers. Construction, applications, ladder logic and programming. Simulation: Modeling and simulation using software e.g. MATLAB. (Prerequisite: Earned minimum 100 credits)

Suggested Texts and References:

1. Norman S Nise, "Control System Engineering", John Wiley & Sons.
2. K. Ogata, "Modern Control Engineering", Prentice Hall.
3. J. D'Azzo, C. Houpis, "Feedback Control System: Analysis and Synthesis", McGraw Hill.
4. G. E. Franklin, J. D. Powell, and A. Emami-Naeni, "Feedback Control of Dynamic Systems", Addison-Wesley.

ETE 463 Analog and Digital Integrated Circuits (Cr. 3)

Introduction: Introduction to analog design, passive and active loads and frequency limitation, CMOS circuit modeling: Large signal model, model parameters, second order model effects. Current Sink and Source, Current Mirror: Basic, cascode and active current mirror and current amplifiers. Differential Amplifier: single ended and differential operation, common mode response, differential pair with MOS loads, frequency response of differential pair and cascade stage. Noise: statistical characteristics of noise, types, representation in circuits, noise in single stage and differential amplifiers and noise bandwidth. Switch Capacitor Circuit: Sampling switches, switched capacitor amplifiers including unity gain buffer and noninverting amplifier; switched capacitor integrator, switched capacitor common mode feedback. Band-gap

references: Supply voltage independent biasing, temperature independent references, proportional to absolute temperature current generation and constant trans-conductance biasing. Nonlinearity and mismatch: Nonlinearity of Differential Circuits, Effects of negative feedback on nonlinearity, capacitor nonlinearity, reduction of noise by offset cancellation. Short channel effects and device models: scaling theory, short channel effect, velocity saturation, hot carrier effect, output impedance variation with drain source voltage. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Digital of analog CMOS Integrated Circuits; Behzad Razavi
2. Microelectronics, by Millman and Grabel; McGraw Hill.
3. Linear Integrated Circuits, by Coughlin and Driscott; Prentice Hall.
4. Linear Integrated Circuits, by Gaykward; Prentice Hall.

ETE 464 Nanotechnology (Cr. 3)

Introduction: The nanoscale dimension and paradigm,history and current practice; Nanoscale science and engineering principles, Overview of current industry applications. Fundamentals for nanotechnology: Self-assembly and overview of Complex Adaptive Systems (CAS), Nanomaterials in consumer markets; photonics, nano-opto, MEMS; Microarray, nano-bio applications; Computing technologies - present and future; Nano medicine. Carbon nanotube applications and MWNT; Fabricating carbon nanotubes and nano-wall structures; Key applications of CNT and MWNT. Overview and history of development: Industry applications - market size: Challenges and future development. Nanolithography; Thin film processes; MEMS and semiconductors; Physical limits to UV and x-ray. Metrology techniques; Imaging using SEM, SPM-AFM; Traditional surface and materials analysis techniques. Molecular manufacturing; Self-assembly and 'bottom-up' manufacturing; Current practice - applications in nano-bio; Drexler-Smalley debate - realistic projections. Polymer chemistry applications in nanotechnology; Organic molecules and supramolecular chemistry;

Liquid crystal and flexible flat panel display, surfaces / colloid chemistry; Role of surfaces in nanotechnology devices; colloid chemistry and particles in nanotechnology, thin film deposition processes; Plasma deposition / surface modification; applications in thin film deposition. Quantum devices : quantum dots; Quantum computing algorithms / quantum informatics, carbon fullerene and CNT waste. Materials science and processing; Nano-bio applications, bioinformatics; Quantum computing and informatics. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. A.K. Bandyopadhyay, " Nano Materials", New Age International Publishers.
2. Bharat Bhushan, "Handbook of Nanotechnology", Springer.
3. Mark Ratner and Daniel Ratner, "Nano Technology", Pearson Education.
4. Gregory Timp, "Nanotechnology", Springer.
5. Ahmed Busnaina, "Nanomanufacturing Handbook", CRC Press.

