CURRICULUM

OF

TELECOMMUNICATION

FOR

B.E/B.S
M.E/M.S

(Revised 2004)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

Prof. Dr. Altaf Ali G. Shaikh  Adviser (HRD)
Qazi Riaz Ahmad       Director Curriculum
Malik Ghulam Abbas   Deputy Director
Miss Ghayyur Fatima   Deputy Director
Mr. Tahir Ali Shah    Assistant Director
Mrs. Noshaba Awais    Assistant Director

Composed by Mr. Zulfqar Ali, HEC Islamabad
## CONTENTS

1. Introduction 6  
2. List of Core Courses for B.E/B.S 9-10  
3. List of Elective Courses for B.E/B.S 10-11  
4. List of General Education Courses for B.E/B.S. 11-12  
5. Vision of Curriculum 13  
6. Topical outlines of General Courses 14  
7. Topical outlines of Core Courses 19  
8. Topical outlines of Elective Courses 28  
9. List of Master level Courses 38  
10. Recommendations 39
PREFACE

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum of a subject, one can judge the state of intellectual development and the state of progress of a nation. The world has turned into a global village, new ideas and information are pouring in a constant stream. It is, therefore, imperative to update our curricula by introducing the recent developments in the relevant fields of knowledge.

In exercise of the powers conferred by Sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide Notification No.D773/76-JEA (Cur.), dated December 4, 1976, appointed Higher Education Commission as the Competent Authority to look after the Curriculum Revision work beyond Class XII at Bachelor level and onwards to all Degrees, Certificates and Diplomas awarded by Degree Colleges, Universities and other Institutions of higher education.

In pursuance of the above decisions and directives, the Commission is continually performing curriculum revision in collaboration with the Universities. According to the decision of the special meeting of Vice-Chancellors’ Committee, curriculum of a subject must be reviewed after every 3 years. For the purpose, various Committees are constituted at the national level comprising senior teachers nominated by the Universities. Teachers from local degree colleges and experts from user organizations, where required, are also included in these Committees.

The National Curriculum Revision Committee on Telecommunication in its meeting held in June 2004 at the HEC, Islamabad finalized the draft curriculum after due consideration of the comments and suggestions received from the Universities and Colleges where the subject under consideration is taught.

The Final draft prepared by the National Curriculum Revision Committee duly approved by the Competent Authority is being circulated for implementation by the Universities.

(PROF. DR. ALTAF ALI G. SHAIKH)
Adviser (HRD)

July 2004
CURRICULUM DEVELOPMENT

STAGE-I

STAGE-II

STAGE-III

STAGE-IV

CURRI. UNDER CONSIDERATION

CURRI. IN DRAFT STAGE

FINAL STAGE

FOLLOW UP STUDY

COLLECTION OF REC

APPRaisal of 1st DRAFT BY EXP. OF COL./UNIV

PREP. OF FINAL CURRI.

QUESTIONNAIRE

CONS. OF CRC.

FINALIZATION OF DRAFT BY CRC

INCORPORATION OF REC. OF V.C.C.

COMMENTS

PREP. OF DRAFT BY CRC

APPROVAL OF CURRI. BY V.C.C.

PRINTING OF CURRI.

REVIEW

IMP. OF CURRI.

BACK TO STAGE-I

ORIENTATION COURSES

Abbreviations Used:
CRC. Curriculum Revision Committee
VCC. Vice-Chancellor’s Committee
EXP. Experts
COL. Colleges
UNI. Universities
PREP. Preparation
REC. Recommendations
**INTRODUCTION**

The final meeting of National Curriculum Revision Committee was held from 08-10 June, 2004. The basic agenda was to finalize the curriculum of B.S (Telecommunication)/B.E (Telecommunication Engineering)/B.Sc. (Telecommunication Engineering) drafted in an earlier meeting held in January 2004. The meeting was inaugurated by Dr. Altaf Ali G. Shaikh, Adviser (HRD), HEC. The meeting started with recitation of verses from Holy Quran and introduction of the participants. The following attended the meeting:

