SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR

CURRICULUM 2014

COMPUTER SCIENCE

BS (4-YEAR PROGRAM)

City Campus, Asamai Road, Near Qila Bala Hisar, Peshawar
Contact Number: 091-9239297

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

CURRICULUM OF COMPUTER SCIENCE

BS PROGRAM

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

TITLE:

"CURRICULUM COMPUTER SCIENCE – BS PROGRAM"

Approved from Statutory Bodies:

- 3rd Meeting of Board of Studies held in 2nd May 2014
- 4th Meeting of Board of Studies held in 12th Dec 2017

COMPILED BY:

Academics Section.
Shaheed Benazir Bhutto Women University, Peshawar.

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SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR

CURRICULUM

OF

BS – COMPUTER SCIENCE (4-YEAR PROGRAM)

ACADEMICS SECTION
SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

CONTENTS

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

UNIVERSITY AT A GLANCE

Shaheed Benazir Bhutto Women University Peshawar is a premier women university of Khyber Pakhtunkhwa. It has earned this position by virtue of its futuristic outlook towards higher education, strong emphasis on need-based research and focus on innovation and entrepreneurship. Its academic programmes are designed to meet the national needs and challenges of the new millennium. While traditional fields of Social, Biological and Physical Sciences have been updated with emerging trends, modern disciplines are being offered to prepare professionals to manage the ever-growing demands of knowledge economy with requisite degree of expertise.

This university is the first ever female university which was established in accordance with the Frontier Women University Act 2004, passed by the Provincial Assembly and assented by the Governor Khyber Pakhtunkhwa on 7th February, 2005. However, according to the revised Act (Khyber Pakhtunkhwa Act No. XI 2010), passed by the provincial assembly Khyber Pakhtunkhwa on September 6, 2010, the University was renamed as Shaheed Benazir Bhutto Women University. The University is destined to be a leading public sector Women University to impart education to the female population of this region in order to develop scientific, socio cultural, economic and political stability, through learner centered teaching and research, while strengthening the identity of the students at national and international level.

Shaheed Benazir Bhutto Women University has come a long way in developing as a global centre of excellence for imparting higher education. The universities at large have assumed the role of drivers of knowledge-based regional development. In contemporary times, the transformation in the world economy is perennial; technologies evolve at neck breaking speeds. These are extra ordinary times requiring extra ordinary preparations and efforts.

VISION OF THE UNIVERSITY

Shaheed Benazir Bhutto Women University aspires for excellence in learning, education, creativity, research and innovation.

MISSION STATEMENT OF THE UNIVERSITY

The mission of Shaheed Benazir Bhutto Women University is to contribute to the society through transformative powers of education, creativity and research with a focus on diversity, linkages, entrepreneurship and innovation. We aim to prepare individuals with problem solving attitude, humanistic outlook, critical thinking and the ability to respond to socio-economic challenges.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

INTRODUCTION TO DEPARTMENT OF COMPUTER SCIENCE

Through the development of sophisticated computer systems, processors, and embedded applications, computer scientists have the opportunity to change society in ways unimagined several years ago. Computer science is the scientific and practical approach to computation and its applications. It is the systematic study of the feasibility, structure, expression, and mechanization of the methodical processes (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded in bits and bytes in a computer memory or transcribed in genes and protein structures in a human cell. A computer scientist specializes in the theory of computation and the design of computational systems.

Its subfields can be divided into a variety of theoretical and practical disciplines. Some fields, such as computational complexity theory, are highly abstract, while fields such as computer graphics emphasize real-world visual applications. Still other fields focus on the challenges in implementing computation. For example, programming language theory considers various approaches to the description of computation, whilst the study of computer programming itself investigates various aspects of the use of programming language and complex systems. Human-computer interaction considers the challenges in making computers and computations useful, usable, and universally accessible to humans.

Our goal is the education and training of a diverse body of students who can lead this information technology revolution. To this end, the computing programs orient students toward the pragmatic aspects of computing and provide the learning and practices to make them proficient computing professionals. Computational thinking is rooted in solid mathematics and science, and grounding in these fundamentals is essential. Our laboratory environment exposes students to many commercial software tools and systems, and introduces modern software

development techniques. In the context of the practice of computing, this early grounding forms the basis for an education that prepares students for a computing career.

BACKGROUND

The earliest foundations of what would become computer science predate the invention of the modern digital computer. Machines for calculating fixed numerical tasks such as the abacus have existed since antiquity but they only supported the human mind, aiding in computations as complex as multiplication and division.

Blaise Pascal designed and constructed the first working mechanical calculator, Pascal's calculator, in 1642. Two hundred years later, Thomas de Colmar launched the mechanical calculator industry when he released his simplified arithmometer, which was the first calculating machine strong enough and reliable enough to be used daily in an office environment. Charles Babbage started the design of the first *automatic mechanical calculator*, his difference engine, in 1822, which eventually gave him the idea of the first *programmable mechanical calculator*, his Analytical Engine. He started developing this machine in 1834 and "in less than two years he had sketched out many of the salient features of the modern computer. A crucial step was the adoption of a punched card system derived from the Jacquard loom making it infinitely programmable. In 1843, during the translation of a French article on the *analytical engine*, Ada Lovelace wrote, in one of the many notes she included, an algorithm to compute the Bernoulli numbers, which is considered to be the first computer program. Around 1885, Herman Hollerith invented the tabulator which used punched cards to process statistical information; eventually his company became part of IBM. In 1937, one hundred years after Babbage's impossible dream, Howard Aiken convinced IBM, which was making all kinds of punched card equipment and was also in the calculator business to develop his giant programmable calculator, the ASCC/Harvard Mark I, based on Babbage's *analytical engine*, which itself used cards and a central computing unit. When the machine was finished, some hailed it as "Babbage's dream come true".

During the 1940s, as new and more powerful computing machines were developed, the term *computer* came to refer to the machines rather than their human predecessors. As it became clear that computers could be used for more than just mathematical calculations, the field of computer science broadened to study computation in general. Computer science began to be established as a distinct academic discipline in the 1950s and early 1960s. The world's first computer science degree program, the Cambridge Diploma in Computer Science, began at the University of Cambridge Computer Laboratory in 1953. The first computer science degree program in the United States was formed at Purdue University in 1962. Since practical computers became available, many applications of computing have become distinct areas of study in their own right.

Although many initially believed it was impossible that computers themselves could actually be a scientific field of study, in the late fifties it gradually became accepted among the greater academic population. It is the now well-known IBM brand that formed part of the computer science revolution during this time. IBM (short for International Business Machines) released the IBM 704 and later the IBM 709 computers, which were widely used during the exploration period of such devices. "Still, working with the IBM [computer] was frustrating...if you had misplaced as much as one letter in one instruction, the program would crash, and you would have to start the whole process over again". During the late 1950s, the computer science discipline was very much in its developmental stages, and such issues were commonplace.

Time has seen significant improvements in the usability and effectiveness of computing technology. Modern society has seen a significant shift in the users of computer technology, from usage only by experts and professionals, to a near-ubiquitous user base. Initially, computers were quite costly, and some degree of human aid was needed for efficient use - in part from professional computer operators. As computer adoption became more widespread and affordable, less human assistance was needed for common usage.

VISION OF THE DEPARTMENT

The department aspires to redefine learning, creativity, research and stimulating innovation in a global context by setting new standards.

MISSION STATEMENT OF THE DEPARTMENT

The department yearns to impart knowledge in the field of Computer Science and Information Technology by preparing our students for the professional environment through promoting quality and innovation considering the future needs. Enhancing their skills not only as computer scientists but also inculcating in them good ethics, social responsibility and a humanistic approach.

OBJECTIVES OF THE DEPARTMENT

Recent developments in computer hardware, software and communication technologies have offered new exciting opportunities and challenges for creation of innovative learning environments for Computer Science and its curricula design. One of the key elements here is to prepare the graduates for the future. The challenge of getting all newly emerging technologies incorporated in to the curriculum is becoming pivotal for the effectiveness of curricula. There is a need for curricula structures that are really able to grow as we put new demands on them. The curriculum is required to provide integration of all components and the foundations that allow accessing all of the new knowledge and technology to fulfill the vision of future.

The basic intention of an academic programme in Computer Science is to develop the student's critical professional thinking and intuition. The curriculum must be structured to provide a balanced mixture of learning experiences to make the graduate capable of sound professional decisions. As a result the graduate should be able to assume responsible positions in business, government, and education at the research, development, and planning levels. The programme should also provide an excellent foundation for further formal learning and training. The Computer Science curriculum is expected to provide environments to put into practice, the principles and techniques learnt during the course of implementation of academic programme.

The following summarizes some key characteristics for consideration as a basis of a successful academic programme in Computer Science:

1. The programmes should provide a broad understanding of the field via introducing concepts, theory, and techniques.
2. Intensive education/training in focused areas of Computer Science is desirable.
3. The programmes may encourage students to develop and use abstract models in addition to apply respective technology in practical situations.
4. Computer Science graduates require special communication skills both orally and in writing. They must be able to produce well-organized reports, which clearly delineate objectives, methods of solution, results, and conclusions for a complex task.
5. The programme should provide formal foundations for higher learning.
6. The programme should be dynamic and flexible enough to maintain currency with the latest scientific and technological developments in the field.
7. The programme should provide professional orientation to prepare students for industry.

The Bachelor of Science in Computer Science program has been offered at SBBWU since 2005. Our goal has been and continues to be a high quality degree program that ensures that students will be able to integrate theory and practice, recognize the importance of abstraction and appreciate the value of efficient design created to meet clearly developed requirements. The program is intended to prepare students for lifelong learning as they undertake professional careers in computing.

Students will be able to solve problems using algorithms and techniques. They will have sufficient understanding of the theoretical underpinnings of Computer Science such that learning a new programming language, operating system, or information system will be viewed as a routine matter — something that can be done in 2 – 3 days. Additionally, students will graduate with the ability to communicate well, both orally and in writing. Students will graduate with the ability to work well in a multi-disciplinary environment. Finally, students will graduate with an understanding of the context of their skills within a broader academic and applied environment.

Specifically, the core objectives are to ensure that students graduate with:

A. Robust problem-solving skills.
B. Substantial knowledge of a broad class of problem-solving techniques (e.g.; this includes Algorithms, heuristics, and design techniques).

C. Substantial understanding of the fundamentals of Computer Science.
D. Ability to clearly communicate technical concepts both orally and in writing.
E. Ability to readily work with other disciplines.
F. Appropriate, occasional innovation of our curriculum so it incorporates ever-changing Computer Science technology.

INTENDED LEARNING OUTCOMES OF THE DEPARTMENT

The department concurs with the all of the outcomes mentioned below.

- An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.
- An ability to function effectively on teams to accomplish a common goal.
- An understanding of professional, ethical, legal, security, and social issues and responsibilities.
- An ability to communicate effectively with a range of audiences.
- An ability to analyze the local and global impact of computing on individuals, organizations and society.
- Recognition of the need for, and an ability to engage in, continuing professional development.
- An ability to use current techniques, skills, and tools necessary for computing practices..
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity..
- Be prepared to enter a top-ranked graduate program in Computer Science.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY

PESHAWAR

CURRICULUM

OF

BACHELORS IN COMPUTER SCIENCE

(4-YEAR PROGRAM)

ACADEMICS SECTION
SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

PREFACE

The accomplishment of anything worthwhile, whether large or small, depends on the completion of goals, activities and milestones. An effective curriculum offers all these things. It provides administrators, teachers and students with structure and sense of progression. Therefore, the importance and impact of curriculum cannot be overstated. A curriculum is more than putting together a set of academically required subjects. Several things must be considered such as the learning needs of students; the consensus of teachers and administrators; the expectations of the community promoted a sense of order and structure in the pursuit of academic success.