ETE 465 Biomedical Signal Processing (Cr. 3)

Biomedical signal fundamentals: Nature of biomedical signal and noise, types of biomedical signals, Frequency-Domain biosignal analysis, digitization of biosignals, types of noise present in biomedical environments, parameters of noise, examples of biomedical noisy signals. Digital Signal Processing of Biomedical Signals: Biomedical Signals & Systems, Transforms, Frequency Response & the Transfer Function, Sampling Biomedical Signals, Random Variables & Processes existing in biomedical systems, DSP Functions as related to Biomedical signal analysis, Signal Preconditioning and Acquisition, Filtering, Detection & Classification;

Spectrum Estimation, Parameter Estimation & Modeling, Filtering of Biomedical Signals, Detection and Classification of Biomedical Signals, Spectrum Estimation of Biomedical Signals, Classical Spectrum Estimation, Parameter Estimation for Biomedical Signals, Biomedical Array Signal Processing. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Rangaraj Rangayyan, " Biomedical Signal Analysis: A Case-Study Approach," Wiley InterScience.
2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley InterScience.
3. Sornmo & Laguna, "Bioelectrical Signal Processing in Cardiac & Neurological Applications," Elsevier.

ETE 466 VLSI Design (Cr. 3)

Introduction: Moore's Law, Top down design approach, Detailed MOS gate capacitance and MOS diffusion capacitance model, NMOS and CMOS inverter with different loads, Bi-CMOS circuits. Fabrication: NMOS and CMOS fabrication process CMOS circuit and Logic Design: Noise Margin, latch-up problems, Scaling of MOS circuits, Beta Ratio effect and physical design of simple & complex logic gates. CMOS circuit characteristics and performance estimation: Resistance, Capacitance, rise and fall times, delay, gate transistor sizing and power consumption, Pseudo, Dynamic, Domino logic; pass transistors, transmission gates, different types of transistor level circuit design using transmission gates.

Stick Diagram: Lambda based layout design Rules, CMOS circuit design process using stick diagram. CMOS Subsystem Design: Design of and ALU sub-system, adder, multipliers, registers, modeling of interconnect wires. Dynamic random access memory (DRAM), Static random access memory (SRAM), Full custom mask layout design using Microwind & DSCH2 software. Behavioral description and structural description, circuit design using HDL (Hardware description Language). VLSI Design Styles: Standard cell based design, full custom design, concepts and techniques for floor planning, placement, global routing and detailed routing. Introduction to Field programmable gate arrays (FPGA). Introduction to GaAs technology: Ultra-fast VLSI circuits and systems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Introduction to VLSI circuits and Systems, by J.P. Uyemura ; John-Wiley & Sons.
2. Basic VLSI Design, by Pucknell and Eshraghian ; Prentice Hall.
3. CMOS VLSI Design, by Weeste, Harris and Banerjee ; Pearson Education.

ETE 467 Optoelectronics (Cr. 3)

Optical properties in semiconductor: Direct and indirect band-gap materials, radiative and nonradiative recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency in radiation.

Properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation. Light emitting diode (LED): Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers. Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions. Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers. Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors. Solar cells: Solar energy and spectrum, silicon and Schottkey solar cells, solar

energy converters. Modulation of light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto-optic devices, introduction to integrated optics. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Optical Fiber Communication, by Senior; Prentice Hall.
2. Fiber-optic Communication Technology, by Mynbaev and Scheiner; Pearson Education.
3. Optical Fiber Communication, by Kaiser; McGraw Hill.
4. Fiber optical Communication, by Agarwal; Mcgraw Hill.