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Abdul Karim Baloch</td>
<td>Convener</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professor, Department of Electronics &amp; Telecommunication, Mehran University of Engineering &amp; Technology, Jamshoro, Sindh</td>
</tr>
<tr>
<td>2</td>
<td>Prof. Dr. Tauseef-ur-Rehman</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professor and Head, Department of Telecommunication &amp; Computer Engineering, International Islamic University, Islamabad</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Noor M. Sheikh</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professor &amp; Dean, Faculty of Electrical Engineering, University of Engineering &amp; Technology, Lahore</td>
</tr>
<tr>
<td>4</td>
<td>Prof. Dr. Jamil Ahmed</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prof. (HEC Foreign Faculty Hiring Programme), Institute of Space Technology, Islamabad</td>
</tr>
<tr>
<td>5</td>
<td>Prof. Dr. Imdad Ali Ismaili</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professor, Institute of Information Technology, University of Sindh, Jamshoro</td>
</tr>
<tr>
<td>6</td>
<td>Mr. Muhammad Iqbal Khan</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Director, College of Engineering, PAF-Karachi Institute of Economics &amp; Technology, Korangi Creek, Karachi-75190</td>
</tr>
<tr>
<td>7</td>
<td>Dr. Syed Ismail Shah</td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centre for Advance Studies in Engineering, Sir Syed Memorial Building, 19 Attaturk Avenue, G-5/1, Islamabad</td>
</tr>
</tbody>
</table>
8. Dr. Abdul Qadir, Member
   Associate Professor,
   Department of Electrical Engineering,
   NED University of Engineering & Technology,
   University Road, Karachi

9. Prof. Dr. Ijaz Mujtaba Ghauri, Member
   Professor & Director,
   Centre of Advance Studies in Physics,
   Government College University,
   Church Road, Lahore

10. Prof. Akbar Rahmatullah, Member
    Visiting Professor, 66-A/4, Abid Majeed Road,
    Lahore Cantonment

11. Col. (Retd) Akhlaq Ahmed, Member
    Director, Institute of Engineering & Technology,
    604-Israr Plaza, Lane # 5 Main Peshawar Road,
    Near Chaur Chowk, Rawalpindi

12. Engr. Lt. Col. Saleem, Member
    Faculty of EE Department,
    Military College of Signals,
    National University of Science & Technology, Rawalpindi

13. Col. Raja Iqbal, Member
    Head, Department of Electrical Engineering,
    Military College of Signals,
    National University of Science & Technology, Rawalpindi Cantt.

14. Col. (Retd) Muhammad Anwar, Member
    Director Studies, 11EC, C/o Al-Mizan, 274,
    Peshawar Road, Rawalpindi

15. Maj. Muhammad Tariq Siddique, Member
    Military College of Signals, NUST, Humayun Road,
    Rawalpindi
16. Engr. Muhammad Yousif Shaikh, Member
Assistant Professor,
Department of Engineering & Technology,
Allama Iqbal Open University, Islamabad

17. Mr. Zaka-ul-Mustafa, Member
Demonstrator, Institute of Communication Technology,
PTCL, Plot # 19, H-9/1, Islamabad

18. Engr. Fazal Ahmed, Member
Assistant Professor, EE Department
National University of Sciences & Technology,
Military College of Signals, Humanyun Road, Rawalpindi

19. Engr. Amir Malik, Member
Asstt. Professor, Faculty of Engineering & Computer Science,
Muhammad Ali Jinnah University, Islamabad

20. Mr. Bilal Munir, Member
Assistant Prof.
Department of Electronic Engg.,
Balochistan University of Information Technology & Management Sciences,
Jinnah Town, Samungli Road,
Quetta

21. Engr. Shujaat Ali, Member
Lecturer/IT Cum Network Administrator,
Institute of Business & Management Science,
NWFP Agricultural University,
Peshawar

22. Dr. Muhammad Abdul Qadir, Secretary
Associate Professor,
Faculty of Engineering & Computer Science,
Muhammad Ali Jinnah University, Jinnah Avenue,
Blue Area, Islamabad

The Convener, Dr. A.K. Baloch, briefed on the previous proceedings for the members who were attending the meeting for the first time. He highlighted the scope and TOR for the Committee. The issues raised by few members related to the name of the degree were addressed. It was finally decided that the name of the degree will remain same i.e. Telecommunication Engineering, however
universities that are running the programme with the name of Electrical Engineering with specialization in Telecommunication Engineering, may get guidance from the recommended curriculum.

Two sub-committees were formed to refine/revise the previous recommendations for Core & Elective Courses and prepare their recommendations for the house to finalize.

Core Revision Committee was formulated to revise the first draft of the core courses and suggest any changes/addition/improvements which would be incorporated in the final draft after getting it approved from the house. The Committee comprises of:

a. Dr. Noor A. Sheikh (Convener)  
b. Dr. Jamil Ahmad  
c. Col. Akhlaq Ahmad  
d. Col. Raja Iqbal  
e. Prof. Akbar Rahmatullah  
f. Mr. Amir Malik

After a thorough discussion, the Core Revision Committee presented the list of core courses to the House. Again the whole House deliberated upon and after suggesting some changes approved the following courses:

**List of Core Courses for B.E/B.S**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Courses</th>
<th>Theory</th>
<th>Lab</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Circuit Analysis</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Electronic Devices</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Digital Electronics</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Electromagnetic Theory</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Signals and Systems</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Digital Signal Processing</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Analogue Communications</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>Digital Communications</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Wave Propagation &amp; Antenna Theory</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>Control Systems</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Telecommunication Systems</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>Telecom Transmission &amp; Switching Systems</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>Digital Logic Design</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>14.</td>
<td>Computer Programming</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
Elective Revision Committee was formulated to revise the first draft of the elective courses and suggest any changes/addition/improvements which would be incorporated in the final draft after getting it approved from the house. The committee comprises of:

a. Dr. Ismail Shah (Convener)
b. Dr. Ejaz Ghori
c. Dr. Abdul Qadir (NED)
d. Mr. Iqbal Khan
e. Dr. S.Tauseef-ur-Rehman
f. Dr. Imdad Ismaili
g. Maj. Tariq Siddique
h. Mr. Fazal Ahmad
i. Mr. Bilal Munir

After a thorough discussion, the Committee for elective courses proposed following courses for the undergraduate programme in Telecommunication. The list is not exhaustive and serves as general template only. The courses mentioned in the list are further subdivided into four major areas namely; Computer Sciences (CS), Communication (Com), Signal Processing (SP) and Support (Gen). Again the whole House deliberated upon and after suggesting some changes approved the following courses:

**List of Elective Courses for B.E/B.S**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of Courses</th>
<th>Theory (SCH)</th>
<th>Lab</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stochastic Processes</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Information Theory &amp; Coding</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Satellite Communications</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Microwave Engineering</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Selected Topics in Telecommunication</td>
<td>3 to 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Routing &amp; Switching Principles</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Network Security</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dr. S. Tauseef-ur-Rehman was delegated the task of preparing the course contents for General Education as well as for Mathematical courses. The house later on approved the course list, which is reproduced below and the details of these courses are attached in Appendix-A.

**List of General Education Courses for B.E/B.S**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Theory (SCH)</th>
<th>Laboratory (SCH)</th>
<th>Total (SCH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Calculus 1</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Calculus 2</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Complex Variable &amp; Transforms</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Linear Algebra &amp; Differential Equations</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Probability &amp; Random Variables</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Applied Physics</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Communication Skills</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Technical Report Writing</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>Pakistan Studies</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
Due to illness of Dr. Abdul Qadir, Dr. S. Tauseef-ur-Rehman was elected as Acting Secretary. The Convener outlined the tasks to the House and requested the sub-committees to prepare topical outlines for their respective groups. Again the committees deliberated upon extensively on their tasks and prepared the outlines.

The outlines prepared by the Core Courses Committee were discussed at length in the House and the changes, suggested and proposed by the House were duly incorporated. The same are attached in Appendix-B.

The outlines prepared by the Elective Courses Committee were discussed at length in the House and the changes, suggested and proposed by the House were duly incorporated. The same are attached in Appendix-C.

The Master Level programme in Telecommunication Engineering was discussed in detail. The House agreed that in order to have greater flexibility and keeping in view the different levels of expertise and facilities available at various universities/ institutes, only course titles will be provided for Master Level programme in Telecommunication Engineering. The selected course titles for a minimum of 30 SCH are attached as per Appendix-D.

The House prepared a list of recommendations for consideration by the educational institutions and HEC. The same is attached at Appendix-E.

Dr. Nazir A. Sangi, Dean, Faculty of Science, Allama Iqbal Open University thanked all the participants on behalf of HEC. Finally, the Convener expressed his vote of thanks to all the participants for sparing their valuable time and taking keen interest in this task of national importance.
Vision of Curriculum

Engineering and Applied Sciences play an important role in the overall development of a nation. It reflects the sense of national development and could be considered as a pride. A nation with an advanced engineering programme and facilities forms the backbone of industrial revolution and is an envy of other countries and is a role model for other nations to follow. Strength in engineering areas provides special leverage and clout, which is reflected in the political and foreign policies as well. In order to survive and be a role model for the whole Ummah, Pakistan needs to strengthen its base.

2. Recently a new paradigm shift is obvious in the policies of the government. Herein, a strong emphasis is being placed on all the disciplines with a special focus on engineering and applied sciences. This is a welcome change. However, to fully benefit from the generous policies offered by the government, we have to adopt a long-term and far-reaching policy. This requires a vision; a vision which is not only sufficient for today but is also valid for the next 10 years and so. It is imperative that such a vision is just not only based on tall claims but have adequate tangible figures that can form the basis of evaluation, and subsequent upgradation. This document is a step forward towards this direction.

3. Another focal point in such an exercise lies with the quality of the work force being produced. The proliferation of colleges offering Bachelor and Master degree programmes (related to different disciplines) has resulted in large variations in curricula, the critical shortage of qualified faculty and quality universities, the high cost of education, hindering growth and expansion of current universities and poor monitoring and accreditation mechanisms are the key reasons for the poor quality of manpower being produced.