Designing a curriculum involves the interaction of several participants, reaching beyond the academic wall to impact the entire community. Without an effective curriculum, students would not be able to understand or meet the challenges of society. A curriculum prepares an individual with the knowledge to be successful, confident and responsible citizens. The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

Assistant Registrar Academics
Shaheed Benazir Bhutto Women University Peshawar

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR

DEPARTMENT OF COMPUTER SCIENCE

MEMBERS OF THE BOARD OF STUDIES

The member who attended the meeting of Board of Studies, Department of Computer Science held on 12th December, 2017 is as follows:

1. Prof. Dr. Razia Sultana	**Dean, Faculty of Social Sciences, SBBWU, Peshawar.**
2. Prof. Dr. Omar Usman	**Associate Professor, FAST Peshawar.**
3. Prof. Dr. Saeed Mahfooz	**Professor, Department of Computer Science, UOP.**
4. Dr. Sara Shehzad	**Associate Professor, Department of Computer Science, UOP.**
5. Dr. Neelam Gohar	**Incharge, Department of Computer Science, SBBWUP.**
6. Dr. Salma Noor	**Assistant Professor, Department of Computer Science, SBBWUP.**
7. Dr. Fouzia Jabeen	**Lecturer, Computer Science Department, SBBWUP.**

MEMBERS OF THE BOARD OF STUDIES

The member who attended the meeting of Board of Studies, Department of Computer Science held on 2nd May, 2014 is as follows:

1. Prof. Dr. Salim-ur-Rehman	**Vice Chancellor, Sarhad University, Peshawar.**
2. Dr. Mohammad Ali	**Assistant Professor, IM Sciences, Peshawar.**
3. Dr. Sajid Anwar	**Assistant Professor, IM Sciences, Peshawar.**
4. Dr. Sara Shehzad	**Assistant Professor, University of Peshawar.**
5. Dr. Neelam Gohar	**Coordinator, Computer Science Department, SBBWUP**
6. Ms. Mah Rukh	**Lecturer, Computer Science Department, SBBWUP**

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

MISSION STATEMENT

The mission of this program is to provide quality computing education to the female of Khyber Pakhtunkhwa at bachelor's level, by providing computational and research facilities along with highly qualified faculty and a professional learning environment, to produce competitive and well-groomed computer professionals as required by the current job market and industrial standards.

BS PROGRAMME OBJECTIVES

Recent developments in computer hardware, software and communication technologies have offered new exciting opportunities and challenges for creation of innovative learning environments for Computer Science and its curricula design. One of the key elements here is to prepare the graduates for the future. The challenge of getting all newly emerging technologies incorporated in to the curriculum is becoming pivotal for the effectiveness of curricula. There is a need for curricula structures that are really able to grow as we put new demands on them. The curriculum is required to provide integration of all components and the foundations that allow accessing all of the new knowledge and technology to fulfill the vision of future.

The basic intention of an academic programme in Computer Science is to develop the student's critical professional thinking and intuition. The curriculum must be structured to provide a balanced mixture of learning experiences to make the graduate capable of sound professional decisions. As a result the graduate should be able to assume responsible positions in business, government, and education at the research, development, and planning levels. The programme should also provide an excellent foundation for further formal learning and training. The Computer Science curriculum is expected to provide environments to put into practice, the principles and techniques learnt during the course of implementation of academic programme.

The following summarizes some key characteristics for consideration as a basis of a successful academic programme in Computer Science:

1. The program will provide the understanding of the fundamental and technical concepts in computer sciences.
2. The program focuses not only on the Computer Science subjects, but also introduces the students to an array of multidisciplinary subjects. This enables the graduates to work in any competitive environment and provides an extensive education in contemporary approaches, analysis, design and implementation of software.
3. The program will be able to establish a portfolio of up-to-date skills, abilities, and accomplishments that distinguish them from the competitors.
4. The program will enable the student to have a strong foundation in computing and information technology theoretical concepts and they can apply these concepts to problems requiring computer solutions.
5. The program will develop critical professional thinking and intuition in students.
6. The graduates will learn to communicate effectively in professional and educational environments.

The objectives of this program are:

1. To enable the student to have a strong foundation in their core area, along with array of multidisciplinary subjects and apply these concepts to problems requiring computer solutions. This will prepare the students to work in any competitive environment and provide an extensive **quality education** in contemporary approaches, analysis, design and implementation of software.

2. To produce **computer professionals** through promoting up-to-date professional and intellectual skills, abilities and accomplishments**,** for a successful career in an environment this will help to distinguish the students from the competition.

3. To establish a strong sense of **ethical values** in the students, through positive learning environment. This will help to promote an ethical culture in the society.

4. To develop **research environment**, critical professional thinking and intuition in students through highly qualified faculty and up-to-date labs. This will help students to communicate effectively in career and educational environments.

LEARNING OUTCOMES OF THE BS PROGRAMME

At the end of this program the graduate will be able to have:

1. A thorough *understanding* of computer technology.
2. Practical *skill* in the use of computer technologies.
3. The ability to *conceive*, *design*, and *implement* software systems, using appropriate existing technologies where available, and producing creative solutions when necessary.
4. The ability to *work in teams*, with other computer scientists as well as non-computer scientists; to *communicate*, orally and in writing, with specialists and non-specialists, about computer technology
5. *Integrity* in their professional dealings, and *sensitivity* to ethical issues that arise in society's use of computers.

REQUIREMENTS OF THE BS PROGRAMME

BS student is required to either do a Research/developmental Project in the final semester to fulfill the degree requirements. Candidates will be expected to develop their ideas to the point of publication.

ADMISSION REQUIREMENTS

ELIGIBILITY CRITERIA

At least 45% marks in Intermediate FSc (pre-medical, pre-engineering, inter sciences) in aggregate.

DURATION

- 4 years
- Programme spread over 8-Semesters.
- 2-Semesters per year.

COURSE AND CREDIT HOUR REQUIREMENTS

A total of 132-144 credits are required to complete Bachelor of Science in Computer Science.

EVALUATION

For uniformity in the evaluation system, the minimum CGPA required for award of degree is 2.0 out of 4.0 at undergraduate level subject to meet all requirements of the university.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

FOUR-YEAR CURRICULA FOR BS DEGREE IN COMPUTER SCIENCE

STRUCTURE

S.NO	CATEGORIES	NO. OF COURSES MIN- MAX	CREDIT HOURS MIN- MAX
1	Compulsory Requirement (No Choice).	9-10	27-30
2	General Courses to be chosen from other departments.	10-11	29-33
3	Discipline Specific Foundation Courses	6-7	19-21
4	Major Courses including Research Project/Internship	11-12	36-39
5	Electives within the Major	8-9	24-27
TOTAL		**44-49**	**135-150**

Total numbers of Credit Hours	150
Duration	4 YEARS
Semester Duration	16-18 WEEKS
Semesters	8
Course Load Per Semester	16-18 CREDIT HOURS
Number of Courses Per Semester	4-6 (not more than 3 lab/practical courses)

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

LAYOUT

S.No	COMPULSORY REQUIREMENTS (NO CHOICE)	
	9-10 COURSES	
	27-30 CREDIT HOURS	
	SUBJECT	CREDIT HOURS
1.	Introduction to Information and Communication Technology	3(2,1)
2.	Programming Fundamental	3(2,1)
3.	Object Oriented Programming I	3(2,1)
4.	Discrete Structures	3(3,0)
5.	Data Structures	3(2,1)
6.	Digital Logic Design	3(2,1)
7.	Operating Systems	3(2,1)
8.	Database Systems	3(2,1)
9.	Software Engineering	3(3,0)
10.	Computer Networks	3(2,1)
	Total Credit Hours	**30(22,8)**

S.No	GENERAL COURSES TO BE CHOSEN FROM OTHER DEPARTMENTS	
	10-11 COURSES	
	29-31 CREDIT HOURS	
	SUBJECT	CREDIT HOURS
1.	English I	3(3,0)
2.	English II	3(3,0)
3.	Technical and Business Writing	3(3,0)
4.	Pakistan Studies	2(2,0)
5.	Islamic Studies	2(2,0)
6.	Economics	3(3,0)
7.	Entrepreneurship	3(3,0)
8.	Financial Accounting	3(3,0)
9.	Human Resource Management	3(3,0)
10.	Psychology	3(3,0)
11.	Professional Practices	3(3,0)
	Total Credit Hours	**33(33,0)**

S.No	DISCIPLINE SPECIFIC FOUNDATION COURSES	
	6-7 COURSES	
	19-21 CREDIT HOURS	
	SUBJECT	CREDIT HOURS
1.	Calculus and Analytical Geometry	3(3,0)
2.	Basic Electronics	3(2,1)
3.	Linear Algebra	3(3,0)
4.	Electricity & Magnetism	3(2,1)
5.	Probability and Statistics	3(3,0)
6.	Differential Equation	3(3,0)
7.	Numerical Computing	3(2,1)
	Total Credit Hours	**21(18,3)**

S.No	MAJOR COURSES INCLUDING RESEARCH PROJECT/INTERNSHIP	
	11-12 COURSES	
	36- 39 CREDIT HOURS	
	SUBJECT	CREDIT HOURS
1.	Data Communication	3(3,0)
2.	Computer Organization and Assembly Language	3(2,1)
3.	Computer Graphics	3(2,1)
4.	Theory of Automation and Formal Languages	3(3,0)
5.	Human Computer Interaction	3(2,1)
6.	Object Oriented Analysis and Design	3(3,0)
7.	Object Oriented Programming II	3(2,1)
8.	Network Security	3(3,0)
9.	Computer Architecture	3(3,0)
10.	Analysis of Algorithms	3(3,0)
11.	Compiler Construction	3(3,0)
12.	Research Project	6(0,6)
	Total Credit Hours	**39(29,10)**

S.No	ELECTIVE COURSES WITHIN THE MAJOR	
	8-9 COURSES	
	24-27 CREDIT HOURS	
	SUBJECT	CR. HR.
1.	Software Project Management	3(3,0)
2.	Data Warehousing	3(2,1)
3.	Data Mining	3(3,0)
4.	Computer vision	3(2,1)
5.	Digital Image Processing	3(2,1)
6.	Distributed Database System	3(2,1)
7.	Signals and systems	3 (2,1)
8.	Web Based Programming	3 (2,1)
	Total Credit Hours	**24(19,5)**

Total Credit Hours:

- University may recommend the courses in the category of general courses from Humanities, Social & Biological Sciences.

Note: Elective courses may be developed and offered by the concerned universities according to their specialties.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE
SCHEME OF STUDIES OF BS (SESSION (2014-2018) AND SESSION 2015-2019)

S.NO	SEMESTER	COURSE TITLE	COURSE CODE	CREDIT HOURS
1.	1st	English-I	ENG311	3 (3,0)
2.		Pakistan Studies	HUM302	2 (2,0)
3.		Programming Fundamentals	CSC302	3 (2,1)
4.		Calculus and Analytical Geometry	MTH310	3 (3,0)
5.		Physics	PHY303	3 (2,1)
6.		Introduction to Information and Communication Technology	CSC301	3 (2,1)
			Total Credit Hours	**17**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
7.	2nd	English-II	ENG321	3 (3,0)
8.		Islamic Studies	ISL320	2 (2,0)
9.		Object Oriented Programming	CSC312	3 (2,1)
10.		Linear Algebra	MTH311	3 (3,0)
11.		Data Communication	CSC311	3 (3,0)
12.		Basic Electronics	PHY304	3 (2,1)
			Total Credit Hours	**17**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
13.	3rd	Data Structures	CSC422	3(2,1)
14.		Digital Logic Design	CSC421	3(2,1)
15.		Probability and Statistics	STAT416	3(3,0)
16.		Technical and Business Writing	ENG431	3(3,0)
17.		Discrete Structures	CSC404	3(3,0)
18.		Computer Networks	CSC414	3(3,0)
			Total Credit Hours	**18**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
19.	4th	Computer Organization and Assembly Language	CSC431	3(2,1)
20.		Multivariate Calculus	MTH410	3(3,0)
21.		Operating Systems	CSC432	3(2,1)
22.		Database System	CSC424	3(2,1)
23.		Advanced Programming Language	CSC425	3(2,1)
24.		Financial Accounting	MS402	3(3,0)
			Total Credit Hours	**18**

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

SCHEME OF STUDIES OF BS (SESSION(2014-2018) AND SESSION (2015-2019)

S.NO	SEMESTER	COURSE TITLE	COURSE CODE	CREDIT HOURS
25.	5th	Software Engineering	CSC533	3 (3,0)
26.		Theory of Automation and Formal Languages	CSC502	3 (3,0)
27.		Computer Architecture	CSC542	3 (3,0)
28.		Psychology	PSY516	3 (3,0)
29.		Differential Equations	MTH510	3 (3,0)
30.		Human Resource Management	MS 504	3 (3,0)
			Total Credit Hours	**18**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
31.	6th	Object Oriented Analysis and Design	CSC523	3 (3,0)
32.		Computer Graphics	CSC525	3(2,1)
33.		Human Computer Interaction	CSC533	3 (2,1)
34.		Compiler Construction	CSC513	3 (3,0)
35.		Entrepreneurship	MS503	3(3,0)
36.		Economics	ECON501	3(3,0)
			Total Credit Hours	**18**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
37.	7th	Numerical Computing	MTH610	3(2,1)
38.		Analysis of Algorithms	CSC645	3(3,0)
39.		Network Security	CSC625	3(3,0)
40.		Professional Practices	CSC630	3(3,0)
(ONE HAS TO BE SELECTED FROM LIST OF ELECTIVE COURSES)				
			Total Credit Hours	**15**
S.NO	**SEMESTER**	**COURSE TITLE**	**COURSE CODE**	**CREDIT HOURS**
41.	8th	Artificial Intelligence	CSC643	3(3,0)
42.		Final Project	CSC699	6
(TWO HAS TO BE SELECTED FROM LIST OF ELECTIVES)				

LIST OF ELECTIVE COURSES				
43.		Software Project Management	CSC644	3(3,0)
44.		Data Warehousing	CSC635	3(2,1)
45.		Data Mining	CSC634	3(2,1)
46.		Computer vision	CSC636	3(2,1)
47.		Digital Image Processing	CSC632	3(2,1)
48.		Distributed Database System	CSC637	3(2,1)
49.		Signals and systems	CSC620	3 (2,1)
50.		Web Based Programming	CSC633	3 (2,1)

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SEMESTER-I

Course Name: English-I	**Course Code:** ENG311
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:
The course is designed to enhance language skills and develop critical thinking and to develop good English writing, language usage and reading skills.

