CURRICULUM

OF

TELECOMMUNICATION SYSTEMS

BS/MS

(Revised 2014)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

Prof. Dr. Mukhtar Ahmed  
Chairperson

Prof. Dr. M. Naeem Khalid  
Adviser (Academics)

Mr. Fida Hussain  
Director General (Acad)

Mr. Rizwan Shoukat  
Deputy Director (Curr)

Mr. Abid Wahab  
Assistant Director (Curr)

Mr. Riaz-ul-Haque  
Assistant Director (Curr)
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PREFACE

The curriculum, with varying definitions, is said to be a plan of the teaching-learning process that students of an academic programme are required to undergo. It includes objectives and learning outcomes, course contents, scheme of studies, teaching methodologies and methods of assessment of learning. Since knowledge in all disciplines and fields is expanding at a fast pace and new disciplines are also emerging; it is imperative that curricula be developed and revised accordingly.

University Grants Commission (UGC) was designated as the competent authority to develop, review and revise curricula beyond Class-XII vide Section 3, Sub-Section 2 (ii), Act of Parliament No. X of 1976 titled “Supervision of Curricula and Textbooks and Maintenance of Standard of Education”. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission (HEC) under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

In compliance with the above provisions, the Curriculum Division of HEC undertakes the revision of curricula after every three years through respective National Curriculum Revision Committees (NCRCs) which consist of eminent professors and researchers of relevant fields from public and private sector universities, R&D organizations, councils, industry and civil society by seeking nominations from their organizations.

In order to impart quality education which is at par with international standards, HEC NCRCs have developed unified templates as guidelines for the development and revision of curricula in the disciplines of Basic Sciences, Applied Sciences, Social Sciences, Agriculture and Engineering in 2007 and 2009.

It is hoped that this curriculum document, prepared by the respective NCRC’s, would serve the purpose of meeting our national, social and economic needs, and it would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards. The curriculum is also placed on the website of HEC (www.hec.gov.pk).

(Fida Hussain)
Director General (Academics)
CURRICULUM DEVELOPMENT PROCESS

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

IMPLE. 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 NCRC on Telecommunication Systems was held at HEC Regional Center, Peshawar from March 03 - 05, 2014 to finalize the draft curriculum of Telecommunication Systems at BS level. The first meeting on drafting the curriculum was held at the HEC Islamabad from September 02-04, 2013.

The meeting was attended by the following members:

1. **Prof. Dr. Muhammad Saleem Sheikh,**
   Professor of Physics & Telecommunication,
   Department of Electronics & Telecommunication,
   Preston University, Islamabad.
   **Convener**

2. **Dr. Rashid Hussain,**
   Associate Professor / Deputy Director,
   Faculty of Engineering Science and Technology,
   Department of Telecommunication Engineering,
   Hamdard University, Madinat-al-Hikmah,
   Muhammad Bin Qasim Avenue, Karachi.
   **Secretary/Member**

3. **Dr. Qadeer Hasan,**
   Principal Engineer,
   Department of Electrical Engineering,
   COMSATS Institute of Information Technology,
   Islamabad.
   **Member**

4. **Engr. Muhammad Nadeem Iqbal,**
   Associate Chairman,
   Department of Telecommunication Engineering,
   Sir Syed University of Engineering and Technology,
   University Road, Karachi.
   **Member**

5. **Dr. Irfan Ahmed,**
   Associate Professor,
   Department of Electronic,
   NED University of Engineering & Technology,
   Karachi.
   **Member**

6. **Dr. Shahbaz Khan,**
   Chairman,
   Department of Telecommunication Engineering,
   University of Engineering and Technology,
   Peshawar, Mardan Campus.
   **Member**

7. **Dr. Asfandyar Khan,**
   Assistant Professor,
   Chairman, Telecommunication Systems,
   Institute of Engineering & Computing Science (IECS),
   University of Science & Technology, Bannu.
   **Member**
Dr. Bilal Shams,
Assistant Professor,
Institute of Information Technology,
Kohat University of Science & Technology, Kohat.

The following members attended the preliminary meeting but unable to participate in the final meeting:

1. **Engr. Muhammad Afzal**  
   Associate Professor / Chairman,  
   Department of Electrical Engineering,  
   G.C. University, Faisalabad

2. **Dr. Faisal Karim Shaikh**  
   Associate Professor,  
   Department of Telecommunication Engineering,  
   Mehran University of Engg. & Technology, Jamshoro.

3. **Prof. Dr. Qamarul Islam,**  
   Professor & HOD,  
   Department of Electrical Engineering,  
   Institute of Space Technology, Islamabad.

4. **Dr. Imran Rashid,**  
   Assistant Professor,  
   Department of Electrical Engineering,  
   Military College of Signals (NUST), Humayun Road, Rawalpindi.

5. **Dr. Aftab Ahmed Memon,**  
   Professor & Chairman,  
   Department of Telecommunication Engineering,  
   Mehran University of Engg. & Technology, Jamshoro.

6. **Dr. Syed Husnain A. Naqvi,**  
   Assistant Professor,  
   Department of Computer Science,  
   International Islamic University, Islamabad.

The Committee worked on suggestions given by the members of the Committee and incorporated their suggestions, where necessary in the final draft of BS & MS (Telecommunication System). Latest books were readily added through use of HEC internet facility. The committee also visited Sarhad University of Science & Information Technology and the University of Engineering & Technology, Peshawar. During the visits the committee exchanged their views with the management and faculty members regarding the process of curriculum development and its intended implementation.
The Committee also discussed and finalized scheme of study for MS in Telecommunication Systems.