Based on the facts delineated, the vision is:

“To produce telecommunication graduates of high standards and to meet the prevalent and future challenges in the field of telecommunication by providing significant contribution in theoretical foundations with quality of the methodology, analytical techniques and clarity of organization”
Topical Outlines: General Courses

Calculus I


Suggested Text:
Calculus by Thomas Finney
Calculus by H Anton

Calculus II


Suggested Text:
Calculus by GB Thomas R I Finney
Calculus by Swokowski, Olinick & Pence
Calculus by Edwards and Penny
Calculus by Howard Anton, 6th Edition

Complex Variable Transforms


Suggested Text:
Advance Engineering Mathematics by Erwin Kreyzig
Mathematical Methods by Dr S M Yousaf
Linear Algebra and Differential Equations


Suggested Text:
Linear Algebra by David C Lay

Probability & Random Variables

Suggested Text:
Probability and Statistics (Jay L Devore) 3rd Edition
Introduction to Probability and Statistics (J S Milton, J C Atnold)
Statistics for Business & Economics (McClave, Benson) 6th/7th Ed.
Probabilities, Random Variables, & Random Processes Michel O’Flynn.
Modern Elementary Statistics (Freund and Simon) 9th Edition
Introduction to Statistics (Ronald E Walpole)

Applied Physics
Review of Vector Motion, Position, Velocity, and Acceleration Vectors, Applications of Laws of Motion, Projectile Motion, Motion in Resistive Media, Rocket Motion, Motion of Charged Particles in Electrical and Magnetic Fields, Rotational Motion, Constant Angular Acceleration, Uniform Circular Motion, Torque, Linear and Angular Momentum and Their Conservation, System of Particles, Centre of Mass, Two-Body Collisions in Two-Dimensions, Moment of Inertia of Objects, Wave Motion, Mathematical Concepts of Simple and Damped Harmonic Motion, Analytical Treatments of Superposition of Waves, Concepts and Applications of Diffraction and Polarization of Light and Sound Waves, Thermo dynamical Concepts and Basics of Electrodynamics, Electric Charge, Coulomb’s Law, Electric Field and Intensity, Electric Potential, Capacitors and Charge Storage Concepts, Magnetism, Magnetic Fields, Faraday’s and Lenz’s Laws, Ampere’s Law and its Applications, Eddy Currents, Inductance, Induced Current and Their Applications (Transformers, Generators Etc.), Definitions of the Values of AC Signals (Average and RMS Values), Electric and Magnetic Circuits, Electric Current, Resistance, Ohm’s Law, Simple Resistive Circuits (Series and Parallel), Kirchoff Laws, Network Theorems (DC Analysis), RC and RL Circuits, Fundamentals of Semiconductor Physics, Band Theory, Semiconductors (Intrinsic and Extrinsic), PN Junction, PN- Junctions As A Rectifier,

Suggested Text:
University Physics by Freedman and Young (10th and higher editions),
College Physics by Resnick, Halliday and Krane (6th and higher edition)

Communication Skills

Suggested Text:
Business English by Vawdrey, Stoddard and Bell

Technical Report Writing


Suggested Text:
Research Method: Guidance for Postgraduates, Greenfield, T Arnold

Islamic Studies

Fazail-E-Quran, Surat Hujraat With Translation, Surat Al-Furgan (Ayat 63 60 77), Kitab and Sunnat, Importance of Sunnat, Twenty Selected Hadiths With Translation, Islam in the Light of Quran and Hadiths, Tauheed, Risalat, Aakhirat, Prayer (Salaat), Fasting (Soam), Zakaat, Hajj, Jihad, Seerat-un-Nabi, Study of Seerat-ul-Nabi, Makkah Life of Holy Prophet (Peace Be Upon Him), Birth, Hijrat and Methods of Teaching, Madina Life of Holy Prophet (Peace Be Upon Him), Fatah-e-Makkah and Hajjat-Ul-Wida.
Pakistan Studies


Suggested Text:
Zafar MD, Pakistan Studies

Engineering Economics


Suggested Text:
As Deemed Fit by the Faculty.