Intended Learning Outcomes:
Students will be able: to express their ideas in a coherent manner, speak English with correct pronunciation, read and comprehend the written material, understand the class lectures easily.

Course Outline:

- Basics of Grammar, Parts of speech and use of articles,
- Sentence structure, active and passive voice,
- Practice in unified sentence,
- Analysis of phrase, clause and sentence structure,
- Transitive and intransitive verbs,
- Punctuation and spelling.
- Principles of writing good English,
- Understanding the composition process: writing clearly; word, sentence and paragraph. Comprehension and expression.
- Use of grammar and punctuation.
- Process of writing, observing, audience analysis, collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension,
- skills for taking notes in class,
- Skills for exams.

Reference Material:

1. Warriner, J.E.(Latest Edition). *Warriner's English Grammar and Composition.*
2. Wren, Martin.(Latest Edition).*High School English grammar and composition*.
3. Murphy.R.(Latest Edition). *Basic Grammar*.

Functional English

a) Grammar

1. Thomson.A.J and A.V. Martinet.A.V. *Practical English Grammar*. Third edition. Oxford University Press. 1997. ISBN 0 194313492

b) Writing

Boutin,M,C., Brinand,S and Grellet,F. *Writing, Intermediate*. Oxford Supplementary Skills, Fourth Impression 1993, ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) **Reading/Comprehension**

Tomlinson, B and Ellis,R. *Reading. Upper Intermediate*, Oxford Supplementary Skills, Third Impression 1992, ISBN 0 19 453402 2

Course Name: Pakistan Studies	**Course Code:** HUM302
Course Structure: Lectures: 2, Labs: 0	**Credit Hours:** 2
Prerequisites: None	

Course Objectives:

This is a history-related course with the goal to introduce the student to basic history. Students will be presented with material, which will give them a broad base of understanding of their nation history. Contemporary issues will also be discussed as well as the history of nations changes which have occurred over the past one hundred years.

Intended Learning Outcomes:

- Upon completion of this subject the students will be able to:
- Learn about the historical revolutions that led to freedom
- Understand the great works and study what steps their leaders had taken to free the nation
- The aims and goals of establishing a Muslim state
- What reform their leaders have made to develop the state

Course outline:

- Ideology of Pakistan
- Historical perspective of Pakistan Ideology
- Aligarh movement, Establishment of Pakistan, Land of Pakistan
- Geographic boundaries of Pakistan, Resources of Pakistan
- Division of Assets, Ayub Khan's era, Creation of Bangladesh
- Bhutto's reforms, Zia's era, Social structure of Pakistan
- Literacy in Pakistan, Agriculture of Pakistan
- Industries of Pakistan, Foreign policy of Pakistan
- Pakistan and the Muslim World
- Pakistan and ECO
- Pakistan and India
- Muslim society in Indo Pak, movement led by societies, downfall of Islamic society, Establishment of British raj, Allama Iqbal, Muslim League, Independence movement, Pakistan culture and society, Constitutional and administrative issues, Pakistan and geo-political dimension, Pakistan International affairs, Pakistan and challenges ahead.

Reference Material:

1. Rabbani, I., *Pakistan Studies*
2. Iqbal, J.: *Ideology of Pakistan*, Ferozsons, Rawalpindi

Course Name: Programming Fundamentals	**Course Code:** CSC302
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:

The course is designed to familiarize students with the basic structured programming skills. It emphasizes upon problem analysis, algorithm designing, and programme development and testing.

Intended Learning Outcomes:

- This course is designed to familiarize students with the basic structured programming skills.
- It emphasis upon problem analysis, algorithm designing and program development and testing.

Course Outline:

- Overview of computers and programming.
- Types of programming languages(Low level, assembly language and High level Languages)
- Overview of language for e.g. C++ language.
- Language processors(compiler, Interpreter, Assembler)
- Basics of structured and Modular programming.
- Basic Algorithms and problem solving,
- Development of basic algorithms, analyzing problem, designing solution, testing designed solution.
- Fundamental programming constructs,
- Translation of algorithms to programmes,
- Data types
- Variables and constants
- Operators (Arithmetic, assignment operator, increment and decrement, operator precedence.
- Comments(Single line and multiple line)
- Control structures(If structure, if-else structure, multiple if else structure, nested if structure, compound conditions witch structure)
- Go to statement.
- Looping structure(for loop, while loop, do-While), break, continue
- Functions(Use defined and built in)
- Arrays(Sequential search, binary search, Selection sort, bubble sort, two dimensional arrays and multi dimensional arrays)
- Structures(Nested structures)
- Union
- Enumerations
- Pointers
- Testing programmes

Reference Material:

1. Hanley & Kauffman.(Latest Edition). *Problem Solving and Program Design in C.* Addison-Wesley .
2. Deital,H.M., & Dietal,P.J. (Latest Edition). *C How to Program*. Prentice Hall
3. IT series. *Object oriented Programming using C++*.

Course Name: Calculus and Analytical Geometry	**Course Code:** MTH310
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:
To provide foundation and basic ground for calculus and analytical geometry background.

Intended Learning Outcomes:
At the end of the course student would be able: to solve problem using calculus concepts of limits, derivations, integration analytically and graphically, use calculus concepts in computer applications.

Course Outline:

- Complex Numbers,
- DeMoivre's Theorem and its Applications,
- Simple Cartesian Curves,
- Functions and Graphs, Symmetrical Properties, Curve Tracing, Limit and Continuity, Differentiation of Functions.
- Derivative as Slope of Tangent to a Curve and as Rate of Change,
- Application to Tangent and Normal, Linearization,
- Maxima/Minima and Point of Inflexion,
- Taylor and Maclaurin Expansions and their convergence.
- Integral as Anti-derivative, Indefinite Integration of Simple Functions.
- Methods of Integration: Integration by Substitution, by Parts, and by Partial Fractions,
- Definite Integral as Limit of a Sum, Application to Area, Arc Length,
- Volume and Surface of Revolution.

Reference Material:

1. Edwars, C.H., Penney, D.E.(Latest Edition).*Calculus*.Prentice hall,Inc..
2. Anton, H.., Bivens, I., Devis, S. (Latest Edition). Calculus. Newyork: John Wiley and sons, Inc.
3. Thomas, G.B.(Latest Edition).*Calculus and analytical geometry*.Addison Welsey Longman, Inc.

Course Name: Physics	**Course Code:** PHY-303
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:
To give the basic physics concepts and understanding of its law.

Intended Learning Outcomes:
The students will be:

- Proficient in the basic concepts of physics required for computer science graduates

Course Outline:

- Electrostatics: Coulombs law, Coulombs law and its experimental verification, Electric charge, Charge quantized, Electric fields, Gauss's Law, Electric Potential, Flux of Electric field,
- Gauss's law and its application,

- Electric potential as line integral potential due to charge distribution,
- Capacitors and dielectrics, Equation of continuity,
- Capacity of a spherical parallel plate capacitor,
- Polarization of constant, energy density of electrostatic field.
- Electric Current and Magnetic field: Current and magnetic field, electric current, Ohms law, Equation of continuity, field due to a current interaction of magnetic field with current,
- Magnetic induction vector, B, Biot Savart law, field due to straight and circular current,
- Ampere's law, Ampere's circuital theorem, field due to a solenoid and a toroid, thermo electrically feedback, Pelter and Thomson's effect,
- total e.m.f in thermocouple, Photo Voltaic effect, pi electric effect,
- Faraday's law, Faraday's law of electromagnetic induction and its, Differential form,
- self induction, self inductance of a toroidal solenoid mutual induction,
- Mutual inductance of a toroidal solenoid, Magnetic field in matter-1, magnetization vector,
- the magnetic intensity, Vector H, Magnetic energy density, dia Para and Ferro magnetism hysteretic.

Reference Material:

1. Halliday, D., Resnick, R., Walker, J.(Latest Edition).*Fundamentals of Physics extended* .NY: Wiley & Sons.

Course Name: Introduction to Information and Communication Technology	**Course Code:** CSC301
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:

This is an introductory course on Information and Communication Technologies. The topics include ICT terminologies, hardware and software components, the internet and world wide web, and ICT based applications.

Intended Learning Outcomes:

After the completion of this course, the student will be able to:

- Understand different terms associated with ICT
- Identify various components of a computer system
- Identify the various categories of software and their usage
- Understand different terms associated with the Internet and World Wide Web.
- Use various web tools including Web Browsers, E-mail clients and search utilities.
- Use text processing, spreadsheets and presentation tools
- Understand the enabling/pervasive features of ICT

Course Outline:

- Introducing Computer Systems, Types of computer and history of computer
- Hardware: Computer Systems & Components
- Interacting with the Computer, input and output devices

- Storage Devices, Types of file systems
- Boolean Algebra and number systems, Conversions, binary arithmetic
- Software: Operating Systems, Types of Operating systems
- Programming and Application Software, types of software
- Database Management system, Database, Introduction to RDBMS, Uses of Databases, Management information systems
- Computer Programmes, hardware software interaction, compilers and interpreters, Input-Processing-Output charts, algorithms, flowcharts, generations of language
- Networks, uses of networks, Types of networks, network topologies and protocols
- Data Communication
- The Internet and world wide web, web browsers and HTML tags, search engines
- Email, Internet features, E-commerce
- Collaborative Computing and Social Networking
- Connecting to the Internet, E-Commerce, Security
- IT Security, threats, identity theft, online spying tools, threats to hardware hacking
- Taking protective measures
- Project Week
- Review Week

Reference Material:

1. Norton, P.(Latest edition). *Introduction to Computers* .McGraw Hill .
2. Williams, S.(Latest edition). *Using Information Technology: A Practical Introduction to Computer & Communications* .McGraw Hill.
3. Sarah ,E., Hutchinson., Stacey, C., Sawyer.(Latest edition).*Computers, Communications & information: A user's introduction*.
4. Leon,A., Leon.M. (Latest edition). *Fundamentals of Information Technology*. Leon press.

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SEMESTER-II

COURSE NAME: English – II	**COURSE CODE:** ENG321
COURSE STRUCTURE: Lectures: 3, Labs: 0	**CREDIT HOURS:** 3
PREREQUISITES: None	

Course Objectives:
To develop good English writing, language usage and reading skills. To appreciate the importance of business communication and to develop understanding of communication concepts, principles, theories and problems. To develop good oral communication and presentation skills.

Intended Learning Outcomes:
After the completion of this course students will be able to improve their four basic skills (reading, writing, speaking and listening), thus making them fluent in their written and spoken English.

Course Contents:

- Principles of writing good English,
- Understanding the composition process: writing clearly; words, sentence and paragraphs. Comprehension and expression.
- Use of grammar and punctuation.
- Process of writing, observing, audience collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension, skills for taking notes in class, skills for exams.
- Business communications; planning messages, writing concise but with impact.
- Letter formats, mechanics of business, letter writing, letters, memo and applications, summaries, proposals, writing resumes, styles and formats, oral communications, verbal and non-verbal communication, conducting meetings, small group communication, taking minutes.
- Presentation skills; presentation strategies, defining the objective, scope and audience of the presentation, material gathering material organization strategies, time management, opening and concluding, use of audio-visual aids, delivery and presentation.