**Recommendations:**

The purpose of this curriculum is to provide a uniform guideline to universities and institutions in Pakistan while developing their curriculum with an effort to have uniformity of standards in their programs.

- It is suggested that the credit hours for the proposed program should remain within the limits of 124 – 136 for BS in Telecommunication Systems.

- Higher Education Commission should support the institutions for the development of laboratories for Telecommunication Systems.

- The committee recommends that the intended candidates for this program must have sufficient background in Physics and Mathematics to perform well.

Mr. Riaz-ul-Haque, Assistant Director Curriculum, HEC, thanked the Convener and all the members of the committee for sparing their precious time and for their quality contribution towards finalization of the preliminary draft curriculum in the discipline of Telecommunication Systems. The committee appreciated the efforts made by Mr. Riaz-ul-Haque, for his facilitation, coordination and cooperation.

The committee lauded the efforts by Mr. Zaheer Ahmed Awan, Director HEC RC Peshawar for providing excellent facilities and warm hospitality. The meeting ended with vote of thanks to and from the chair.
PROGRAMME MISSION STATEMENT

Programme Title: BS Telecommunication Systems
The program is designed in accordance with the HEC stipulated Semester credit hour requirement and also takes into consideration the Quality Assurance aspect in curriculum development.

Mission Statement
To produce quality professionals with abilities to manage and operate telecommunication systems

PROGRAMME GRADUATE SKILLS (PGS)
The graduate of this program will be equipped with the following skills to demonstrate an understanding of key technologies applicable within the main areas of Telecommunications:

(a) Basic knowledge of Telecommunications Public and private Network infrastructure, both land based and cellular in terms of architecture, operations, protocols and traffic planning.
(b) Basic knowledge of Telecommunications standards, standard setting bodies and regulations.
(c) Basic knowledge of support techniques, technologies and systems.
(d) Abilities to systematically evaluate situations to cope with change and provide optimal solutions for particular applications.
(e) Expertise in Telecommunication Business and market operations.
(f) Ability to work effectively in real world Telecommunications setting, demonstrating team work and leadership skills.
Curriculum Review Basis – Undergraduate Degrees

The curriculum for the undergraduate BS degree programme is based on the following considerations:

Duration

<table>
<thead>
<tr>
<th>Duration</th>
<th>Four (4) years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total duration:</td>
<td>Eight (8)</td>
</tr>
<tr>
<td>Total number of semesters:</td>
<td>Sixteen (16) – Eighteen (18)</td>
</tr>
<tr>
<td>Duration of a semester:</td>
<td>Sixteen (16) weeks of instruction</td>
</tr>
<tr>
<td>weeks</td>
<td>One (1) to two (2) weeks for examinations</td>
</tr>
</tbody>
</table>

Credit Hours

<table>
<thead>
<tr>
<th>Credit Hours</th>
<th>128 to 136</th>
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</thead>
<tbody>
<tr>
<td>Total number of credit hours</td>
<td></td>
</tr>
<tr>
<td>Contact hours:</td>
<td></td>
</tr>
<tr>
<td>One (1) contact hour per week for each credit hour of instruction</td>
<td></td>
</tr>
<tr>
<td>Three (3) contact hours per week for each credit hour of laboratory work</td>
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</tbody>
</table>

Course Load

<table>
<thead>
<tr>
<th>Course Load per Semester:</th>
<th>15-18 Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Courses per Semester:</td>
<td>4-6 (not more than 3 lab/practical courses)</td>
</tr>
</tbody>
</table>
CATEGORY-WISE FRAMEWORK
BS IN TELECOMMUNICATION SYSTEMS

Duration: 4 years
Number of semesters: 8
Number of weeks per semester: 16-18 (16 weeks for instruction and 2 weeks for examination)

Total number of Credit Hours (CH): 128 to 136
Number of Credit Hours (CH) per semester: 15-18

Contact hours:
One (1) contact hour per week for each credit hour of instruction
Three (3) contact hours per week for each credit hour of laboratory work

Category-based distribution of the courses:

Compulsory : 21.37%
General Education : 14.5%
Foundations : 25.19%
Major : 29.78%
Electives : 9.16%
## Category wise Framework for BS in Telecommunication Systems