ETE 469 Robotics and Mechatronics (Cr. 3)

Robotic Mechanism - Classification - Drive Systems Robots - Co-ordinate system - Degrees of Freedom, Spatial Descriptions -Transformations Position and orientation. Description of Frames - Mapping involving frames - Transform equations. Kinematics of Manipulators, Link parameters, Link frame assignment and forward kinematics, Inverse manipulator, Velocities and static forces, Velocity transformation, Force control system. Interfacing computers to Robots RS 232 Interface, Hardware Handshaking, Software Handshaking, RS 232 communication. Machine Vision: Image Geometry, Coordinate Systems Sampling and Quantization. Image Definitions: Levels of Computation, Point Level, Local Level, Global level, Object Level, Binary Image Processing, Thresholding, Geometric properties Size Position Orientation Projections Binary Algorithms. Morphological Operators Basic Lighting Techniques. Optics - Lens Equation Image Resolution, Depth of Field View Volume Exposure Shading Image radiance Surface orientation Reflectance Map Shape from Processing Color constancy: Statistical methods of Texture analysis- Structural analysis of Ordered Texture Model based methods for Texture analysis Shape from Texture Depth stereo imaging Stereo matching Shape from X-Range Imaging Active Vision. Dynamic Vision Change Detection Segmentation using motion. Motion Correspondence Image flow. Segmentation using a moving camera. Tracking Shape from motion. Object recognition. System components. Complexity of Object Recognition. Object Representation. Feature Detection Recognition Strategies Verification. Principles, modeling, interfacing and signal conditioning of motion sensors and actuators; hardware-in-the-loop simulation and rapid prototyping of real-time closed-loop computer control of electromechanical systems; modeling, analysis and identification of discrete-time or samples-data dynamic systems; commonly used digital controller design methods; introduction to nonlinear effects and their compensation in mechatronic systems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. P.A.Jananki Raman, " Robotics and Image Processing " , Tata McGraw Hill.
2. Ramesh Jain, RangacharKasturi, Brian G.Schunck, Machine Vision, McGraw Hill International Edition.
3. K.S.Fu, R.C. Gonzalez, C.S.G.Lee," Robotics Control, Sensing, Vision, and Intelligence, McGraw-Hill Incs.
4. Michael C.Fairhurst, " Computer Vision for Robotic Systems- An Introduction , Prentice Hall Inc.
5. Mikell P. Groover, Mitchell Weiss, Roger N.Nagel, Nicholas G.Odrey
6. Industrial Robotics Technology, Programming and Applications, McGraw- Hill International Editions.
7. Awcock and R.Thomas, "Applied Image Processing ", McGraw Hill Inc.
8. Rembold, " Microsystem Technology and Micro Robotics " Springer Ferlog Publishers.

ETE 470 Biomedical Instrumentation (Cr. 3)

Biomedical Signal Transduction Principles: RTD and Thermister, Thermo emf Transducer-thermocouples; Noncontact type infrared thermometry; Optical pyrometer. Thermistor used for cardiac output measurement, nasal air flow measurement, Inductive and Capacitive Transducers, Piezoelectric Transducer. Patient monitoring systems: Review of physiology behind biomedical instrumentation, Different Types of Electrocardiograph Systems (ECG), Ambulatory monitoring Instruments. Measurement of heart rate, Blood pressure, Temperature, Respiration rate, Apnea detectors; Computerized patient monitoring system. Pulmonary Function Analyzers. Kidney Structure, Regulation of Water and Electrolyte Balance, Artificial Kidney, Dialysis System, Lithotripsy. Mechanism of Hearing, Sound Conduction System, Basic Audiometer; Pure tone audiometer; Audiometer system Bekesy; Evoked response Audiometer system, Hearing Aids Anatomy of Eye, Errors in Vision, ophthalmoscope, Tonometer, Perimeter. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Harry.N. Norton, 'Biomedical Sensors- Fundamentals and applications', William Andrew Publications.
2. Richard S.C. Cobbold, 'Transducers for Biomedical measurements', Krieger Publishing Company.
3. John G. Webster, 'Medical Instrumentation application and design',Wiley.
4. Geddes L.A and Baker L.E, 'Principles of Applied Biomedical Instrumentation', Wiley-Interscience.
5. E.A.H.Hall, 'Biosensors', (Prentice Hall, Advanced Reference Series, Engineering, New Jersey.
6. Tatsuo Togawa, Toshiyo Tamura, P. Ake Oberg, 'Biomedical Transducers and Instruments', CRC Press.
7. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', Tata McGraw Hill New.
8. S.K.Venkata Ram, 'Biomedical Electronics and Instrumentation', Galgotia Publication Pvt. Ltd. New Delhi.
9. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 'Biomedical Instrumentation and Measurements', Prentice-Hall India.