1. **Paragraph writing:** Practice in writing a good, unified and coherent paragraph
2. **Essay writing** : Introduction
3. **CV and job application:** Translation skills- Urdu to English
4. **Study skills:** Skimming and scanning, intensive and extensive, and speed reading,

summary and précis writing and comprehension

5. **Academic skills:** Letter/memo writing, minutes of meetings, use of library and internet

6. **Presentation skills**
   Personality development (emphasis on content, style and pronunciation)
   Note: documentaries to be shown for discussion and review

Reference Material:

1. Kaye,E.A.(Latest Edition).*Maximize your presentation Skills: How to Speak, Look and Act on your Way to the Top*. Prima Lifestyle.
2. Hargie,O.(Latest Edition).*Effective Presentation Skills* . Practical Guide Better Speaking.
3. Powell,M.(Latest Edition).*Presenting in English*. Language Teaching Publications.

Communication Skills

a. Grammar
   1. Thomson, A,J and A.V. Martinet,A,V. *Practical English Grammar, Exercises 2*. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b. Writing
   1. Boutin,M,C., Brinand,S and Grellet,F. *Intermediate Oxford Supplementary Skills*. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
   2. Nolasco,R. *Upper-Intermediate*. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c. Reading

1. Tomlinson,B and Ellis,R. *Oxford Supplementary Skills*. Third Impression 1991. ISBN 0 19 453403 0.
2. John. Reading and Study Skills

COURSE NAME: Islamic Studies	**COURSE CODE:** ISL 320
COURSE STRUCTURE: Lectures: 2, Labs: 0	**CREDIT HOURS:** 2
PREREQUISITES: None	

Course Objectives:

To impart an understanding of the fundamental principles and teachings of Islam through study of selected verses of the Quran and Prophetic Sayings. Important facets of the Prophet's life and salient, features of Islamic Civilization. To provide appreciation of other prominent religions, systems of ethics and cultures to prepare students to survive in international and multicultural work place.

Intended Learning Outcomes:

Student will have knowledge of basic teaching of Islam, and they know the history and present status of Pakistan.

Course Contents:

Introduction to Quranic Studies

- Basic Concepts of Quran
- History of Quran
- Uloom-ul -Quran

Study of Selected Text of Holy Quran

- Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- Verses of Surah Al-Hujrat Related to Adab Al-Nabi
    - (Verse No-1-18)

- Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

Study of Selected Text of Holy Quran

- Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

Seats of Holy Prophet (S.A.W) I

- Life of Muhammad Bin Abdullah (Before Prophet Hood)
- Life of Holy Prophet (S.A.W) in Makkah
- Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II

- Life of Holy Prophet (S.A.W) in Madina
- Important Events of Life Holy Prophet in Madina
- Important Lessons Derived from the life of Holy Prophet in Madina

Introduction To Sunnah

- Basic Concepts of Hadith
- History of Hadith
- Kinds of Hadith
- Uloom –ul-Hadith
- Sunnah & Hadith
- Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence

- Basic Concepts of Islamic Law & Jurisprudence
- History & Importance of Islamic Law & Jurisprudence
- Sources of Islamic Law & Jurisprudence
- Nature of Differences in Islamic Law
- Islam and Sectarianism

Islamic Culture & Civilization

- Basic Concepts of Islamic Culture & Civilization
- Historical Development of Islamic Culture & Civilization
- Characteristics of Islamic Culture & Civilization
- Islamic Culture & Civilization and Contemporary Issues

Islam & Science

- Basic Concepts of Islam & Science
- Contributions of Muslims in the Development of Science
- Quranic & Science

Islamic Economic System

- Basic Concepts of Islamic Economic System
- Means of Distribution of wealth in Islamic Economics
- Islamic Concept of Riba
- Islamic Ways of Trade & Commerce

Political System of Islam

- Basic Concepts of Islamic Political System
- Islamic Concept of Sovereignty
- Basic Institutions of Govt. in Islam

Islamic History

- Period of Khlaft-E-Rashida
- Period of Ummayyads
- Period of Abbasids

Social System of Islam

- Basic Concepts Of Social System Of Islam
- Elements Of Family
- Ethical Values Of Islam

Reference material:

1. Muhammad, H., *Emergence of Islam" , IRI, Islamabad*
2. Muhammad, H., *Muslim Conduct of State"*
3. Muhammad, H., *Introduction to Islam* Mulana Muhammad Yousaf Islahi,"
4. Hassan, H. H., *An Introduction to the Study of Islamic Law*". leaf Publication Islamabad, Pakistan.
5. Hasan, A., (Latest Edition) *Principles of Islamic Jurisprudence*. Islamic Research Institute, International Islamic University, Islamabad (Latest Edition)
6. Mir Waliullah, (Latest Edition) *Muslim Jrisprudence and the Quranic Law of Crimes* Islamic Book Service (Latest Edition)
7. Bhatia, H.S., (Latest Edition) *Studies in Islamic Law, Religion and Society*. Deep & Deep Publications New Delhi (Latest Edition)
8. Zia-ul-Haq, M., (Latest Edition) *Introduction to Al Sharia Al Islamia*. Allama Iqbal Open University, Islamabad

Course Name: Object Oriented Programming	**Course Code:** CSC312
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Programming Fundamentals	

Course Objectives:

The course aims to focus on object-oriented concepts, analysis and software development.

Intended Learning Outcomes:

- After completion of the course students will be able to develop programs using Object Oriented Paradigm.
- Identify the key principles in object-oriented programming (OOP);
- Apply core OOP principles and techniques as well as advanced features provided by modern programming languages to computer programming

- Apply practical knowledge of OOP design and implementation to application development;

Course Outline:

- Evolution of Object Oriented (OO) programming,
- OO concepts and principles.
- problem solving in OO paradigm.
- OO programme design process, classes, methods, objects.
- encapsulation;
- Constructors(Constructors with parameters, Default copy constructor)
- Destructors
- Static data member
- Friend functions
- Friend classes
- Static functions
- Operator Overloading(Unary and Binary)
- Function overloading.
- Function overriding
- derived classes,
- Inheritance (Multiple and multilevel, public, private and protected inheritance)
- Containership
- Virtual functions and pure virtual functions.
- Polymorphism.
- Virtual base class
- Templates
- I/O and file processing,
- Exception handling
- Association, Aggregation, Composition, Generalization

Reference Material:

1. Deital,H.M., & Dietal,P.J. (Latest Edition) *C++ How to Program*. Prentice Hall
2. Deital,H.M., & Dietal,P.J. (Latest Edition) *Java How to Program*. Prentice Hall
3. IT series. Object oriented Programming using C++.

Course Name: Linear Algebra	**Course Code:** MTH311
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:

To provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.

Intended Learning Outcomes:

Students will understand: some applications of system of linear equations, apply matrix multiplications in digraphs and communication matrices.

Course Outline:

- Vectors, Vector Spaces,
- Matrices & Determinants, Cofactor and Inverse, Rank, Linear Independence,
- Solution of system of Linear systems,
- Positive Definite matrix, Linear Transformations,
- Operations on matrices, Inner products, orthgonality and least squares, Eigen value & Eigenvectors.
- Applications to Systems of Equations and to Geometry, Singular Value Decomposition.

Reference Material:

1. Hill,B.D.(Latest Edition). *Elementary Linear Algebra with Applications.* Prentice Hall
2. Strang,G., Coonley,B., Andy ,B., Andrew,B.(Latest Edition). *Strang's Linear Algebra And Its Applications.* Brooks/Cole.
3. Rorres,C.(Latest Edition). *Elementary Linear Algebra: Applications* Version.

Course Name: Data Communication	**Course Code:** CSC311
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3

Prerequisites: None

Course Objectives:

To introduce students to the concept of computer communication. Network Layers, Network models (OSI, TCP/IP) and Protocol Standards. Emphasis is given on the understanding of physical and data link layer characteristics.

Intended Learning Outcomes:

Students will understand the working of physical and data link layers of OSI model, its characteristics and basic concepts of data communication.

Course Outline:

- Introduction to data communication and its basic components
- Types of data
- Network topologies
- Types of networks
- OSI and TCP/IP model and layers
- Brief characteristics of each layer
- Protocol Standards
- Digital to analog communication
- Digital to digital communication
- Analog to digital communication
- Analog to analog communication
- Error correction and detection schemes
- Flow control in data link layer and its schemes
- Multiple Access Control techniques
- Multiplexing techniques
- Noise media, Asynchronous and synchronous transmission, Data Link Control, Bridging

Reference Material:

1. Tanenbaum, A.S. (Latest Edition) *Introduction to Computer Networks*.
2. Douglas, E. C. (Latest Edition) *Computer Networks and Internets* .Prentice Hall

3. Behrouz A. Farouzan. (Latest Edition) *Data Communications and Networking,*

Course Name: Basic Electronics	**Course Code:** PHY-304
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:
Introduction of Electronics

Intended Learning Outcomes:
Student will know the function of different components of electronics devices.

Course Outline:

- Fundamentals of Semiconductor physics: Band theory, semiconductors (intrinsic and extrinsic), pn junction, pn junctions as a rectifier,
- clipper and clamper circuits, zener diode and voltage regulator, LED and LCD etc.,
- *Transistors:* Bipolar Junction transistors, BJT biasing circuits, Q-point, BJT as a switch, BJT amplifiers, classes of amplifiers, power amplifiers, Metal oxide transistors,
- nMOS, pMOS and CMOS inverters circuits.
- Introduction to A/D and D/A conversion circuits.

Reference Material:

1. Freedman,Y(Latest Edition). *University Physics*. Addison Wesley
2. Resnick, R., Halliday, D., Krane, K. S.(Latest Edition).*College Physics.*

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SEMESTER -III

Course Name: Data Structures	**Course Code:** CSC422
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Object Oriented Programming I, Discrete Structures	

Course Objectives:
The course is designed to teach students structures and schemes, which allow them to write programmes to efficiently manipulate, store, and retrieve data. Students are exposed to the concepts of time and space complexity of computer programmes.

Intended Learning Outcomes:
After the completion of this course student would be able to write efficient programme using different data structures.

Course Outline:

- Introduction to data structures (Basics of Data Structure: definition, types, operations performed, algorithms introduction)
- Arrays, Stacks,
- Queues, Priority Queues,
  Linked Lists, Double linked lists, circular
- Trees (types and traversals algorithms), Spanning Trees,
  Graphs and Traversals, isomorphoric graphs
- Strategies for choosing the appropriate data structure
  Recursion(tail, non-tail,indirect,nested), tail back tracking
- Searching algorithms (Linear and Binary search)
- Sorting algorithms (Bubble, Insertion, Selection, Quick sort, Radix sort etc)
- Hashing
- Storage and retrieval properties and techniques for the various data structures
- Complexity analysis, memory management and garbage collection

Reference Material:

1. Weiss, M.A. (Latest Edition). *Data Structures and Algorithm Analysis in Java.* Addison-Wesley
2. Sedgewick, R. (Latest Edition). *Algorithms in C++, Parts 1-4: Fundamentals, Data Structure, Sorting, Searching.* Addison-Wesley Professional.

Course Name: Digital Logic Design	**Course Code:** CSC421
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3

Prerequisites: Introduction to Information and Communication Technologies, Basic Electronics

Course Objectives:

This course introduces the concept of digital logic, gates and the digital circuits. Further, it focuses on the design and analysis combinational and sequential circuits. It also serves to familiarize the students with the logic design of basic computer hardware components.

Intended Learning Outcomes:

- Students will easily do conversion from one number system to another and will be able to do subtraction through addition.
- Students are expected to minimize a Boolean expression thus creating an efficient logic diagram for an operation.
- They will learn basic combinational and sequential circuits.

Course Outline:

- Overview of Number systems and conversions
- Boolean Algebra, Truth table, Switching algebra, and logic gates
- Simplification of Boolean functions
- Karnaugh Map and Quin-McCluskey methods,
- Combinational Design; two level NAND/NOR implementation, Tabular Minimization, Combinational Logic Design: adders, subtracters, code converters, parity checkers, multilevel NAND/NOR/XOR circuits,
- MSI Components, design and use of encoders, decoders, multiplexers,
- BCD adders, and comparators, Latches and flip-flops (RS, JK, D flip flop, master slave flip flop)
- Synchronous sequential circuit design and analysis, binary arithmetic and arithmetic circuit
- Registers,
- Synchronous and asynchronous counters,
- Memories, Control Logic Design,
- Modern trends in memory
- Trigged devices and types, introduction to programmable logic devices(CPLD,FPGA)
- **LAB Outline**
- Using tools like verilog, HDL/VHDL, Multisim etc.