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Title</th>
<th>LEC CH</th>
<th>TOTAL CH</th>
<th>Pgs Of Each Course (Quality Check)</th>
<th>NCRC Proposal for Each Category</th>
<th>HEC Specifications for Each Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Courses</td>
<td>CH</td>
<td>%age</td>
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<td></td>
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<tr>
<td>Compulsory (by HEC)</td>
<td>Eng-I, English Composition and Comprehension</td>
<td>3 0 3</td>
<td>F</td>
<td>10</td>
<td>28</td>
<td>21.37%</td>
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<tr>
<td></td>
<td>Eng-II, Communication Skills</td>
<td>3 0 3</td>
<td>F</td>
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<tr>
<td></td>
<td>Islamic Studies/Ethics</td>
<td>2 0 2</td>
<td>F</td>
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<td></td>
<td>Pakistan Studies</td>
<td>2 0 2</td>
<td>F</td>
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<tr>
<td></td>
<td>Calculus I</td>
<td>3 0 3</td>
<td>C</td>
<td></td>
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<tr>
<td></td>
<td>Linear Algebra</td>
<td>3 0 3</td>
<td>C</td>
<td></td>
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<tr>
<td></td>
<td>Calculus II</td>
<td>3 0 3</td>
<td>C</td>
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<tr>
<td></td>
<td>Probability &amp; Statistics</td>
<td>3 0 3</td>
<td>C, D</td>
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<tr>
<td></td>
<td>Introduction to Computing</td>
<td>2 1 3</td>
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<td></td>
<td>Complex Variables and Transforms</td>
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<td>C, D</td>
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<tr>
<td>General Education</td>
<td>Applied Physics</td>
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<td></td>
<td>Object Oriented Programming</td>
<td>3 1 4</td>
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<td>Organizational Behavior</td>
<td>3 0 3</td>
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<tr>
<td></td>
<td>Introduction to Business and Marketing</td>
<td>3 0 3</td>
<td>E</td>
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<tr>
<td></td>
<td>Eng-III, Technical Report Writing</td>
<td>2 0 2</td>
<td>F</td>
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<td>Professional Ethics</td>
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<td>Foundation</td>
<td>Electric Circuits I</td>
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<tr>
<td></td>
<td>Electronic Devices &amp; Circuits</td>
<td>3 1 4</td>
<td>C</td>
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<tr>
<td></td>
<td>Digital Logic Design</td>
<td>3 1 4</td>
<td>C</td>
<td></td>
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<td></td>
<td>Signals and Systems</td>
<td>3 1 4</td>
<td>C</td>
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<tr>
<td></td>
<td>Microcontrollers &amp; Embedded Systems</td>
<td>3 1 4</td>
<td>A, C</td>
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<tr>
<td>Category</td>
<td>Course Title</td>
<td>LEC CH</td>
<td>TOTAL CH</td>
<td>Pgs Of Each Course (Quality Check)</td>
<td>NCRC Proposal for Each Category</td>
<td>HEC Specifications for Each Category</td>
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<td>Courses CH</td>
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<td>Courses CH</td>
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<tr>
<td>Data Communications and Networking</td>
<td>3 1 4 A, C</td>
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<tr>
<td>Telecommunication Systems</td>
<td>3 0 3 A</td>
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<td>Electric Circuit II</td>
<td>3 0 3 A, C</td>
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<tr>
<td>Electromagnetic Theory</td>
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<tr>
<td>Project Management</td>
<td>3 0 3 E, F</td>
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<tr>
<td>Analogue &amp; Digital Communications Systems</td>
<td>3 0/1 3/4 A, C</td>
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<tr>
<td>Antenna and Wave Propagation</td>
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<td>Telecommunication Policies and Regulations</td>
<td>3 0 3 B</td>
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<tr>
<td>Economics</td>
<td>3 0 3 D, E</td>
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<td>e-Business Management</td>
<td>3 0 3 D, E</td>
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<td>Wireless and Mobile Communications</td>
<td>3 0 3 A, C</td>
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<td>Optical Fiber Communication</td>
<td>3 0/1 3/4 A, B</td>
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<td>Telecom Network Management</td>
<td>3 0 3 A, B, E</td>
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<tr>
<td>Transmission and Switching Systems</td>
<td>3 0 3 A, D</td>
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<td>Information and Network Security</td>
<td>3 0 3 A,C</td>
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<td>Project Part-I</td>
<td>3 0 3 A, E, F</td>
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<td>Project Part-II</td>
<td>3 0 3 A, E, F</td>
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<tr>
<td>Technical Electives-I</td>
<td>3 0 3 All</td>
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<td>Technical Elective-II</td>
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<td>Technical Elective-III</td>
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<td>Technical Elective-IV</td>
<td>3 0 3 All</td>
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</tbody>
</table>

|                  | 13 | 39 | 29.78% | 13 | 42 | 31.58% |
|                  |    |    |        |    |    |        |

13
### AREA-WISE FRAMEWORK

**BS in Telecommunication Systems**

<table>
<thead>
<tr>
<th>Duration:</th>
<th>4 years</th>
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<tbody>
<tr>
<td>Number of semesters:</td>
<td>8</td>
</tr>
<tr>
<td>Number of weeks per semester:</td>
<td>16-18 (16 weeks for instruction and 2 weeks for examination)</td>
</tr>
</tbody>
</table>

- **Total number of Credit Hours (CH):** 128-136
- **Number of Credit Hours (CH):** 15-18

**Contact hours:** One (1) contact hour per week for each credit hour of instruction. Three (3) contact hours per week for each credit hour of laboratory work

**Area-based distribution of the courses:**

- **Humanities and Natural Sciences:** 25.95%
- **Management Sciences:** 16.04%
- **Technological Subjects and Project:** 58.01%
## Area-Wise Framework for BS in Telecommunication Systems

<table>
<thead>
<tr>
<th>Main Area Knowledge Area</th>
<th>Sub Area</th>
<th>Course Title</th>
<th>Lec CH</th>
<th>Lab CH</th>
<th>Total CH</th>
<th>Total CH of Sub-Area</th>
<th>Total CH of Main Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities and Natural Sciences</td>
<td>Humanities</td>
<td>English</td>
<td>3 0 3</td>
<td>3 8 12</td>
<td>34 (25.95 %)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Eng-I, English Composition and Comprehension</td>
<td></td>
<td>3 0 3</td>
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<tr>
<td></td>
<td></td>
<td>Eng-II, Communication Skills</td>
<td></td>
<td>2 0 2</td>
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<tr>
<td></td>
<td>Cultural &amp; Social Sciences</td>
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<tr>
<td></td>
<td>Islamic Studies/Ethics</td>
<td>2 0 2</td>
<td>3 7</td>
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<td></td>
<td>Pakistan Studies</td>
<td>2 0 2</td>
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<tr>
<td></td>
<td>Professional Ethics</td>
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<tr>
<td>Natural Sciences</td>
<td>Mathematics</td>
<td>Calculus I</td>
<td>3 0 3</td>
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<td></td>
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<td>Calculus II</td>
<td>3 0 3</td>
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<td></td>
<td></td>
<td>Linear Algebra</td>
<td>3 0 3</td>
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<td>Complex Variables and Transforms</td>
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<tr>
<td></td>
<td></td>
<td>Probability &amp; Statistics</td>
<td>3 0 3</td>
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List of Major-based Depth Electives