ETE 471 Electrical Properties of Materials (Cr. 3)

Brief review of the general properties of conductors: Resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminum, solderability, contact resistance, applications in the field of electrical engineering. Special electrical property of materials: Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications; High resistivity materials and their applications e.g., manganin, constantin; nichrome, mercury, platinum, carbon and tungsten, superconductors and their applications. Semi-conducting materials and insulating materials: General and electrical properties, thermal & chemical properties: heat resistance, classification according to permissible temperature rise, effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, thermal conductivity, insulating materials and their applications, plastics and thermo-plastic materials and their important properties and applications, mica and mica products, asbestos and asbestos products ceramic materials (porcelain and steatite), glass and glass products, cotton, silk, jute, paper (dry and impregnated), rubber, bitumen, mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation, enamels for winding wires, glass fiber sleeves. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. L. Solymar and D. Walsh, "Electrical Properties of Materials," Oxford University Press.
2. William F. Smith, Javad Hashemi, "Foundations of Materials Science and Engineering," McGraw-Hill.
3. S M Dhir, "Electronic Components and Materials," Tata Mc Graw Hill.

ETE 473 IC Fabrication Process Integration (Cr. 3)

Monolithic Fabrication Processes and Structures: Crystal growth and wafer preparation. Photolithographic process, pattern generation, pattern transfer, mask alignment, Photo mask fabrication. Diffusion:Mathematical model, constant source diffusion, limited source diffusion, two-step diffusion; diffusion Systems for Silicon, Boron, Phosphorous; Ion implantation. Epitaxy: Molecular Beam Epitaxy, Vapor-Phase Epitaxy, Liquid-Phase Epitaxy, Heteroepitaxy Ion Implantation: Penetration Range, Implantation Damage, Annealing, Ion Implantation Systems. Oxidation: Thermal Oxidation of Silicon, Anodic Oxidation, Plasma Processes Etching and Cleaning: Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching, Cleaning. Film Deposition: Evaporation, chemical vapor deposition (CVD), plasma CVD, Integrated circuit isolation: pn junction isolation, mesa isolation and oxide isolation. BJT based microcircuits, interconnection, contacts, Testing, bonding and packaging. Optimization of designs: cost, reliability, performance, and power dissipation, timing considerations, and clocking approaches, design of large system blocks. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. William C. Till, James T. Luxon, Integrated circuits: materials, devices, and fabrication, Prentice-Hall
2. D. Widmann, H. Mader, and H. Friedrich, Technology of Integrated Circuits, Springer
3. Charles F. Wojslaw, Integrated Circuits: Theory and Applications, Reston Publishing Company
4. Douglas J. Hamilton, William G. Howard, Basic Integrated Circuit Engineering, McGraw-Hill

ETE 475 Special Topics in Electronics (Cr. 3)

Special topics related to Electronics. (Prerequisite: Earned minimum 100 credits)

Group – C Computer and Software Engineering

CSE 476 Data Structures (3 Cr.)