Reference Material:

1. Morris, M.M., Ciletti, M.D.(Latest Edition). *Digital Design.* Prentice Hall.
2. Floyd, T.L. (Latest Edition). *Digital Fundamentals*. Floyd Publisher.

Course Name: Probability and Statistics	**Course Code:** STAT416
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3

Prerequisites: None

Course Objectives:

To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making.

Intended Learning Outcomes:

- This course will enable the students to understand the concept of probability, random

variables, and discrete distributions.
- They will be able to apply different probability techniques in problem solving and to forecast and predict about future happening keeping in mind the previous evidence.

Course Outline:
- Introduction to Statistics,
- Descriptive Statistics, Statistics in decision making,
- Graphical representation of Data Stem-and Lead plot,
- Box-Cox plots, measures of central tendencies and dispersion,
- moments of frequency distribution; Counting techniques,
- introduction to probability, sample space, events, laws of probability,
- Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric,
- Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses,
- Use of elementary statistical packages for explanatory Data analysis.

Reference Material:

1. Walpole, R.E., Myers, R.H. (Latest Edition). *Probability & Statistics for Engineers & Scientists.* Prentice Hall.
2. Devore, J.L.(Latest Edition). *Probability and Statistics for Engineering and the Sciences.* Duxbury Publishers.
3. Cowan, G.(Latest Edition). *Statistical Data Analysis*. Clarendon and Oxford.

Course Name: Technical and Business Writing	**Course Code:** ENG431
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:

To develop efficient literature survey, analysis, report writing and document designing skills.

Intended Learning Outcomes:
- By the end of the semester the students will be able to improve their effective learning skills and knowledge to: plan the structure of document to ensure correct information flow.
- The course will improve the students 'customer experience; they will be able to know how to interact with the customer**.**

Course Outline:
- Overview of technical reporting, use of library and information gathering,
- administering questionnaires, reviewing the gathered information.
- Technical exposition; topical arrangement, exemplification, definition, classification and division, casual analysis, effective exposition, technical narration, description and argumentation, persuasive strategy.
- Organizing information and generation solution: brainstorming, organizing material, construction of the formal outline, outlining conventions, electronic communication,

generation solutions.

- Polishing style: paragraphs, listening sentence structure, clarity, length and order, pomposity, empty words, pompous vocabulary,
- document design: document structure, preamble, summaries, abstracts, table of contents, footnotes, glossaries, cross-referencing, plagiarism, citation and bibliography, glossaries, index, appendices, typesetting systems, creating the professional report; elements, mechanical elements and graphical elements.
- Reports: Proposals, progress reports, Leaflets, brochures, handbooks, magazines articles, research papers, feasibility reports, project reports, technical research reports, manuals and documentation, thesis. Electronic documents, Linear verses hierarchical structure documents.

Reference Material:

1. Tony, G., and Arnold.(Latest Edition).*Research Methods, Guidance for Postgraduates.*

Course Name: Discrete Structures	**Course Code:** CSC404
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3

Prerequisites: None

Course Objectives:

Introduces the foundations of discrete mathematics as they apply to Computer Science, focusing on providing a solid theoretical foundation. Further, this course aims to develop an understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, iterative procedures, predicate calculus, tree and graph structures. In this course emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.

Intended Learning Outcomes:

After completing the course, the students will:

- Have an understanding of standard propositional logic and logic connectives
- Have an understanding of algorithm and their complexity
- Have an understanding of graphs and be able to solve real world problems using Computer Science

Course Outline:

- Introduction to logic, symbolic representation of statements, truth tables, logical equivalence, Laws of Logic
- Predicate Calculus, quantifiers
- Sets, set operations, Venn diagram, set identities, paradox
- Sequences, arithmetic sequence, geometric sequence
- Algorithms. Loop invariants, Complexity of Algorithms
- Methods of Proof: Direct proofs; proofs by contradiction
- Mathematical Induction
- Relations (Recursion)
- Relations
- Functions and relations, non functions, types of functions, composition of functions
- Recursion, recursively defined functions
- Elementary number Theory, Applications of number theory Cardinality and countability

- Pigeonhole principle
- Graphs, types of graphs, paths, circuits, walk, matrices, directed graphs, isomorphism of graphs, graph coloring
- Trees, types of trees, binary tree, representation of algebraic expressions by binary trees, spanning trees, minimal spanning tree, Kirchhoff's theorem
- Optimization, shortest path problem, network flow
- Discrete Probability, probability theory, Combinatorics, sum rule, product rule
- Negation, Conjunction, Disjunction, rules of interference, partial orderings and peano postulates

Reference Material:

1. Rosen, K.H. (Latest Edition*) Discrete Mathematics and Its Applications.* Mcgraw Hill Book Co.
2. Johnsonbaugh, R. (Latest Edition*) Discrete Mathematics.* Prentice Hall.
3. Kolman., Busby., Ross. (Latest Edition*) Discrete Mathematical Structures.* Prentice-Hall Publishers.
4. Grimaldi, R. P. (Latest Edition*) Discrete and Combinatorial Mathematics: An Applied Introduction*. Addison-Wesley Pub. Co.

Course Name: Computer Networks	**Course Code:** CSC414
Course Structure: 3, Labs: 0	**Credit Hours:** 3

Pre-requisite: Data Communication

Course Objectives:

To provide understanding of network, transport and application layer of the Internet model. In addition to this to provide basic knowledge of important network types

Intended Learning Outcomes:

- Students will understand how different types of messages are communicated between two devices at the upper three layers of the Internet model.
- Basic protocols at these three upper layers and addresses.

Course Outlines:

- Frame Relay, ATM, Ethernet, FDDI
- Network addressing, IPv4 and IP v6, Basic routing protocols
- UDP, TCP, SCTP
- SMTP, DNS, FTP and HTTP

Reference Material:

1. Forouzan, B.A. (Latest Edition). *Data Communications and Networking*
2. Stalling,W.(Latest Edition). Business *Data Communication*

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

DETAILED COURSE OUTLINE OF COMPUTER SCIENCE
BS (4 YEARS PROGRAM)

SEMESTER-IV

Course Name: Computer Organization and Assembly Language	**Course Code:**CSC431
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Digital Logic Design	

Course Objectives:

The main objective of this course is to introduce the organization of computer systems and usage of assembly language for optimization and control. Emphasis should be given to expose the low-level logic employed for problem solving while using assembly language as a tool. At the end of the course the students should be capable of writing moderately complex assembly language subroutines and interfacing them to any high level language.

Intended Learning Outcomes:

Students will be able to do programming at low level according to computer hardware.

Course Outline:

- Microprocessor Bus Structure: Addressing, Data and Control,
- Memory Organization and Structure (Segmented and Linear Models),
- Introduction to Registers and Flags,
- Data Movement, Arithmetic and Logic,
- Programme Control, Subroutines,
- Stack and its operation,
- Peripheral Control Interrupts,
- Interfacing with high level languages, Real-time application.
- Objectives and Perspectives of Assembly Language,
- Addressing Modes,
- Introduction to the Assembler and Debugger,
- Manipulate and translate machine and assembly code,
- Describe actions inside the processing chip,
- Discuss operations performed by an instruction set,
- Write a fully documented program using an assembler of choice

Reference Material:

1. Stallings,W.(Latest Edition). *Computer Organization & Architecture.* Prentice Hall.
2. Irvine (Latest Edition)..*Assembly Language for Intel-based Computers.* Prentice Hall.
3. Patterson,D.A., Hennessy.J.L.(Latest Edition*) Computer Organization and Design, the Hardware/Software Interface*. Elsevier Publishers.

Course Name: Multivariate Calculus	**Course Code:** MTH410
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Calculus and Analytical Geometry	

Course Objectives:

The goals are to develop the skills to have ground knowledge of multivariate calculus and appreciation for their further computer science courses.

Intended Learning Outcomes:

Students will be able: to apply mathematical and computational methods to range of application problems in multivariate calculus, evaluate partial derivations and multiple integrals of multivariate functions.

Course Outline:

- Functions of Several Variables and Partial Differentiation.
- Multiple Integrals, Line and Surface Integrals.
- Green's and Stoke's Theorem.
- Fourier Series: periodic functions, Functions of any period P-2L, Even & odd functions, Half Range expansions, Fourier Transform.
- Laplace Transform, Z-Transform.

Reference Material:

1. Stewart,J. (Latest Edition).*Multivariable Calculus*. Cengage Learning publishers.
2. Swokowski, Olinick,M., Pence, D.(*Latest Edition*). *Calculus and Analytical Geometry*. Thomson Learning EMEA, Ltd.
3. Anton,H, Herr,A.(Latest Edition). *Multivariable Calculus*. John Wiley.

Course Name: Operating Systems	**Course Code:** CSC432
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Data Structures	

Course Objectives:

To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible

Intended Learning Outcomes:

- Distinguish the fundamental components of operating system.
- They get knowledge of uni-tasking, multitasking, timesharing operating systems.
- Students are supposed to recognize various process scheduling mechanisms, benefits and drawbacks of concurrent programming.
- They learn causes of deadlock, its prevention and avoidance mechanisms.
- Management of real memory, virtual memory, input/output, processor and file management.

Course Outline:

- History and Goals,
- Evolution of multi-user systems,
- Process and CPU management,
- Multithreading, Kernel and User Modes, Protection, Problems of cooperative processes,

Synchronization,
- Deadlocks,
- Memory management and virtual memory, Relocation, External Fragmentation,
- Paging and Demand Paging,
- Secondary storage,
- Security and Protection,
- File systems, I/O systems,
- Introduction to distributed operating systems.
- Scheduling and dispatch,
- Introduction to concurrency.
- Control of disks and I/O devices

- Lab assignments involving different single and multithreaded OS algorithms.

Reference Material:

1. Silberschatz,A., Galvin,P.C., Peterson, J.L.(Latest Edition). *Applied Operating Systems Concepts.* Wiley & Sons,Inc.
2. Tanenbaum, A.S. (Latest Edition) *Modern Operating Systems*. Macmillan Pub. Co

Course Name: Database System	**Course Code:** CSC424
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Data structures	

Course Objectives:

The course aims to introduce basic database concepts, different data models, data storage and retrieval techniques and database design techniques. The course primarily focuses on relational data model and DBMS concepts.

Intended Learning Outcomes:

- After completing the course, the students will be familiar with data modelling concepts used in DB development
- Undertake and successfully complete logical data base design tasks.
- Be familiar with a broad range of data management issues, including data integrity, concurrency and security.

Course Outline:

- Basic database concepts; Entity Relationship modeling, Relational data model and algebra,
- Structured Query language; RDBMS; Database design, functional dependencies and normal forms; query optimization concepts
- Transaction processing and optimization concepts; concurrency control and recovery techniques; Database security and authorization.
- Small Group Project implementing a database.
- Physical database design: Storage and file structure; indexed files; b-trees; files with dense index; files with variable length records;

- Database efficiency and tuning.

Reference Material

1. Date, C.J. (Latest Edition*) Database Systems* Addison .Wesley Pub. Co.
2. Connolly, R., Begg, P.(Latest Edition*) Database Systems: A Practical Approach to Design, Implementation and Management.* Addison-Wesley Pub. Co .
3. Elmasri , Navathe.(Latest Edition*) Fundamentals of Database Systems.* Addison-Wesley

Course Name: Advanced Programming Language	**Course Code:** CSC425
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Object Oriented Programming I	

Course Objectives

As a senior level course aims at uplifting students approach and emphasizes upon development of applications/Applets/Servlets using JAVA language.

Intended Learning Outcomes

After completion of the course students will be able to develop Applet related applications using JAVA language.

Course Outline

- Introduction, Data Types, Syntax etc.
- Writing Simple Java Console Application
- Packages and Interface
- Exceptions, Checked and unchecked Exception
- Threads, Writing Java Application, The Java Class Libraries
- Interthread Communication, Deadlock Handling
- Writing Simple Applets
- Introduction to AWT and Applets, Use of AWT components in Java Application
- Event Delegation Modal
- Introduction to Servlets, Servlets Life Cycle
- Developing Basic Servlets
- Using doPost, doGet, Service according to HTML Form Methods
- SSI (Server Side Include), Session Management
- Data base connectivity
- Introduction to RMI and Java Beans
- Introduction to JBULIDER

Reference Material:

1. Schildt H., (Latest Edition).*The Complete Reference JAVA*.McGraw Hill.
2. Bayross, I., (Latest Edition). *Web enabled Commercial application development using JAVA*.BPS Publications.
3. Lewis, J., and Loftus, W., (Latest Edition).*JAVA software solutions.*Sddison.Wesley Longman,Inc.
4. Anderson, R., Francis, B.,(Latest Edition). *Programming in JAVA.* Wrox series Publications.