1. Ubiquitous Computing
2. Information Theory and Coding
3. Broadband Networks
4. Cyber Policies and Regulations
5. Software Define Radios
6. Mobile Operating Systems and Software Applications
7. Intelligent Networks
8. Tests & Measurements
9. Mobile and Pervasive Computing
10. Voice Over IP (VoIP)
11. Multimedia Networks
12. Satellite Communications
13. Broadcasting Systems
14. Reliability Assessment of Telecommunications Systems
DETAILS OF COMPULSORY COURSES

English Composition and Comprehension 3 + 0

Prerequisite: None

Course Outline:
a. Grammar
b. Writing
c. Reading/Comprehension
d. Speaking

Recommended Books:
a) Grammar

b) Writing

c) Reading/Comprehension

d) Speaking

Communication Skills 3 + 0

Prerequisite: None

Course Outline:

Paragraph writing
Practice in writing a good, unified and coherent paragraph

Essay writing
Introduction

CV and job application
Translation skills

Urdu to English

Study skills
Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

**Academic skills**
Letter / memo writing and minutes of the meeting, use of library and internet **recourses**

**Presentation skills**
Personality development (emphasis on content, style and pronunciation)

**Note**: documentaries to be shown for discussion and review

**Recommended Books:**

a) **Grammar**

b) **Writing**

c) **Reading**
2. Reading and Study Skills by John Langan

**Technical Report Writing 2+0**

**Prerequisite**: None

**Course Outline:**

**Presentation skills**

**Essay writing**
Descriptive, narrative, discursive, argumentative

**Academic writing**
How to write a proposal for research paper/term paper
How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

**Technical Report writing**

**Progress report writing**

*Note:* Extensive reading is required for vocabulary building

**Recommended Books:**

d) **Essay Writing and Academic Writing**  

e) **Presentation Skills**  
   Any available software

f) **Reading**  
1. The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

**Introduction to Computing**  

2+1  

*Prerequisite:* None

**Course Outline:**  
Introduction of basic components such as CPU, memory, peripheral devices, storage media and devices, physical and logical storage, data organization and file storage. Introduction to system software, and application software. Programming fundamentals, compilation and interpretation, problem specification, algorithms, flow chart, pseudo code, basic programming techniques, data types and declaration, header file and linkage, variables and constants, arrays, input/output, termination, remark, control structures, branching, conditional structures, repetition and loops, basic library functions.

**Lab Outline:**  
Consistent with the course outline.
Recommended Books:

Pakistan Studies  2 + 0

Prerequisite: None

Course Outline:

1. Historical Perspective
   b. Factors leading to Muslim Separatism
   c. People and Land
      i. Indus Civilization
      ii. Muslim advent
      iii. Location and Geo-Physical features.

2. Government and Politics in Pakistan

   Political and constitutional phases:
   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999 onward

3. Contemporary Pakistan

   Page 58 of 77
   1. Economic institutions and issues
   2. Society and social structure
   3. Ethnicity
   4. Foreign policy of Pakistan and challenges
   5. Futuristic outlook of Pakistan

Recommended Books:

Islamic Studies 2 + 0

Prerequisite: None

Course Objective:
This course is aimed:
1. To provide Basic information about Islamic Studies
2. To enhance understanding of the students regarding Islamic Civilization
3. To improve Students skill to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Outline:

UNIT NO. 1: INTRODUCTION TO QURANIC STUDIES
1. Basic Concepts of Quran
UNIT No. 2: STUDY OF SELECTED TEXT OF HOLLY QURAN
1. Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
2. Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18) Page 63 of 84
3. Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
4. Verses of Surah al-Furqan Related to Social Ethics (Verse No-63-77)
5. Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)

UNIT No. 3: STUDY OF SELECTED TEXT OF HOLY QURAN
1. Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6, 21, 40, 56, 57, 58.)
2. Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
3. Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14)

UNIT NO. 4: SEERAT OF HOLY PROPHET (S.A.W)-I
1. Life of Muhammad Bin Abdullah (Before Prophet Hood)
2. Life of Holy Prophet (S.A.W) in Makkah
3. Important Lessons Derived from the life of Holy Prophet in Makkah

UNIT NO. 5: SEERAT OF HOLY PROPHET (S.A.W)-II
1. Life of Holy Prophet (S.A.W) in Madina
2. Important Events of Life Holy Prophet in Madina
3. Important Lessons Derived from the life of Holy Prophet in Madina

UNIT NO. 6: INTRODUCTION TO SUNNAH
1. Basic Concepts of Hadith
2. History of Hadith
3. Kinds of Hadith
4. Uloom-ul-Hadith
5. Sunnah & Hadith
6. Legal Position of Sunnah

UNIT NO. 7: SELECTED STUDY FROM TEXT OF HADITH

UNIT NO. 8: INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE
1. Basic Concepts of Islamic Law & Jurisprudence
2. History & Importance of Islamic Law & Jurisprudence
3. Sources of Islamic Law & Jurisprudence
4. Nature of Differences in Islamic Law
5. Islam and Sectarianism