Engineering Management

Introduction to Principles of Management and Organizational Behaviour as They Apply To the Engineering Profession. Special Emphasis on Project Management, Team Building, Quality Leadership, and the Marketing of Technology. Group Exercises, Case Studies, Extensive Writing and Speaking Assignments.
Appendix-B

Topical Outlines: Core Courses

Circuit Analysis


Suggested Text:
Basic Engineering Circuit Analysis by J David Irwin

Pre-Requisites:
Calculus-I, Calculus-II

Electronic Devices


Suggested Text:
Electronic Devices by Floyd – 5th edition
Micro-electronics by Jacob Millman and Arvin Grabel

Pre-Requisites:
Applied Physics
Digital Electronics


Suggested Text:
Digital systems by Floyd
Electronic Circuits: Discrete and integrated by Schilling and Belove

Pre-Requisites:
Electronic Devices, Circuit Analysis

EM Theory


Suggested Text:
Electromagnetic Waves and Radiating systems by Edward C Jordan
Electromagnetics by John D Krans, McGraw-Hill

Pre-Requisites:
Calculus-II, Applied Physics

Signals and Systems

**Suggested Text:**
Signals and Systems by Oppenheim & Wilsky
Signals and System, Schaum Series

**Pre-Requisites:**
Complex Variable & Transforms

**Digital Signal Processing**


**Suggested Text:**
Discrete time Signal Processing by Oppenheim and R W Schafer
Fundamentals of Digital Signal Processing by Paul A Lynn

**Pre-Requisites:**
Signal and Systems, Linear Algebra

**Analogue Communications**


**Suggested Text:**
Modern Analogue and Digital Communication System by B P Lathi
Communication System by A B Carlson

**Pre-Requisites:**
Probability and Random Variables, Signal and Systems
Digital Communications


Suggested Text:
Digital Communication by Bernard Sklar
Principle of Communication System by Taub & Schilling
Communication System by A B Carlson

Pre-Requisites:
Analogue Communications, Digital Signal Processing

Transmission, Propagation and Antenna Theory


Suggested Text:
Telecommunication by Warren Hioki
ARRL Hand Book Antenna Design
Pre-Requisites:
EM Theory and Circuit Analysis

Control Systems


Suggested Text:
Modern Control System by Richard Dorf and Robert Bishop Addison Wesley
Control System Engineering by I J Nagrath & M Gopal
Control System Engineering & Design by S Thompson

Pre-Requisites:
Linear Algebra, Signals and Systems

Transmission & Switching Systems


Suggested Text:
Digital Telephony by Bellamy, John Wiley and Sons
Telecommunications Switching Principles by M T Hills
Telecommunication Switching Systems and Networks, by Thiagarajan Vishwanathan
Digital Switching Systems – System Reliability and Analysis by Syed R Ali

**Pre-Requisites:**
Analogue Communications, Digital Communications

**Telecommunication Systems**


**Suggested Text:**
Basic TV Circuits by Grob
Spread Spectrum System by David L Nicholson
Telecommunication Transmission Handbook

**Pre-Requisites:**
Analogue Communications, EM Theory and Transmission, Propagation & Antenna Theory

**Digital Logic Design**

Review of Boolean Algebra, Logic Gates (AND, OR, NOT Etc.), Sum of Products, Products of Sums, Minterm & Maxterms, K-Maps, QM Method, Flip Flops (RS, D, JK, T, Master-Slave, Flip-Flop), Adders (Half & Full) & Subtractor (Half & Full), Comparators, Combinational and Sequential Circuits, Encoders & Decoders, Multiplexers & Demultiplexers, Counters (Ripple Counters, MOD Counters Etc), Registers (Serial & Parallel Load), Memories (ROMS & RAMS), PLAs, State Transition Diagrams.

**Suggested Text:**
Digital Electronics and Microprocessor Technology by Dr B S Choudhry and Dr A K Baloch, Naseem Book Depot
Logic and Computer Design Fundamental by Morris Mano and Charles R Kime
Principles of Digital Design by Deniel D Ganski
Digital Logic Fundamental by R J Tocci
Digital Logic Design Fundamental by Norman Balabanian & Bradley Carlson
Verilog HDL – A Guide to Digital Design and Synthesis by Samir Planitkar
**Pre-Requisites:**
Digital Electronics

**Computer Programming**


**Suggested Text:**
C/C++ by Robert Lafore
Object Oriented Programming, C++ by Robert Lafore
C/C++ for Electronics and Telecommunication Engineers by J K Kella, Dr B S Chowdhry, A R Memon, Naseem Book Depot

**Data Structure & Algorithms**

Introduction, Linear Data Structure (Stack, Linked Lists & Queue), Non-Linear Data Structure, Binary Tree, B-Tree, B+ Tree, Binary Search, Quick & Selection Sort, Recursion, Graphs, Hash Structure, Heaps, Indices.