Course Name: Financial Accounting	**Course Code:** MS402
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:
To give the students basic concepts of accounting**.**

Intended Learning Outcomes
The students will be able to:

- Define, describe, apply and explain the meaning of key financial accounting terms, concepts and ideas
- Show an understanding of different accounting concepts for establishing businesses
- Conduct a business analysis from the perspective of different stakeholders

Course Outline

- Meaning of cash, reporting cash in balance sheet.
- Cash receipt and cash disbursement.
- Voucher System. Bank system.
- Reconciliation the bank statement.
- The cash budget as a control over department.
- Expenditure. Un-Collectable accounts.
- The allowance in doubtful accounts.
- Writing off un-collectable accounts.
- Accounts for notes receivable.
- Inventory defined.
- Cost flow assumption.
- Average Cost methods.
- First in First out method.
- Last in First in method.
- Plant and equipment, major categories. Determining the cost of Plant and Equipment .Cash expenditure and revenue Expenditure. Depreciation, causes, methods. Intangible assets. Characteristics, amortization, good will, patents, trade mark and trade names.
- Franchises copyrights. Natural resources. Accounting for natural resources. Current Liabilities. Accents payable, note payable and accrued liabilities, partnership contract, contract.
- Opening the account of new partnership, investment, drawing accounts, loan from partners. Closing the accounts of the partnership, income statement and statement of partner's capital. Admission withdrawal of a partner, liquidizes of a partner, corporation, advantage, disadvantages, common stock and proffered stock.
- Accounts for corporation.

Reference Material

1. Meigs, R.F., Williams, J.R.(Latest Edition). *Accounting.* McGraw Hill.

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DEPARTMENT OF COMPUTER SCIENCE

DETAILED COURSE OUTLINE OF COMPUTER SCIENCE
BS (4 YEARS PROGRAM)

SEMESTER-V

Course Name: Software Engineering	**Course Code:** CSC533
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives

The students will study techniques for software verification, validation and testing. They would also study reliability and performance issues in software design and development. Upon successful completion of this course the student will be to understand the importance of software engineering to computer science and the most important general approaches to structuring the software production process, analyze the requirements for a software system and produce a software design from requirements (Data Flow Diagram (DFD)), assess software productivity using metrics, use different testing techniques used in software engineering to test software systems, manage the important issues for planning a project.

Intended Learning Outcomes

The students will be able to discuss and apply:

- the main techniques for modelling and analysing software,
- the major software architectural paradigms,
- process models

Course Outline

- **Introduction to Software Engineering**
  - Introduction to Software and system Engineering
  - Types of software
- **Process Models**
  - Introduction to process
  - Introduction to models; usage; advantages And disadvantages
- **System Engineering**
  - Activities
  - Product Engineering
  - Information engineering
  - Business Process Engineering
- **Requirement Engineering**
  - Definition
  - Types of Requirements

- **Analysis Modeling**
  - Introduction to analysis
  - Techniques of Analysis
  - Steps of Analysis
  - Software configuration management
  - Umbrella Activities
  - Software requirement specification techniques
- **Design**
  - Design Concepts
  - Data design; architectural design, procedural design, component level design
  - Coupling
  - Cohesion
- **User Interface Design**
  - Guide lines
- **Testing Strategies**
  - Introduction
  - Principles
  - Types of Testing
- **Project Management**
  - Introduction
  - 4 P's of Project Management
  - Task set, CMM perspective, SDLC, SWOT analysis, FDD<UML and DFD's. Leveling and balancing, webapps interface design, maintainence and reengineering

Reference Material:

1. Pressman, R.(Latest Edition). *Software Engineering: A Practitioner's Approach*. McGraw-Hill.
2. Sommerville, I.(Latest Edition). *Software Engineering.* Addison-Wesley.

Course Name: Theory of Automation and Formal Languages	**Course Code:**CSC502
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Discrete Structures	

Course Objectives:

The course aims to develop an appreciation of the theoretical foundations of computer science through study of mathematical & abstract models of computers and the theory of formal languages. *Theory of formal languages* and use of various abstract machines as 'recognizers' and parsing will be studied for identifying/validating the synthetic characteristics of programming languages.

Intended Learning Outcomes:

After the completion of the course students will be able to:

- Construct and minimize automata;
- Construct an automaton for a given regular expression;

- Construct a pushdown automaton for a given context-free language;
- Construct a Turing machine deciding a given problem,
- Prove whether a language is or isn't regular or context-free by using the Pumping Lemma;
- Prove that a given context-free grammar generates a given context-free language;
- Prove undecidability of a given problem

Course Outline:

- Language definitions, preliminaries
- Regular expressions and languages, algebraic laws of regular expressions, application of regular expressions
- Finite Automata, transition table
- Transition graphs, Generalised transition graphs, nondeterminism
- Kleene's theorem, turning TG into RE, Converting RE into FA, Nondeterministic finite automata
- Finite Automata with output, comparison of automata
- Regular languages, closure properties, complements and intersections
- Nonregular languages, The pumping Lemma
- Context Free Grammars, Generative grammars, Tress, Ambiguity, Total language tree
- Pushdown Automata
- Context free languages, closure properties, complements and intersections, mixing context free and regular languages
- Grammatical Format, regular grammars, Chomsky Normal Form, Leftmost derivations
- Decidability, emptiness, uselessness, finiteness, the CYK algorithm, parsing simple arithmetic
- Turing Machines, subprogrammes
- Post machines, Simulating PM on TM, Simulating TM on PM
- Variations on the TM
- TM Encoding
- Universal TM
- Chomsky Hierarchy, Chomsky hierarchy of grammars
- Defining Computers by TM, computable functions, TM as language generators
- Non regular grammar and PDA, context sensitive language, grammar and linear bound algebra

Reference Material

1. Linz, P.(Latest Edition*) An Introduction to Formal Languages and Automata.* Jones & Bartlett Publishers.
2. Eugene, S.P., Kavier.(Latest Edition.).*Theory of Automata, Formal Languages and Computation.* New Age Publishers.
3. Hopcroft, J., Ullman,J .(Latest Edition*) Introduction to Automata Theory, Languages, and Computation*. Addison-Wesley.
4. Martin,J.C.(Latest edition). *Introduction to Languages and the Theory of Computation.* McGraw-Hill.

Course Name: Computer Architecture	**Course Code:**CSC542
Course Structure: Lectures:3, Labs: 0	**Credit Hours:** 3
Prerequisites: Digital Logic and Design	

Course Objectives

Get a deeper understanding of how computers work, working knowledge of various subsystems and the general principles that affect their performance, analyze the performance of systems and quantify the performance measurements, fundamentals of all technologies, and advanced architectural features that boost the performance of computers.

Intended Learning Outcomes

Students would have in-depth understanding of internal structure and working of computer system**.**

Course Outline

- Introduction and Performance
  - Technology trends
  - Measuring CPU performance
  - Amdahl's law and averaging performance metrics
- Instruction Sets
  - Components of an instruction set
  - Understanding instruction sets from an implementation perspective
  - RISC and CISC and example instruction sets
- Computer Arithmetic
  - Ripple carry, carry lookahead, and other adder designs
  - ALU and Shifters
  - Floating-point arithmetic and floating-point hardware design
- Datapath and Control
  - Single-cycle and multi-cycle datapaths
  - Control of datapaths and implementing control finite-state machines
- Pipelining
  - Basic pipelined datapath and control
  - Data dependences, data hazards, bypassing, code scheduling
  - Branch hazards, delayed branches, branch prediction
- Memory Hierarchies
  - Caches (direct mapped, fully associative, set associative)
  - Main memories
  - Memory hierarchy performance metrics and their use
  - Virtual memory, address translation, TLBs
- Input and Output
  - Common I/O device types and characteristics
  - Memory mapped I/O, DMA, program-controlled I/O, polling, interrupts
  - Networks
- Multiprocessors
  - Introduction to multiprocessors
  - Cache coherence problem

  Exception handling, Parallelism, multiprogramming, design of computer systems and

components

Reference Material

1. Patterson, H., Kauffman, M., (Latest edition). *Computer Architecture: A Quantitative Approach.*
2. Patterson, H., Kauffman, M., (Latest edition). *Computer Organization & Design: The Hardware/Software Interface.*

Course Name: Psychology	**Course Code:** PSY516
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives

To get the basics of Psychology and human behavior.

Intended Learning Outcomes

The students will be able to:

- Apply psychological theory to the development of interactive systems and
- In establishing innovative ideas

Course Outline

- Understanding Psychology: subject matter of psychology, scope of psychology, development of psychology as a science, school of psychology, fields of psychology,
- current prospective of psychology
- Psychology as a science of bio-social behavior, the relation of psychology with biological and social sciences.
- Methodology, major research methods, the experimental methods, the correlation method, non experimental method, ethical principle in psychological research.
- Attention, the nature of attention, conditions of attention, span of attention. Learning, learning and maturation, methods of learning, principles of classical conditioning ,operant/instrumental conditioning, cognitive and special learning ,observational learning, place learning, tool learning, factors of influencing learning, learning curves.
- Memory: What is memory, span of memory, stages of memory, memory system, retention and forgetting, forgetting, modifying memory capabilities, cognation ,thinking, reasoning, judgment and decision making, use of heuristics in making judgment, problem solving, improving problem solving strategies, creativity.
- Intelligence and intelligence testing, individual differences, in intelligence, theories of intelligence, the measurement of intelligence, characteristics of a psychological test, types of intelligence test. Behavioral disorders; basic causes of abnormal behavior, reaction to life stress.

Reference Material:

1. Riaz, M.N.(Latest Edition).*Psychology.* Oxford University Press.

Course Name: Differential Equations	**Course Code:** MTH510
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Calculus and Analytical Geometry	

Course Objectives:
Develop fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems

Intended Learning Outcomes:
Students will be able to solve 1st and 2nd order ODES, able to apply ODES in computer applications, solve ODES such as Laplace, heat and wave equations using separation of variables.

Course Outline:

- Ordinary Differential Equations of the First Order: Geometrical Considerations, Isoclines, Separable Equations, Equations Reducible to Separable Form, Exact Differential Equations, Integrating Factors, Linear First-Order Differential Equations, Variation of Parameters.
- Ordinary Linear Differential Equations; Homogeneous Linear Equations of the Second Order, Homogeneous Second-Order Equations with Constant Coefficients, General Solution, Real Roots, Complex Roots, Double Root of the Characteristic Equation, Differential Operators, Cauchy Equation, Homogeneous Linear Equations of Arbitrary Order, Homogeneous Linear Equations of Arbitrary Order with Constant Coefficients, Non-homogeneous Linear Equations.
- Modeling of Electrical Circuits. Systems of Differential Equations.
- Series Solutions of Differential Equations.
- Partial Differential Equations: Method of Separation of variables, wave, Heat & Laplace equations and their solutions by Fourier series method.

Reference Material

1. Greenberg, M. D. (Latest Edition*).Advanced Engineering Mathematics.* Prentice Hall publishers.
2. Kreyszig, E. (Latest Edition). *Advanced Engineering Mathematics.* John Wiley & Sons Inc.
3. Zill, D.G., Prindle, Weber, Schmidt.(Latest Edition).*A First Course in Differential Equation.* Brooks/Cole Publishing,
4. Zill, D.G., Cullen, M.R. (Latest Edition). *Differential Equations with Boundary-Value Problems*, , Brooks/Cole Publishing,
5. Edwards, C.H., Penney., David, E. (Latest Edition). Penney. *Elementary Differential Equations With Applications*, Prentice Hall.

Course Name: Human Resource Management	**Course Code:** MS504
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives
The aim of this course is to focus on planning and recruitment of right people at right place at right time.

Intended Learning Outcomes
At the end of the course the student will be able to do analysis in proper way optimize the system, making it error free, and concentrate on quality using traditional and object oriented software

engineering concepts.