UNIT NO. 9: ISLAMIC CULTURE & CIVILIZATION
1. Basic Concepts of Islamic Culture & Civilization
2. Historical Development of Islamic Culture & Civilization
3. Characteristics of Islamic Culture & Civilization
4. Islamic Culture & Civilization and Contemporary Issues

UNIT NO. 10: ISLAM & SCIENCE
1. Basic Concepts of Islam & Science
2. Contributions of Muslims in the Development of Science
3. Quran & Science

UNIT NO. 11: ISLAMIC ECONOMIC SYSTEM
1. Basic Concepts of Islamic Economic System
2. Means of Distribution of wealth in Islamic Economics
3. Islamic Concept of Riba
4. Islamic Ways of Trade & Commerce

UNIT NO. 12: POLITICAL SYSTEM OF ISLAM
1. Basic Concepts of Islamic Political System
2. Islamic Concept of Sovereignty
3. Basic Institutions of Govt. in Islam

UNIT NO. 13: ISLAMIC HISTORY
1. Period of khlaft-e-rashida
2. Period of Ummayyads
3. Period of Abbasids

UNIT NO. 14: SOCIAL SYSTEM OF ISLAM
1. Basic concepts of social system of Islam
2. Elements of family
3. Ethical values of Islam

Recommended Books:
1. Hameed Ullah Muhammad, “Emergence of Islam”, IRI, Islamabad
2. Hameed Ullah Muhammad, “Muslim conduct of state”
3. Hameed Ullah Muhammad, “Introduction to Islam”
5. Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, international Islamic University, Islamabad (1993)
8. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

Mathematics

Calculus I 3 + 0
Prerequisite: None

Course Outline:
Introduction to functions, introduction to limit, derivatives and their applications, integral calculus with applications, vector algebra, vector calculus, introduction to analytical geometry, straight line in R3, planes, cylindrical and spherical coordinates, surfaces, cylinders and cones, spheres, spherical trigonometry.

Complex numbers, Demoivers theorem, analytic function, elementary function, complex integration and Cauchy's theorem, Taylor and Laurent series, conformal mapping, Fourier and Laplace transform.

Recommended Books:
1. Advance engineering mathematics by Erwin Kreysig

Calculus II 3+0
Prerequisite: Calculus I

Course Outline:

Recommended Books:
1. Advance engineering mathematics by Erwin Kreyszig

Complex Variables and Transforms  3 + 0
Prerequisites: Calculus II
Course Outline:

Recommended Book:

Linear Algebra  3 + 0
Prerequisite: Calculus I
Course Outline:
The course is divided into two somewhat related parts.
Linear algebra: matrices and matrix operations, Linear System equations, Gaussian elimination, matrix inverses, determinants, vector spaces and subspaces, dependence, dimension, eigenvalues, eigenvectors, diagonalization.

Recommended Books:
Probability & Statistics  3 + 0
Prerequisite: Calculus I

Course Outline:
1. Basic concept of probability, conditional probability, independent events, Baye’s formula.
2. Concept of random variables, discrete and continuous one and two dimensional random
3. Variables, probability distributions, marginal and joint distributions and density functions.
4. Important probability distributions (Binomial, Poisson, Uniform, Normal, Exponentials and Hyper-geometric). Mean, variance, moments and moment generating functions, linear regression and curve fitting. Central limit theorem, autocorrelation and cross-correlations, power spectral density functions and stochastic processes.

Recommended Books:

General Education

Organizational Behaviour  3 + 0
Prerequisite: None

Course Outline:
- Introduction to Organizational Behaviour
  o Organizational Disciplines and topics
  o Psychological Perspective
  o Social-Psychological Perspectives
- Structure and Control in Organization
  o Introduction
  o Bureaucracy
  o Managerial Work
  o Contingency theory
  o Organizational Design
- **Individual and Work Learning**
  - Learning Theories
  - Learning and Work

- **Stress**
  - Types of Stress and Work
  - Occupational Stress Management

- **Individual Differences**
  - Personality and its factors
  - Personality dimensions and social learning
  - Intelligence

- **Motivation and Job Satisfaction**
  - Needs at Work
  - Theories of Motivation and job satisfaction
  - Correlates of Job satisfaction
  - Correlates of Job satisfaction

- **Perception**

- **Communication**

- **Group and Work**
  - Social Interaction
  - Dramaturgy and impression Management
  - Social Skill

- **Group and Inter group Behavior**
  - Group Structure & Norms
  - Group Processes & Formation
  - How throne Studies

- **Leadership**
  - Leadership as an attribute
  - Leadership Style

- **Patterns of Work**
  - Work-the classical approach
  - Marx, Weber, & The critique of labor
  - Foucault & Disciplinary Power

- **Conflict and Consent in Work**
  - The labor Process debate
  - Work place control and resistance
  - Industrial conflict and industrial relations

- **Organizational culture**
  - Organizational culture and strategic management
  - Exploring organizational culture
Evaluating concept of culture

- **Human reliability**
- **Decision Making**
  - Decision making theories
  - Decision making models
- **Power and politics**
  - Types of power
  - Gender discrimination
  - Machiavellianism

**Recommended Books:**
6. Organizational behavior: An Introductory text by Buchanan & Huczynski

**Applied Physics** 3 + 1

**Prerequisite:** None

**Course Outline:**

**Work & Energy:**
Work done by a constant force, scalar product of two vectors, work done by a varying force, kinetic energy and work energy principle,

**Conservation of Energy:**
Conservative and non-conservative forces, potential energy, mechanical energy and its conservation, law of conservation energy, gravitational potential energy and escape velocity, power

**Oscillations & Waves**
Oscillation of a spring, simple harmonic motion, energy in the simple harmonic oscillator, simple harmonic motion related to uniform circular motion, the simple pendulum, damped harmonic motion and vibration resonance, characteristics of wave motion, waves types, energy transported by waves, wave equation, principle of super position, reflection, refraction, diffraction, and standing wave.
Sound waves and Acoustics:
Characteristics of sound, Mathematical Representation of Longitudinal waves, intensity of sound: Decibels, Sources of Sound: Vibration Strings and Air Columns, Quality of sound and Noise: superposition, Interference of Sound Waves: Beats, Doppler’s Effect, Shock Waves and Sonic Boom, Applications: Sonar, Ultrasonic and medical imaging

Lab Outline
From course contents.