**Suggested Text:**
Data Structures and Algorithms (SAMS teach yourself) by Lafore, Sams Publishing, 1999
Fundamentals of Data Structures in C++ by Horowitz, Sahni, and Mehta, Computer Science Press, 1995
Data Structures in JAVA by Standish, Addison Wesley, 2000

**Pre-Requisites:**
Computer Programming
Data Communication & Networks


Suggested Text:
Data Communication by Driscol
Data Communication by W Stallings, Prentice Hall
Compupedia: The Art of Living with Computer by M K Kella, Dr B S Chowdhry, Dr. A Q K Rajput, A R Memon, Naseem Book Depot
Computer Networks by W Stallings, Prentice Hall
Computer Networks by A S Tanenbaum
ISDN and Broadband ISDN by W Stallings, Prentice Hall

Pre-Requisites:
Digital Communications

Mobile Communications

Evolution of Mobile Communications, Principles and Regulations (GSM Standards From ETSI, 3GPP Standards R-99), Technical Features of AMPS, GSM, GPRS, GERAN, UMTS, Systems and Protocol Architecture (e.g. IPv4 –
IPv6, UTRAN), Cellular Security and Cryptography (e.g. A8, A3, A5 Algorithms), Wireless Technologies and Engineering (Air Interface, Core Network), Emerging Wireless Communication Industry (National and International).

**Suggested Text:**
Mobile Communications by Jochess Schiller, 2nd Edition, Addison Wesley

**Pre-Requisites:**
Digital Communications

**Computer Architecture**


**Suggested Text:**
Microprocessor and Interfacing by Douglas V Hall
Micro Computer & Microprocessor System by M. Rafiquzzaman, Saunder College Publications
The 8086/8088 Microprocessor by W A Triebel & A Singh

**Pre-Requisites:**
Digital Logic Design
Topical Outlines: Elective Courses

Stochastic Processes


Suggested Text:
Probability and Random Processes for Engineers by Leon Garcia, 2nd Edition

Information Theory & Coding

Information as Measurable Quantity, Information Contents of A Message, Average Information Per Symbol, Units of Information, Source Coding for Discrete Memoryless Channel, Information Transmission On Discrete Channel, Discrete Channel Capacity, Shannon Harley Theorem, Huffman Coding, Error Correcting Codes.

Suggested Text:
Digital Communication by Simon Haykins
Information Theory by Thomas & Cover

Satellite Communication


Suggested Text:
Mobile Communication Satellite by Tom Logsdon
Global System for Mobile Communications System by Joachim Tisat
Selected Topics in Telecommunication

Subject To The Topic as Devised by The Instructor.

**Suggested Text:**
Subject To The Topic as Devised by The Instructor

Network Security


**Suggested Text:**
Applied Cryptography by Bruce Scheneir

Radar Systems


**Suggested Text:**
Introduction To Radar Systems 3rd Edition, by Merrill I Skolnik
Radar Handbook by Skolnik
Communication Systems 3rd Edition, by Carlson
Antennas and Radio wave Propagation by Collin
Digital Communications by Proakis
Introduction To Random Signals and Noise by Davenport and Root
**Advance Filter Theory**

Importance of Filters, Historical Perspective, Types of Filters, Filter Parameters, Roll off, Electronically Tunable Devices, Operational Amplifier (OA), Operational Transconductance Amplifier (OTA), OA and OTA Based Active Filters, Bilinear Transfer Functions, Simulation of Negative Circuit Elements Using Otas, Direct and Cascade Form Synthesis Approaches, Inductance Simulation Approach, Frequency Dependent Negative Resistance Approach, Phase Shaping Using All Pass Design, Different Responses (Butterworth, Chebychev, Inverse Chebychev), Equiripple Characteristics, Biquads, Design Parameters $\omega_0$ and $Q$, Gain Constant Adjustments, Sallen-Key Circuit, RC-CR Transformation, Universal Filters, Switched Capacitor Filters, Switching Techniques, Time Delay Transfer Functions, Bessel Thompson Filters & Their Response, Sensitivity, Sensitivity Function, Multiparameters Sensitivity, Bode Sensitivity, Sensitivity Analysis of Sallen-Key Filter.

**Suggested Text:**
- Analog Filter Design, by M V Van Valkenberg
- Analog Filter Theory & Design by Wye Kie Chen
- Handbook of Filter, Edited by W K Chen

**Compression Techniques**


**ASIC Design**

Physical Layouts (Stick Diagrams), CMOS (INVENTORS, and Their Theory) + (MOS Current Mode Leave MCML, Design Principles of CMOS, High Speed Techniques in CMOS, Small Projects in VHDL, Design Implementation on FPG, Development Environment of FPGAs.

**Suggested Text:**
- Digital Integrated Circuits by Brodersem and Choudrakasan

**Multimedia Systems**


**Suggested Text:**
- Multimedia Systems by J F Koegel and Buford, ACM Press
Parallel/Distributed Computing

Data Parallelism, Multi-Processor Architecture, Process Communication, Data Sharing, Synchronous Parallelism, Multi-Computer Architecture, Data Partitioning, Distributed Memory, Scheduling Parallel Program, Object Oriented Parallel Program, Deadlock Handling, Concurrency Control.