Course Outline

- Concept of Human Resource management, Human Resource Challengers, Human Resource Function, Philosophical Approaches to Human Resource management,
- Job Design Analysis: An overview of job design, Techniques of job design, job analysis, Application of job analysis.
- Human Resource Planning & Recruitment :Significance of human resource planning , the planning process , the implementation of program , Recruitment , Evolution -Significance, Constraints and challenges, recruitment &selection policy issues, source of recruitment,
- Training & Development: Significance of training & development , principles of training &development Training & development methods, Evaluation of training and development
- Motivation & Reward System: Concept of motivation, reward systems, Motivation through job design, Motivation through employee participation, other motivation techniques.
- Performance Appraisal**:** Appraisal definition and application basic consideration in appraisal, appraisal methods, and legal issues for appraisal, appraisal challenges.
- Compensation for administrators and professionals financial benefits and other services. Environmental influence.

Reference Material:

1. Stanton, (Latest Edition).*Fundamentals of Marketing*, McGraw Hill Companies.
2. Philip, K .M*arketing Management, Analysis, Planning, Control*. Prentice Hill.

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DEPARTMENT OF COMPUTER SCIENCE

DETAILED COURSE OUTLINE OF COMPUTER SCIENCE BS (4 YEARS PROGRAM)

SEMESTER-VI

Course Name: Object Oriented Analysis and Design	**Course Code:**CSC523
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Object Oriented Paradigm/Programming, Software Engineering	

Course Objectives

To study how to produce detailed object models and design from the system requirements; use the modeling concepts provided by UML; identify use cases and expand them into full behavioral design; expand the analysis in into a design ready for implementation and construct design that are reliable.

Intended Learning Outcomes

At the end of the course the student will be able: apply different object oriented techniques, apply UML on any system.

Course Outline

- **Principles of Object Technology**
  - Introduction to object Technology
  - Principles of Object Orientation
  - Principles of modeling with UML
  - Modeling System behavior with use cases
  - Finding classes
  - Object collaborations
  - Interaction diagrams; class diagrams; state diagrams
- **Fundamental of Business Modeling**
  - Introduction to Business Modeling
  - Using the unified modeling language
  - Business Modeling Process
  - From Behavior Modeling to System Modeling
  - Project Examples
- **Fundamentals of Rational Rose**
  - Rose Modeling Basics
  - Construction of Use Cases modeling in Rose
  - Use Case realization Structure
  - Interaction Diagrams; Class diagrams
  - Introduction to Round Trip Engineering
- **Object Oriented Analysis with UML**
  - Modeling System Behavior with use cases
  - Analysis and design overview

- Architectural Analysis
- Distribute behavior to classes
- Review the analysis Model

- **Object Oriented Design with UML**
  - Identify design elements
  - Identify design mechanisms
  - Incorporate existing design elements
  - Describe the run time architecture
  - Describe distribution
  - Patterns
  - Use case design
  - Sub-system design
  - Class diagram; class structure; modeling state; class relationship
  - Implementation overview
  - Structure and implementation model

Reference Material:

1. *Larmen, C.*, (Latest Edition). *Applying UML and patterns*

Course Name: Computer Graphics	**Course Code:**CSC525
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3

Prerequisites: Object Oriented Programming I, Linear Algebra, Calculus and Analytical Geometry

Course Objectives:

This course is designed to provide a comprehensive introduction to computer graphics, learn concepts of computer graphics and its algorithms. The aim is to learn concepts of illumination, animation, shading and geometrical transformations. This will lead to the ability to understand contemporary terminology, progress, issues, and trends in computer graphics.

Intended Learning Outcomes:

- After completion of the course students will be able to:
- Have an understanding of the concepts of computer graphics
- Be able to implement the concepts of computer graphics on a suitable platform

Course Outline:

- Introduction, Applications of Computer Graphics, Overview of Image Representation
- Graphics Hardware, Applications of Graphics, Image resolution, Image quality issues, Cathode Ray Tubes, Vector Display Devices, Colour Lookup Table, LCD Technology, Plasama, classes of logical input devices, Physical input devices, Interactive Devices
- Scan-converting point, lines, ellipse, arcs and sectors, polygon, characters and circles
- Line Drawing Algorithm: Digital Differential Analyzer, Bresenham's, Circle Drawing: mid-point, Line Algorithms
- Scaling, Rotation, Translation, composite transformations: 2D and 3D

- Region Filling, aliasing effects, anti-aliasing, image compression
- Window to Viewport mapping, 2-D Clipping, point clipping, line clipping, polygon clipping
- Panning and Zooming
- Projections: Taxonomy of projection, perspective projection orthogonal projection
- Advanced geometric and Raster Algorithms, Clipping scan converting primitives, special problems with text, making copyPixel fast, Page description languages
- Hidden Surfaces, depth comparisons, Z-buffer algorithm, Back-Face Removal, Scan-line algorithm, Hidden Line Elimination, Rendering of mathematical surfaces
- Curve and Surface Design, simple geometric forms, wireframe models, curved surfaces, curve design, polynomial basis function, curved-surface design
- Rendering, Shading, Phong Model, Colour and Animation, basic rules of animation
- Ray tracing, the Pinhole Camera, Ray-surface intersection, A recursive ray tracer
- Hardware for interactive graphics: fundamental graphics unit, rasterizer, pixel driver
- Segmentation, two and three dimensional image geometry and transformation

Reference Material:

1. Foley, J.D., Dam,A.V., Feiner,S.K., Hughes,J.F. (Latest edition) *Computer Graphics, Principles and Practice.* Addison-Wesley .

2. Hill,. F.S. (Latest edition) *Computer Graphics*. MacMillan.

3. Burger,P., Gillies,D.F. (Latest edition). *Interactive Computer Graphics: Functional, Procedural and Device-level methods.* Addison-Wesley.

Course Name: Human Computer Interaction	**Course Code:**CSC533
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Data Structures	

Course Objectives:

This course introduces the human issues of usability and its importance. It considers the implications of human understanding on the usability of computer systems and the importance of understanding the context of use. It describes guidelines for use of different media and interface styles.

Intended Learning Outcomes:

After completion of the course students will be able to understand different media and interface styles and able to develop interactive systems.

Course Outline:

- Introduction to Human Computer Interaction
- The Human, input-output channels, Human memory, reasoning and problem solving, Emotion, Individual differences, psychology and the design of interactive systems
- The Computer, text entry devices, positioning, pointing and drawing, Display Devices, Devices for virtual and 3D interaction, Physical controls sensors and special devices, printing and scanning, Memory, processing and networks
- The Interaction, Models of Interaction, Frameworks and HCI, Ergonomics, Interaction Styles, Elements of the WIMP Interface, Interactivity, The context of the interaction
- Usability paradigm and principles, paradigms of interaction

- Interaction Design Basics, The process of design, Scenarios, Navigation design, screen design and layout, Iteration and prototyping
- HCI in Software Process, Software life cycle, usability engineering, Interactive design and prototyping, design rationale
- Design Rules, Principles to support usability, Standards, Guidelines, Introduction to Golden rules and heuristics, HCI Patterns
- Introduction to Implementation Support, Elements of Windowing Systems, Programming the application, Introduction to using toolkits and User Interface Management Systems
- Evaluation Techniques, Goals of Evaluation, Evaluation through Expert Analysis and user participation, Choosing an Evaluation method
- Universal Design, Universal Design principles, Multi-modal interaction, designing for diversity
- User Support, requirements of user support, approaches to user support, adaptive help systems, designing user support systems
- Communication and Collaboration Models, face-to-face communication, conversation, text-based communication, group working
- Task Analysis, difference between task analysis and other techniques, task decomposition, knowledge-based analysis, entity-relationship based techniques, Source of information and data collection, Uses of task analysis
- Introduction to Groupware and ubiquitous computing

Reference Material

1. Dix ,A., Finlay,J.E. , Abowd,G.D. ,, Beale,R**.** (Latest edition). *University of Birmingham. Human-Computer Interaction* .Prentice Hall
2. Shneiderman, B, Plaisant,C.(Latest edition). *Designing the User Interface: Strategies for Effective Human-Computer Interaction.* Addison-Wesley.

Course Name: Compiler Construction	**Course Code:**CSC513
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Theory of Automata and Formal Languages	

Course Objectives

At the end of the course students should understand the overall structure of a compiler, and will know significant details of a number of important techniques commonly used. They will be aware of the way in which language features raise challenges for compiler builders.

Intended Learning Outcomes

After the completion of this course students would have clear understand of the purpose and function of each part of the compiler and how they are related with each other and their implementation

Course Outline

- Compiler techniques and methodology.
- Organization of compilers.
- Lexical and syntax analysis.
- Parsing techniques. Types of parsers, top down and bottom up parsing
- Object code generation and optimization, detection and recovery from errors.
- Contrast between compilers and interpreters.
- Type checking, semantic analyzer

Reference Material

1. Aho,A.V., Sethi, R.,Ullman,J.D. (Latest Edition). *Compilers: Principles, Techniques, and Tools.* Addison-Wesley Pub. Co.
2. Grune,D., Bal, H.E., Jacobs,C.J. ,Langendoen,K.G.,Wiley,J. (Latest Edition).*Modern Compiler Design*.
3. Appel, A.W.,Ginsburg,.M.. (Latest Edition).*Modern Compiler Implementation in C.* Cambridge University Press.
4. Grune,D., Bal,.H.E., Jacobs,C.J., Langendoen,K.G. (Latest Edition). *Modern Compiler Design* .John Wiley & Sons.

Course Name: Entrepreneurship	**Course Code:** MS503
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Financial Accounting, Human Resource Management	

Course Objectives:

This course is designed for students interested in learning about the fundamental issues related to starting and managing technology-based new ventures. The course encourages students to consider how technology-based solutions can solve economic and socially oriented problems. The course prepares students for more intensive entrepreneurship courses, such as Venture Creation and Entrepreneurial Growth Strategies, which focus on testing, developing and growing new businesses.

Intended learning outcomes:

- to provide students with an exposure to the concepts of entrepreneurship and exposure to an entrepreneurial career
- to provide students with exposure to real world entrepreneurs from the business community
- to provide students with an opportunity to develop tangible business skills, such as business writing, presentation skills and business planning

Course Outline:

Scientists and Engineers as Entrepreneurs

- The Transition to Entrepreneurship
- Why Study Entrepreneurship?
- The Role of Innovation and Entrepreneurship
- The Commercialization Process

Recognizing and Screening Technology Opportunities

- Opportunity Recognition and Creation
- Sources of Opportunity
- Screening Technology Opportunities

Designing and Developing a Technology Start-up

- Developing an Effective Business Plan
- What is a Business Plan?
- Pitfalls to Avoid in Planning Benefits of a Business Plan
- Developing a Well- Conceived Business Plan
- Elements of a Business Plan Updating the Business Plan

- Presentation of the Business Plan: The "Pitch"
- Developing a Business Concept
- Conducting a Feasibility Analysis
- Is This Business Feasible?

Building an Effective Team

- Forming an Effective Founding Team
- Extending the Founding Team
- The Move from Start-Up to Rapid Growth

Developing and Protecting Intellectual Property

- The Concept of Intellectual Property
- The Theory behind IP Protections
- Trade secrets
- Copyrights
- Trademarks
- Patents

Patent and Trademark Strategy

- Protecting Patents
- Understanding Patent Infringement
- Protecting Trademarks
- The License Agreement

Technology Entrepreneurship Strategy

- High Technology Product Development Strategies
- Entrepreneurial Product Development Model
- Outsourcing Technology Innovation
- Developing a Regulatory Strategy

Technology Transition and Entry Strategies

- Transitioning from Project to Operations
- Deciding on a Launch Strategy
- Deciding on an Operational Strategy
- Organizing from a Legal Perspective

Technology Adoption Patterns and Marketing Strategy

- The Nature of High Technology Markets
- The Technology Adoption Cycle
- Determining a Marketing Approach
- Pricing High-Technology Products
- Developing a Marketing Plan
- Promoting High-Technology Products

Start-Up Financial Strategy

- **The Business Model**

- Developing a Business Model
- Understanding Why Business Models Fail

Funding the Technology Start-up

- Risks and Stages of Funding
- The Cost of Raising Capital
- Government Funding Sources
- Seed Capital
- Start-up Funding
- Funding Biotechnology

Reference Material:

1) Kathleen, A. (Latest edition) *Technology entrepreneurship for scientists and engineers*. Prentice Hall

Course Name: Economics	**Course Code:** ECON501
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives:

The course is designed for the beginners with either no formal background or very little acquaintance with economics. The objective is to give the students a clear understanding of the basic concepts, tools of analysis and terminologies used in microeconomics. Emphasis will be on the use of graphs, diagrams and numerical tables/schedules for exposition. The teacher is expected to draw examples from the surrounding world to clarify the concept.