Recommended Books:
2. Fundamentals of Physics [David Halliday, Robert Resnick, Jearl Walker],
3. Latest Edition

Introduction to Business & Marketing 3 + 0
Prerequisite: None

Course Outline:
Business
Introduction, Overview and scope of business, the Evolution and emergence of management thoughts, management functions, planning concepts, objectives, strategies and policies, decision making, staffing, principles of selection, performance and career planning, leading, motivation, leadership and communication, controlling the system and technique of controlling, management and society, future perspectives in business and management.

Marketing

Recommended Books:
3. Stephen Robins, Mary Coulter: Management
4. McFarland: Management: Foundation and practices
5. Robert M Fulmer: The New Management

**Object Oriented Programming**  
Prerequisite: Introduction to Computing

**Course Outline:**
This subject introduces students to object oriented programming concepts. Students will learn to build reusable objects, making use of encapsulation, polymorphism and inheritance in the object oriented programming language. Throughout the subject, the emphasis will be on using object oriented approaches to solving problems.

**Lab Outline:**
Consistent with the course outline

**Recommended Books:**

**FOUNDATION COURSES**

**Microcontrollers & Embedded Systems**  
Prerequisite: Digital Logic Design

**Course Outline:**
Introduction to Embedded Software and hardware, Meaning of Real-Time and Multitasking, application of embedded systems in telecommunication, data representation, C for embedded systems, a programmer’s view of computer organization, Mixing C and Assembly, Input output programming, Concurrent software, Scheduling, Memory Management, Shared memory, System Initialization, RISC and SISC micro-controllers, Micro-controllers interfacing.

**Recommended Books:**

Reference Books:

Electrical Circuits I 3 + 1
Prerequisite: None
Course Outline:
DC Circuits, KCL, KVL, Network Theorems, Mesh and Nodal Analysis, Step response and transients. RC, RL and RLC circuits,
Lab Outline
From course contents.
Recommended Books:

Electrical Circuits II 3+0
Prerequisite: Electrical Circuits I
Course Outline:
Sinusoidal, phasor, power, frequency, active passive filters, solution of AC circuits. Single and three phase AC circuits. Magnetic circuits.
Recommended Books:

Electronic Devices and Circuits 3 + 1
Prerequisite: Electrical Circuits I
Course Outline:
Diodes: reverse bias characteristics – Zeners and avalanche behavior
Diodes: rectification – ac to dc conversion, filtering, figures of merit
Diodes: I-V characteristics,
Diode circuits: clamps, doublers, Signals, conventions, amplification and biasing.
Power supply design, linear and switching regulators.
BJT: structure, I-V characteristics, BJT: large and small signal models, biasing and amplifier stages. Models: regions of operation, large/small signal equivalent circuits, biasing, small and large signal behavior, temperature behavior, special purpose.
FET, JFET structure biasing etc.
MOSFET devices: four terminal devices, I-V characteristics
MOSFET structure and relation to regions of operation, I-V equations, channel modulation, substrate bias and sub threshold behavior.
MOSFET biasing for amplification, as a current source, use of ‘active’ loads.
MOSFET inverters, complementary MOSFETs.
MOSFET small signal operation, SS models, equivalent models, amplifier, operational Amplifier and oscillators their application, structure, biasing using common source, Differential amplifier stage: configuration, biasing, SS models, extension to active

Lab Outline:
The emphasis is first on understanding the characteristics of basic circuits including resistors, capacitors, diodes, and bipolar and field effect transistors. The students then use this understanding to construct more complex circuits such as rectifier circuits and power supplies.

Recommended Books:
1. Principal of electronic devices by Floyd and Malvino

Data Communications and Networking 3 + 1

Prerequisite: None

Introduction

Introduction to Data Communications
The Internet communications model
OSI Reference Model
TCP/IP Protocol Architecture
Analog and Digital Transmission
Frequency Domain Concepts
Time Domain Concepts
Distinction between Data and Signals
Transmission Impairments

• Transmission Media
  o Guided Transmission Media
- Wireless Transmission
- Wireless Propagation
- Line of Sight Propagation
- **Signal Encoding**
  - Digital Data, Digital Signals
  - Digital Data, Analog Signals
- **Signal Encoding**
  - Analog Data, Digital Signals
  - Analog Data, Analog Signals
- **Digital Data Communication Techniques**
  - Synchronous Communication & Asynchronous Communication
  - Error Correction
  - Error Detection
- **Data Link Control**
  - Flow Control
  - Stop and Wait Flow Control
  - Error Control
  - Stop and Wait ARQ
  - Go-back N ARQ
- **Data Link Control**
  - Error Control
  - Selective Reject ARQ
  - High Level Data Link Control (HDLC) protocol
- **Multiplexing**
  - Frequency Division Multiplexing
  - Synchronous Time Division Multiplexing
  - Statistical Time Division Multiplexing
- **Circuit Switching**
  - Circuit Switching Concepts
  - Circuit Switching Networks
  - Control Signaling in Circuit Switching Networks
- **Packet Switching**
  - Packet Switching Principles
  - Datagram
  - Virtual Circuits
  - Packet Size
  - Comparison of Circuit Switching and Packet Switching
- **Routing in Switched Networks**
  - Routing in Circuit Switching Networks
Routing in Packet Switching Networks