Suggested Text:
Introduction To Parallel Computing by Ted, G.Lewis, Hesham El-Rewani, Prentice Hall
The Art of Parallel Programming by Bruce P Lester, Prentice Hall

Advanced Computer Programming


Operating Systems


Suggested Text:
Modern Operating Systems by A S Tanenbaum, Prentice Hall.

Quality Control in Telecommunication Systems

Quality Control, Acceptance Sampling, Operating Characteristic Curve, Type of Sampling Schemes, Rectifying Schemes, Military Standard Plan Sampling Practical Problems, ISO 9000, Salient Features.

Suggested Text:
ISO Manual
**Telecom Traffic Engineering**


**Suggested Text:**
Principles of Telecommunication Traffic Engineering by Bear D Peter Peregrinus Ltd
Digital Telephony by Bellmany

**Engineering Materials**


**Suggested Text:**
Electronics by Grobe

**Telecommunication Protocols**

Review of HDLC Protocol Structure, LAPD (Terminal Adoption), Bearer Channel, Data Link Control, Network Layer (Call Control, Supplementary Services), ISDN Protocol Architecture & Connection, User Network Interface Configurations, SCCP, ISUP, TUP in CCS7, Frame Relay Congestion Control, ATM Protocols and Congestion Control.

**Suggested Text:**
Networking by Comer
Computer Networks by A S Tanenbaum, Prentice Hall

**Optical Fibre Communication**

Optical Beams and Resonators Including Ray Tracing, Gaussian Beam Propagation, Stable and Unstable Resonators, Classical Theory of Spontaneous and Stimulated Emission including Discussion of Homogeneous and

**Suggested Text:**  
Optical Fibre Communications by John Senior  
Optical Fibre Communications by Cruiser, Gerdkiser  
Opto Electronic by Wilson and Hawks  
Laser Electronics by Joseph T Verdeyen.

**Artificial Neural Network**


**Suggested Text:**  
Artificial Intelligence by E Rich, McGraw-Hill

**Digital Image Processing**


**Suggested Text:**  
Digital Image Processing by Gonzalez and Wood, Addition Wesley, 1993  
Computer Vision by Balard Brown  
Introduction To Computer Vision by Robert
Numerical Methods


Suggested Text:
Mathematical Methods by Dr S M Yusuf
Numerical Recipes by Oxford University
Advance Engineering Mathematics by Erwin Kreyszig
Numerical Methods by Prof Mumtaz

Measurement & Instrumentation


Suggested Text:
Electronic Instrumentation and Measurement Techniques by W D Cooper
Measurement Systems, Application and Design by Ernest O Doebrlin, McGraw-Hill Book Co
Sensors Principles and Applications by P Hauptmarn, Prentice Hall
Principles of Measurement Systems by John P Bentley, John Wiley and Sons Inc
Principles of Electronic Instrumentation and Measurement by Berlin Getz, Merrill Publishing Co

Electrical Machines

Magnetic Circuits, Transformers, Principles of Electromechanical Energy Conversion and Rotating Machines, Construction and Operation of Synchronous Generators and Motors, Induction Machines, Construction, Operation and
Performance of Different Types of DC Machines, Small Power AC Motors, Their Types and Applications, Introduction To Brushless DC Motors and Switched Reluctance Motors.

Suggested Text:
Fitzgerald, Kingsely and Umans, McGraw Hill
Electric Machines and Transformers by B S Guru and H R Hizirolu, Oxford University Press
Electrical Machines, Drives and Power Systems by Wieldy, John Wiley and Sons
Electrical Machines by M Yasine
Electrical Machines by Siskind

Microwave Engineering


Suggested Text:
Electronic Communication Systems by Kennedy, McGraw-Hill
Microwave Transistors, Amplifiers, Analysis and Design by Guillermo Gonzalez, Prentice Hall
Microwave Engineering by David M Pozar by John Wiley
Microwave Devices and Circuits by Leo, Prentice Hall
Foundations for Microwave Engineering by R E Collins, McGraw-Hill

Electronic Workshop

PCB Design and Fabrication, Fabricating Simple Electronic Circuit On Breadboard, Use of Software Tools for PCB Design, Fabricating A PCB (Drilling, Etching Etc.), assembling and Soldering Components On A PCB, Electronic Repair/Maintenance Lab Management Hazards and Safety, Electronic Instruments and Device Handling and Storage, Service Instruments and Tools

**Suggested Text:**
First Practical Book of Electronic Workshop by B S Chowdary and A A Ursani

**Engineering Management**


**Suggested Text:**
Reliability Handbook by W G Ireson, McGraw-Hill
PMBOK Handbook, Project Management Institute, 2001

**Telecommunication Policies & Regulations**


**Suggested Text:**
An Introduction To International Telecommunication Law by C H Kenndy and M V Paster, Artech House
International Telecommunication Handbook by R Frieden, Artech House
International Telecommunication Union Handbook of Standards
Network Management Systems