Introduction to widely used and effective methods of data organization. Concepts and examples, elementary data objects, elementary data structures, arrays, lists, stacks, queues, graphs, trees, compound structures, data abstraction and primitive operations on these structures; memory management; sorting and searching; hash techniques; Introduction to the fundamental algorithms and data structures: recursion, backtrack search, lists, stacks, queues, trees, operation on sets, priority queues, graph dictionary. Introduction to the analysis of algorithms to process the basic structures. A brief introduction to database systems and the analysis of data structure performance and use in these systems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Jeffrey Kingston,"Algorithms and Data Structures: Design, Correctness, Analysis", Addison-Wesley.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman.,"Data Structures and Algorithms", Addison Wesley.

CSE 477 Algorithms (3 Cr.)

Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound; Basic search and traversal techniques; Topological sorting; Connected components, spanning trees, shortest paths; Flow algorithms; Approximation algorithms; Parallel algorithms; Algebraic simplification and transformations; Lower bound theory; NP-completeness, NP-hard and NP-complete problems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Donald E. Knuth,"Art of Computer Programming, Volume 1: Fundamental Algorithms ", Addison-Wesley Professional
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., “Data Structures and Algorithms”, Addison Wesley.

CSE 478 Object Oriented Programming (Cr. 3)

Objects and classes; Constructors and destructor; Abstract Data Structures, Function chaining; Friend functions; Function and operator overloading; Composition and Inheritance; Dynamic polymorphism using virtual functions; Exception handling; Template functions and classes; Standard Template Library; Programming Languages C++/ Java/ C#; Java is the language typically used to illustrate the concepts, but another suitable language may be substituted by the instructor. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Grady Booch, "Object Oriented analysis and Design", Addison-Wesley.

CSE 479 Database Management Systems (Cr. 3)

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications oOf the Database.Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers. Functional Dependency, Different anamolies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued dependencies, 4NF, 5NF, Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking. File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. ElmasriRamez and NovatheShamkant, Fundamentals of Database Systems, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System, McGraw-Hill.
4. Gray Jim and Reuter Address, Transaction Processing: Concepts and Techniques, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech.
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.
8. James Martin, "Principles of Database Management Systems",Prentice Hall.
9. RamezElmasri, ShamkantB.Navathe, Fundamentals of Database Systems, Addison Wesley Publishing Edition.
10. ArunK.Majumdar, Pritimay Bhattacharya, Database Management Systems, Tata McGraw Hill.

CSE 480 Computer Graphics and Multimedia (Cr. 3)

Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic Bspline curves, rational B-spline curves.Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.Light & color model; interpolative shading model; Texture;Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia.; Image, video and audio standards.Digital audio, MIDI, processing sound, sampling, compression, MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression.Types, techniques, key frame animation, utility, morphing.Virtual Reality concepts. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Foley, Vandam, Feiner, Hughes – 'Computer Graphics principle', Pearson Education.
3. D. F. Rogers, J. A. Adams, 'Mathematical Elements for Computer Graphics',TMH.
4. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics" – TMH
5. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – TMH.
6. Elsom Cook – "Principles of Interactive Multimedia" – McGraw Hill.
7. Buford J. K. – "Multimedia Systems" – Pearson Education.

8. Andleigh&Thakrar, Multimedia, PHI.
9. Hill, Computer Graphics using open GL, Pearson Education.

CSE 481 Software Engineering Concepts (Cr. 3)
Scopes of Software Engineering. Life cycle models for software development process. Exercise in analysis, design, implementation, testing and maintenance of large modular systems. Software process, project and product. Basic project management concepts. Configuration management. Verification and validation: Quality assurance. Software testing techniques and strategies; Object-oriented design, analysis and testing. Web-engineering and client-server architecture. The course focuses on team development any information system software. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:
1. SubhajitDatta, 'Software Engineering Concepts and Applications', Oxford University Press.
2. Software engineering concepts, Richard E. Fairley, Tata-McGraw-Hill.
3. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of software engineering
4. Allen Macro, Software engineering: concepts and management, Prentice Hall.