- Local Area networks
- Topologies and Transmission Media
- LAN Protocol Architecture

Lab Outline:
From course contents

Recommended Books

Text book:
2. Reference Books:

Digital Logic Design  3 + 1
Prerequisite: Electronic Device and Circuits

Course Outline:
Introductory concepts, number systems, Logic gates and Boolean algebra, Combinational logic circuits, Flip Flops and related devices, Digital arithmetic circuits, counter and registers, MSI Logic circuits

Lab Outline:
Basic logic gates; hardware implementation of combinational circuits, hardware implementation of sequential circuits such as flip-flops, registers, shift registers, counters: MUX/DEMUX, encoder/decoder, arithmetic logic unit (ALU), implementation of logic circuits using SPLDs; project solving a real-life problem.

Recommended Books:
1. Digital design 3rd/ latest edition by M. Mano, publish by prentice hall

Signals and Systems  3 + 1
Prerequisite: Calculus I

Course Outline:

Recommended Books:

**Electromagnetic Theory** 3 + 0

**Prerequisite:** Applied Physics

**Course Outline:**

**Recommended Books:**

**Telecommunication Systems** 3 + 0

**Prerequisite:** None

**Course Outline:**
Comprehensive overview of the fundamental principles of telecommunications, including current status and future directions of the public switched telephone network, cellular networks, satellite networks, and computer networks. Recommended Books:

Telecommunications and Data Communications Handbook by Ray Horak Published by Wiley-Interscience 2007

**Transmission and Switching Systems** 3 + 0

**Prerequisite:** Telecommunication Systems

**Course Outline:**
Transmission systems overview including ISDN, PDH and SDH, EI and T1
Transmission systems, mapping of bits Transmission Systems including
PDH and SDH, Synchronization, routing techniques, Line Encoding
Techniques (HDB3, 2B1Q), Types of Switching Review of switching
technologies - Circuit, Message and Packet Switching,
Telecommunication Network (PSTN, PLMN), Exchanges Hierarchy,
Telecommunications Traffic characterization and models including
characterization of PABX and Public exchange traffic, GOS, BHCA,
Network Traffic Load and Parameters, Blocking Probabilities, Modeling
Switching Systems, Incoming Traffic and Service Time
Characterization, Blocking Models and Loss Estimates, Delay
Systems, Time and Space Switching, T-S-T and S-T-S Systems
and its variations, rationale and applications, Numbering Plans, Routing
Tables, Charging Plans, Call detail recording(CDR), numbering plans,
Classifications of Signaling Systems, Channel Associated Signaling
(CAS) and Common Channel Signaling (CCS) ITU's Common Channel
Signaling System # 7 (CCS7 Or SS7).

Recommended Books:
Digital Telephony by Bellamy published by Wiley Series

MAJOR COURSES

Analog & Digital Communications Systems  3 + 1
Prerequisite: Probability and Statistics, Signals and Systems

Course Outline:
The requirement for modulation, assignable frequency spectrum, block
diagrams showing transmission and reception of signals. Time – domain
and frequency – domain representation of AM Waves, Double side – band
(DSB), single side – band (SSB) and vestigial side band (VSB).
Applications of DSB, SSB & VSB. Demodulation. The time domain and
frequency domain representation of FM and PM waves, comparison of FM
and PM, generation of FM & PM, demodulation. Pulse amplitude
modulation, pulse width modulation, Pulse position modulation, pulse code
modulation (PCM), Differential PCM, Delta modulation. PSK, FSK, DPSK,
QAM.

Recommended Books:
Modern Digital and Analog Communications Systems International By B.
Bhagwandas Pannalal Lathi, Zhi Ding Published by Oxford University
Press

Wireless and Mobile Communication  3 + 0
Prerequisite: Analog and Digital Communication Systems
Course Outline:
Evolution of Wireless Communications, Wireless communications principles, Wireless standards and KPI’s, Outdoor propagation models, Fading channels, Overview of Fading channel models (Rayleigh, Ricean etc.). Fading channel characterization. The cellular concept, basic building blocks of cellular systems, handoffs, power control, traffic engineering. Digital modulation techniques, spread spectrum modulation (direct sequence and frequency hopping), orthogonal frequency-division multiplexing (OFDM). Mitigation Techniques, Equalization, diversity, channel coding. Multiple Access Techniques Frequency division multiple access, time division multiple access, code division multiple access and random access techniques. Wireless Standards and Systems, GSM, wireless LANs, Bluetooth, WiFi and WiMAX.

Recommended Books:

Optical Fiber Communication 3+0
Prerequisites: Applied Physics

Course Outline:
Comparison between optical and electrical mediums, basic optical communication system, Snell’s law, refractive index, line width, optical and electrical bandwidth. Step index fibre, graded index fiber, refractive index profiles, meridional and skew rays, acceptance angle and acceptance con, numerical aperture for meridional and skew rays. Parameters for single mode fiber (cutoff wavelength, mode field diameter, effective refractive index, group delay). Attenuation due to: (i) absorption, (ii) scattering (iii) bending losses Dispersion, Reflectance and optical return losses, special types of fibers. Optical sources, modulators and modulating schemes, line coding, optical detectors, demodulator and demodulation methods, couplers, connectors, switches, splicing, optical amplifiers and repeaters, Optical time division multiplexing, wavelength division multiplexing (techniques and devices) link budgeting w.r.t time and power. LAN system, FDDI, SONETS and SDH, Wavelength routing based optical networks, Optical burst switching.