Suggested Text:
Understanding SNMP MIBs by David Perkins and Evan McGinnis, Prentice Hall PTR, 1997
SNMP, SNMPv2, and CMIP by William Stallings, Addison-Wesley, 1993
Appendix-D

List of Master Level Courses

Advanced Microprocessor Systems
Advanced Data Communication
Computer Vision
Advanced Neural Networks & Fuzzy Logic
Advanced Embedded Systems
Advanced Computer Networks
Parallel & Distributed Computing
Advanced Mobile & Wireless Communication
Modern Trends in Telecommunication and Information Super Highway
Advanced DSP & Filter Design
Human Computer Interaction
Relational Data Base & Management System
Advanced Signal Detection and Estimation
Advanced Network Security
Estimation Theory
Queueing Theory
Advanced Optical Fibre Communication
Advanced Satellite Communication
Advanced Microwave Systems
Information Theory & Coding
Selected Topics in Telecommunication
Statistical Communication
Advanced Digital Communication
Multitrate Systems, Filter Banks and Wavelets
Telecommunication Management Network (TMN)
Software Tools & Techniques in Telecommunication
Multi Protocols Layer Switching
Telecommunication Network Design
IP Based Systems
Mobile Ad hoc Networks
Telecom Policies, Standards and Regulations
Telecom Signalling and Intelligent Networks
Telecommunication Operating Systems
Advanced Telecommunication Switching Systems
RECOMMENDATIONS

1. The programme should not be counted with the number of courses rather it should be counted with the international norms of semester credit hours. If a course is being taught one hour per week for 16 weeks (excluding exam week) then it will be counted as one semester credit hour. In case of lab work, one semester credit hour means the course will be conducted in the laboratory for two hours per week for 16 weeks. Typically, a semester comprises 18 weeks with 16 weeks of study, one week preparations and one week for final examination. The programme should consist of at least 130 semester credit hours (sch) and has duration of 4 years. Individual universities may have more semester credit hours.

2. The minimum number of teaching weeks per academic year should be 32. An institution may have more than these.

3. The Practical/Lab work should comprise sufficient part of the total credit hours and in all the subjects of practical nature as proposed in the curriculum.

4. All the Universities/Institutions should make arrangements for practical training of their students in industrial organizations during summer vacation, especially in the Third Year/Final year.

5. The students should be evaluated during the session through tests, quizzes, assignments and case studies followed by a comprehensive examination at the end of the year/end of term/semester. The evaluation should be distributed uniformly over the complete semester.

6. A minimum of 75% attendance should be made compulsory for all years.

7. The Committee recommended that the title of the degree in Telecommunication should be B.S (Telecommunication)/B.Sc. (Telecommunication Engineering)/B.E (Telecommunication Engineering).

8. The programme should be measured from its semester credit hours instead of the duration in years. There are different systems e.g. semester system, term system, trimester system, annual system etc. The credit hours for these programs must be adjusted with reference to the semester system.

9. Efforts should be made to provide appropriate and latest equipment for the Laboratories of the teaching departments and the process should be continued so that latest/state of the art equipment is added replacing obsolete equipment. Special attention should be given to the provision of adequate funding for recurring expenditure to operate and maintain the Laboratory equipment.
10. Opportunities may be provided to the teachers of Universities for In-service training to update their knowledge in the advanced topics recently introduced in the proposed curriculum.

11. Lectures by subject experts may be facilitated by HEC.

12. University teachers may be provided proper incentives for encouraging them to write books/monographs in the field of their expertise.

13. The HEC may provide funds/facilities for the establishment of Departmental Libraries, which will stock books related to that particular subject. Special emphasis should be given to the provision of research journals. For this purpose the department should be provided with facilities to have E-mail, internet connection to major library services in Pakistan and abroad where they can have access to literature available in digital form. There should also be a national library, which should hold a comprehensive stock of books on the subjects and should serve as lending library for the departments.

14. Industrial training of engineering students is highly desirable and as such efforts should be made to provide training to all students. In order to create adequate training opportunities, the HEC may take up the matter with the Government of Pakistan to enforce legislation making it mandatory for industry to provide training to engineering students in proportion to their capital investment and/or number of engineers employed. For legislation purpose guidance may be obtained from the Apprenticeship Act 1984, and the practice in the neighbouring countries. The industrial training should be for senior students and preferably held during summer vacation, so that the academic activities are not disturbed.

15. Interaction between faculty members of the institutions must be facilitated and encouraged by HEC.

16. Curriculum development activity must be supported by HEC by providing on-line facilities to the interested members.