CSE 482 Software Project Management (Cr. 3)
Overview of Project Management. Project tracking and scheduling. Risk management and analysis. Cost estimation models. Project metrics. Function Point Estimation. Software quality assurance. Program verification and validation techniques Software testing techniques, black-box and white-box techniques. .Testing of various areas: unit, domain, path, equivalent class based portion, component, aggregation, system testing, requirement based testing, acceptance testing. Software reuse and maintenance; Industrial practices in software engineering. . ISO certification standards for software quality assurance;. Software capability maturity model and its impact. The course focuses on taking a group development project from beginning to end. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:
1. Andrew Stellman, Jennifer Greene, 'Applied software project management', O'Reilly Media, Inc.
2. Jalote, 'Software Project Management in Practice', Pearson Education.
3. Futrell, 'Quality Software Project Management', Pearson Education.

CSE 483 Software Testing and Reliability (Cr. 3)
Software quality assurance (SQA), review of SQA practices, quality management, the role of SQA, the SQA program planning, launching and management, independent verification and validation; software inspections, basic principles, reviews, reporting and tracking, managing inspections and reviews; principles of software testing, testing types, test planning, development, execution and reporting; real-time testing and test organization; basic concepts of reliability, modeling software reliability from test results, techniques for analyzing, predicting, designing, and engineering the required and expected reliability of software systems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:
1. Hoang Pham, Software Testing and Reliability, Wiley-IEEE Computer Society Press.
2. Ann Marie Neufelder, Ensuring Software Reliability, Marcel Dekker Incorporated (now Taylor Francis Publishing).

3. A.P. Mathur, Foundations of Software Testing.
4. G.J. Myers, T. Badgett, T.M. Thomas, and C. Sandler, The Art of Software Testing.
C. Kaner, J. Bach, and B. Pettichord, Lessons Learned in Software Testing.
5. W. Perry, Effective Methods for Software Testing.
6. R. A. Radice, High Quality Low Cost Software Inspections.
7. K.E. Wiegers, Peer Reviews in Software.

CSE 484 Intelligent System Engineering (Cr. 3)

Overview, Intelligent Systems: Evolution. How agent should act, Structure of intelligent agents, Environments. Solving problems by searching, Informed search methods, Game playing. A knowledge based agent, The wumpus world environment, Representation, Reasoning, Logic, Proportional logic, First order logic: Syntax and Semantics, Extensions and Notational variation, Using first order logic Properties of good and bad knowledge base, Knowledge engineering, General ontology. Interface rules involving quantifiers, Forward and backward chaining, Completeness Planning, Practical planning: Practical planners, Hierarchical decomposition, Conditional planning. Uncertainty, Representing knowledge in uncertain domain, The semantics of belief networks, Inference in belief networks. General model of learning agents, Inductive learning, learning decision trees, Learning in neural and belief networks: Introduction to neural networks, Perceptrons, Multilayer feed-forward network, Application of ANN, Reinforcement learning: Passive learning in a known environment, Generalization in reinforcement learning, Genetic algorithms. Communication as action, Types of communicating agents, A formal grammar for a subset of English. Introduction to expert system, Representing and using domain knowledge, Expert system shells, Explanation, Knowledge acquisition. Natural language processing, Perception, Robotics. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Struart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”.
2. George F.Luger, “Artificial Intelligence: Structures and Strategies for Complex
3. Problem Solving”, Pearson Education.
4. Nils J. Nillson, “Artificial Intelligence: A New Synthesis”, Harcourt Asia.
5. Elaine Rich and Kevin Knight, “Artificial Intelligence”, TMH.
6. Patrick Winston, “Artificial Intelligence”, Pearson Education.
7. Ivan Brakto, “Prolog Programming for Artificial Intelligence”, Pearson Education.
8. Ed. M. Sasikumar and Others, “Artificial Intelligence : Theory and Practice”.
9. Proceedings of the International Conference KBCS-2002, Vikas Publishing House.