Recommended Books:

Project Management 3 + 0

Prerequisite: Organizational Behavior

Course Contents:
The course provides specific guidelines for achieving greater project success. It addresses the need for modern techniques in project management geared and suited to projects. It provides opportunity to students to have orientation towards lessons learned from failures and problems in projects, and suggest alternative solutions for project issues. The critical success factors for managing projects together with management issues related to vendors and outsourcing across national boundaries are also discussed. It further deals with managing businesses effectively address cross-cultural, social, and political issues.

Recommended Books:
1. Engineering Project Management by Nigel J. Smith Published by Wiley, Latest edition available

Telecomm Networks Management 3+0

Prerequisite: None

Course Outline:
Introduction to TMN, TMN interface Specification Methodology, Enhanced Telecommunication Operations Map (eTOM), Managing Next generation Networks, Generic Network Information Model, Management Services, Management Services, Management capabilities at the F Interface, Simple Network Management protocol (SNMP), common management interface protocol (CMIP, X.700), Enterprise NMS Architecture, Hierarchical Approach to Network Management.

Recommended Books:
3. International Telecommunication Union, November 1994 T.G. Robertazzi:
E-Business Management 3 + 0

Prerequisite: None

Course Outline:

Recommended Books:

Telecommunication Policies and Regulations (3+0)

Prerequisite: Telecommunication Systems

Course Outline:
The Technology and Services of the Environment: Services as “Distributive, Centralized Interactive and Communicative.

Inter Connect: What is Interconnect? The 5 objectives of interconnection policy. Why are regulators involved in Interconnect?

Case Studies: General
Recommended Books:

Antenna and Wave Propagation 3+0
Prerequisite: Electromagnetic Theory
Course Outline:

Recommended Books:

Information and Network Security 3+0
Prerequisite: Data Communications and Networking
Course Outline:
This course covers fundamental principles and the best practices of computer systems and network security. Key topics include security
architecture, cryptographic systems, and security management tools. Specifically, we will study major security protocols and standards, network attacks and defenses, database security, virus, malware, denial of service, firewalls, Botnet, intrusion detection, and wireless security.

**Recommended Books:**

**Computer Security:** Principles and Practice, Latest Edition by William Stallings, Lawrie Brown

**Economics** 3+0

**Prerequisite:** None

**Course Outline:**
This course is designed to help gain a basic understanding of economic principles and issues, without highlighting economic theory and modeling. Topics includes: economic systems opportunity cost and the production possibility frontier, demand and supply; the price mechanism; elasticity cost and revenue; economies of scale, market structure; business objectives and strategy in market failure and government intervention in markets, introduction to macroeconomics; measures of economic performance; different approaches to macroeconomic policy.

**Recommended Books:**


**Introduction to Business and Marketing** 3+0

**Prerequisite:** None

**Course Outline:**
In this course covers basic components of business and marketing, its methods and uses to business firms. Topic includes; Organization, functions, activities, and roles of business; orientation to business terminology, practices, problems, and career opportunities. Marketing focuses on the promotion of various products offered by business firms.

**Recommended Books:**

Introduction to Business by Jeff Madure published by Paradigm 5th edition/Latest edition
Scheme of Study MS Telecommunication Systems
(As per HEC guidelines 24 + 06=30 CrHrs)

The proposed list of courses is for MS in Telecommunication Systems. The list is not exhaustive. Individual universities/ institutions may design specializations and courses keeping in view the demand and availability of faculty and facilities. The curriculum/ syllabus shall be approved by the individual university/ institution as per procedures listed in their charters.

Technical Courses
(Select minimum 18 credit hours)

- Probability and Random Processes
- Advanced Communication Systems
- Advanced Digital Communication
- Information Theory and Coding
- Microwave Systems
- Digital Signal Processing
- Advance Mobile Communication
- Advanced concepts in Radar Systems
- Cyber Security
- Wireless Local Positioning Systems
- Global Positioning and Navigation Systems
- Signal Detection and Estimation
- Advanced Optical Communication Systems
- Advanced Satellite Communication Systems
- Advanced electromagnetic and Antenna systems
- Advanced Broadband Communication Systems
- Multimedia Communication Systems
- Cryptography and Security Systems
- Modeling and Simulation of Telecommunication systems
- Electromagnetic Compatibility Regulations
- Telecommunication Network Operations
- Quality of Service in Telecommunication systems
- Advances in transmission & switching system
- Selected Topics in Telecom systems

Electives Courses
(Select minimum 6 credit hours)

- Advanced Telecommunication Management
Recommendations of the NCRC for Master Program in Telecommunication Systems

Due to the variation in expertise and facilities available in different universities of Pakistan, NCRC recommended a flexible type of Master’s Degree program. Their recommendations follow:

a) For award of Masters degree, candidates will either need to complete 30 credit hours of course work or complete 24 credit hours of course work along with a minimum of 6 credit hours for research work/thesis. For universities not following Semester System, the requirement is 8 courses plus thesis or ten courses with each course having a theory contact for at least three hours per week during the term.

b) The course titles of the MS in Telecommunication Systems have been outlined. Other specializations may be added as required by each university offering the Masters program keeping in view the availability of resources. The details of course contents, structure, and requirement of programs is the responsibility of the individual university according to faculty availability, suitability and needs.