CSE 485 Parallel and Distributed Computing (Cr. 3)

Architectures and Models of Computation:Shared and Distributed Memory Machines, PRAM Model. Interconnection Networks: Crossbar, Bus, Mesh, Tree, Butterfly and MINs, Hypercube, Shuffle Exchange, etc.; Evaluation based on Diameter, Bisection Bandwidth, Number of Edges, etc.;Embeddings: Mesh, Tree, Hypercube; Gray Codes; Flynn’s Taxonomy. Algorithms: Design Methodology and Analysis Techniques: Foster’s Design Methodology, Time Complexity (computation and communication complexities), Speedup, Efficiency, Cost Optimality, Amdahl’s Law, Brent’s Scheduling Principle; Simple PRAM Algorithms: Boolean Operations, Max Finding in O(1) time, Reduction, Prefix-Sum, etc; Basic Algorithms and Techniques:

i. Prime Numbers using Sieve Method; Monte Carlo Methods (e.g., Calculating Pi)
ii. Matrix Multiplication (Row and Column-based on a Ring Topology, and Block-based on a Mesh Topology - Cannon’s algorithm)

iii. Sorting (Odd-Even transposition, Merge sort, Bitonic Merging and Sorting, Hyper Quicksort, Parallel Sorting with Random Sampling, etc.)

Programming: Parallel/Distributed Programming Techniques and Issues: Partitioning, Load Balancing (Static/Dynamic), Synchronization, Task Scheduling, Message Overheads, Deadlocks (Detection/Avoidance); Shared-Memory Programming – Process/Thread-based Primitives for Fork, Locks, Barrier, etc; Message-Passing Programming: MPI/PVM-based Basic Communication Primitives for Send, Receive, Reduction, etc; Debugging, Profiling, and Performance Enhancements of Parallel and Distributed Programs. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Quinn, Michael J., Parallel Programming in C with MPI and OpenMP, McGraw-Hill.
2. Quinn, M., Parallel Computing: Theory and Practice, McGraw Hill.
3. V. Kumar, A. Grama, A. Gupta, and G. Karypis, *Introduction to Parallel Computing* , The Benjamin/Cummings Pub. Co.

CSE 486 Digital Image Processing (3 Cr.)

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, machband effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement. Image Restoration - degradation model, Unconstrained restoration - Lagrange multiplier and Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations. Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm**.**Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson.
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson.
3. Kenneth R. Castleman, Digital Image Processing, Pearson.
4. D, E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall.
5. William K. Pratt, Digital Image Processing, John Wiley.

CSE 487 Numerical Methods (3 Cr.)

Computer Solutions of Polynomial & Transcendental Equations: Introduction, Half-interval method, Method of Regula Falsi, Newton-Raphson and Bairstow's method. Solving Ordinary Differential Equations with Initial Conditions: Runge-Kutta method, Gill's coefficients. Matrix Algebra & Simultaneous Equations: Gauss-Jordan elimination method, matrix normalization, solving simultaneous equations by matrix inversion, Gauss-Seidel iterative method. Eigen values and vectors, polynomial interpolation, least squares curve fitting, Numerical integration, Monte Carlo method and random numbers, linear programming and optimization, Solving

boundary value problems, solving Laplace equation by finite difference method, finite difference equations and DSP problems. (Prerequisite: Earned minimum 100 credits)

Suggested Texts & References:

1. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, McGraw Hill Highr Education
2. Shan S Kuo, Computer Applications of Numerical Methods, Addison-Wesley Publishing
3. Won Young Yang, Wenwu Cao, Tae-Sang Chung, John Morris, Applied Numerical Methods Using MATLAB, John Willey & Sons
4. S R Otto and J P Denier, An Introduction to Programming and Numerical Methods in MATLAB, Springer

CSE 490 Special Topics in Computer & Software Engineering (3 Cr.)

Special topics related to Computer & Software Engineering. (Prerequisite: Earned minimum 100 credits)