Intended Learning Outcomes

The students will be able to:

- Apply the concepts of economics in their professions
- Identify key indicators and measures of economics change, growth, and development.
- Identify and discuss the key concepts underlying comparative advantage
- Identify and explain major types of market failures.

Course Outline:

- **Introduction**

  An overview of the social system, Economy as integral part of the social system, Economic agents and economic problem, Economics as a science of choices between competing wants and limited resources, Classification of economics, Importance and scope of micro-economics, Basic concepts: Commodities, Income and Resources, Production and Consumption, Exchange and Distribution.

- **The Price Mechanism**

  The concept of a market economy, Laws of demand and supply, schedules & graphs of demand and supply, Market equilibrium and determination of price, Movement along

and shifting of demand and 13 supply curves, Concept of elasticity of demand and supply, Importance of elasticity.

- **Consumer's Behavior**

  Consumers/ households as economic agents, Problem of the consumers, The utility theory, Laws of diminishing marginal utility and equi-marginal utilities, Budget constraint and consumer's equilibrium, Individual demand and market demand, Introduction to demand elasticity.

- **Firms and Industries**

  Business enterprises, Forms of business organization: Proprietorship, Partnership, Joint stock companies and Multi-national corporations, Classification of the firms, Production and supply of commodities (goods and services), Objectives of the firm: The profit motive, Output maximization and cost minimization, Industrial structure & market supply.

- **Production and Cost Functions**

  Production function, Primary inputs: factors of production, Secondary/intermediate inputs: Raw material and energy, The laws of returns, Revenues of the firm: total, average and marginal revenues, Cost function: Total, average and marginal costs, Short-run and Long-run costs, Equilibrium of the firm.

- **Market Structure**

  Classification of markets according to nature of commodity, extent, time and degree of competition, Perfect competition among buyers and sellers, Imperfect competition: Monopoly and Monoposony, Monopolistic competition, Price determination, The need for market regulation and role of the government, Public goods and their provision beyond the market.

Reference Material:

1. Mankiw, G. (Latest Edition).*Principles of Economics*. South-West Publishers.
2. Samuelson and Nordrons. (Latest Edition). *Economics*. New Delhi: McGraw Hill.
3. McConnel and Bruce. ((Latest Edition). *Principles of Economics*. New Delhi: McGraw Hill
4. Lipsey and Goerant. (Latest Edition).*Principles of Economics*. Oxford University Press.

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

DETAILED COURSE OUTLINE OF COMPUTER SCIENCE BS (4 YEARS PROGRAM)

SEMESTER - VII

Course Name: Numerical Computing	**Course Code:** MTH610
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Programming Fundamentals, Calculus and Analytical geometry	

Course Objectives

On completion of this unit, students will be able to demonstrate programming proficiency using structured programming techniques to implement numerical methods for solutions using computer-based programming techniques. Using MATLAB for all methods. The course must serve the purpose of scientific software development for science and engineering problems.

Intended Learning Outcomes

Students will be able:

- to understand the computational errors and numerical stability, select appropriate numerical methods for particular problem of interpolation, integration as well as solving single non-linear equation
- to perform analysis on stability and convergence of basic numerical methods.

Course Outline

- The concepts of efficiency, reliability and accuracy of a method.
- Minimizing computational errors.
- Theory of Differences, Difference Operators, Difference Tables, Forward Differences, Backward Differences and Central Differences.
- Mathematical Preliminaries, Solution of Equations in one variable, Interpolation and Polynomial Approximation, Numerical Differentiation and Numerical Integration, Initial Value Problems for Ordinary D differential Equations,
- Direct Methods for Solving Linear Systems, Iterative Techniques in Matrix Algebra, and Solution of non-linear equations.

Reference Material

1. Dahlquist,G.,Björck,A.(Latest Edition). *Numerical Methods in Scientific Computing.* SIAM
2. Heinbockel,J.H. (Latest Edition). *Numerical Methods for Scientific Computing.*
3. Khubaza,I.A. (Latest Edition). *Numerical Analysis*. Pergamon Press.
4. Fairs,J.D., Barden,R.L. (Latest Edition). *Numerical Analysis.* Brooks/Cole Pub Co
5. Gerald,C.F. (Latest Edition). *Numerical Analysis.*

Course Name: Analysis of Algorithms	**Course Code:**CSC645
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Discrete Structure, Data Structures	

Course Objectives:

Detailed study of the basic notions of the design of algorithms and the underlying data structures. Several measures of complexity are introduced. Emphasis on the structure, complexity, and efficiency of algorithms.

Intended Learning Outcomes:

After the completion of this course students would be able to write/analyze efficient algorithms in term of computation time, computer memory and size of input.

Course Outline:

- Introduction to algorithms and its application in different fields
- Asymptotic notations
- Logarithmic functions, exponential functions, Fibonacci functions, modulus functions, strictly and monotonically increasing and decreasing functions
- Recursive functions and their analysis
- Sorting algorithms and their analysis
- Divide-and-conquer sort , bubble sort, insert sort, quick sort, merge sort and linear sorting algorithms
- DAT and HASH tables and applying different functions on them.
- Search trees; Heaps; Greedy approach; Dynamic programming;
- Graph algorithms; Shortest paths finding algorithms
- Difference between NP hard and NP complete problems
- Network flaw, disjoint sets, polynomial and matrix calculations, string matching and approximation algorithms

Reference Material:

1. Cormen,T.H., Leiserson, C.E., Rivest,R.L.(Latest Edition). *Introduction to Algorithms.* NY: McGraw-Hill.

Course Name: Network Security	**Course Code:** CSC625
Course Structure: Lectures:3, Labs: 0	**Credit Hours:** 3
Prerequisites: Computer Networks	

Course Objectives

At the end of the course the student should acquire the following learning outcomes: To show the ability to demonstrate different aspects of e-mail and network security. To show the ability to encrypt “PlainText” into “CipherText” and vice versa, using different encryption algorithms. The ability to understand a given ciphering algorithm and to analyze it.

Intended Learning Outcomes

The student will be familiar with:

- Computer Network Security Architecture.
- Computer Network Security Tools.
- Computer Network Security Threats.

Course Outline

- Introduction;
- Cryptology and simple cryptosystems;
- Conventional encryption techniques; S
- tream and block ciphers; DES; More on Block Ciphers;
- The Advanced Encryption Standard.
- Confidentiality & Message authentication:
- Hash functions;
- Number theory and algorithm complexity;
- Public key Encryption.
- RSA and Discrete Logarithms; Elliptic curves; Digital signatures.
- Key management schemes; Identification schemes; Dial-up security.
- E-mail security, PGP, S-MIME;
- Kerberos and directory authentication.
- Emerging Internet security standards; SET; SSL and IPsec;
- VPNs; Firewalls; Viruses; Miscellaneous topics.

Reference Material

1. Stallings, W. (Latest Edition).*Cryptography and Network Security*, Prentice Hall .
2. Kaufman, C., Perlman, R., Speciner, M.(Latest Edition). *Network Security: Private Communication in a Public World.* Prentice Hall
3. Bishop, M.(Latest Edition). *Computer Security: Art and Science*. Addison-Wesley.
4. Stinson, D.(Latest Edition). *Cryptography: Theory and Practice.* CRC Press, FL:Boca Raton.
5. Mollin, R.A.(Latest Edition). *An Introduction to Cryptography*, Chapman and Hall/CRC.
6. Schneier, B.(Latest Edition). *Applied Cryptography*. *NY:* John Wiley and Sons.
7. Menezes, A., Oorshcot, P., Vanstone,S. (Latest Edition). .*Handbook of Applied Cryptography*. CRC Press, FL: Boca Raton.

Course Name: Professional Practices	**Course Code:**CSC601
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: None	

Course Objectives

A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies.

Intended Learning Outcomes

Student will get familiar with the ethics and different laws, in the use of computer field.

Course Outline

- Historical, social, and economic context of Computing (software engineering, Computer Science, Information Technology);
- Definitions of Computing (software engineering, Computer Science, Information Technology)

- Subject areas and professional activities;
- professional societies; professional ethics;
- professional competency and life-long learning; uses, misuses, and risks of software;
- information security and privacy;
- business practices and the economics of software;
- intellectual property and software law (cyber law);
- social responsibilities, software related contracts,
- Software house organization.

Reference Material

1. Taylor & Francis. (Latest Edition).*Professional Issues in Software Engineering.*

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR
DEPARTMENT OF COMPUTER SCIENCE

DETAILED COURSE OUTLINE OF COMPUTER SCIENCE
BS (4 YEARS PROGRAM)

SEMESTER-VIII

Course Name: Artificial Intelligence	**Course Code:**CSC612
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Discrete Structures	

Course Objectives

This course studies four main objectives of AI. Modeling the environment by constructing computer representations of the real world. Perception and reasoning - obtaining and creating information/***knowledge*** to populate a computational representation. Taking actions by using the knowledge of the environment and desired goals to plan and execute actions. Learning from past experience.

Intended Learning Outcomes

After the completion of the course, the students will be able to:

- Develop an understanding of the role of AI in various fields of life
- Understand the thinking, reasoning capabilities and expertise of human beings
- Learn various tools for representing human intelligence and expertise in machines
- Knowledge about structure and working of expert systems, and robotics.

Course Outline

- Artificial Intelligence: Cybernetic intelligence
- Introduction, Intelligent Agents.
- Problem-solving: Solving Problems by Searching, Informed Search and Exploration,
- Constraint Satisfaction Problems,
- Adversarial Search.
- Knowledge and reasoning: Logical Agents, First-Order Logic, Inference in First-Order Logic,
- Knowledge Representation.
- Planning and Acting in the Real World.
- Uncertain knowledge and reasoning: Uncertainty, Probabilistic Reasoning,
- Probabilistic Reasoning over Time, Making Simple Decisions,
- Making Complex Decisions.
- Learning: Learning from Observations, Knowledge in Learning, Statistical Learning Methods, Reinforcement Learning.
- Communicating, perceiving, and acting: Communication, Probabilistic Language Processing, Perception and Robotics.
- Introduction to LISP/PROLOG and Expert Systems (ES) and Applications.
- Artificial general intelligence, Issues in safe AI, Introduction to cognitive and conscious

systems
Reference Material 1. Luger, G.F. (Latest Edition*).Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. Pearson Education. 2. Russell, S.J., Norvig,P., Canny ,J.F. (Latest Edition). *Artificial Intelligence: A Modern Approach.* Prentice Hall.

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DETAILED COURSE OUTLINE OF COMPUTER SCIENCE
BS (4 YEARS PROGRAM)

DETAIL OF ELECTIVE COURSES
(ONE HAS TO BE SELECTED IN SEMESTER 7TH AND TWO IN SEMESTER 8TH)

Course Name: Software Project Management	**Course Code:**CSC644
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Software Engineering	

Course Objectives:

This course aims to cover the basics:

- Deliver successful software projects that support organization's strategic goals
- Match organizational needs to the most effective software development model
- Plan and manage projects at each stage of the software development life cycle (SDLC)
- Create project plans that address real-world management challenges
- Develop the skills for tracking and controlling software deliverables

Intended Learning Outcomes:

To be able to define, discuss and apply:

- Cost-benefit analysis techniques.
- Software process models: their advantages and disadvantages
- Software estimation techniques
- Activity planning techniques
- Project management issues
- Some of the legal aspects that affect software projects

Course Outline:

- Introduction to software project management
- Project evaluation and program management
- An overview of project planning
- Selection of an appropriate project approach
- Software effort estimation
- Activity planning
- Risk management
- Resource allocation

- Monitoring and control
- Managing contracts
- Managing people in software environments
- Working in teams
- Software quality

Reference Material

1. Hughes,B., and Cotterell,M. (Latest Edition) *Software project Management* .
2. Henry,J., *Software Project Management*, Pearson Education.
3. Jalote,P., Software Project Management in practice, Pearson Education. (Latest Edition)
4. Royce,W., *Software Project Management – A Unified Framework*, Addison Weslay

Web Resources: http://www.columbia.edu/~jm2217/

Course Name: Data Warehousing	**Course Code:** CSC635
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Database System	

Course Objectives

To provide the Introduction of Data warehouse and its purpose. And enable the students to understand different features / issues in data warehousing and its designing.

Intended Learning Outcomes

Students will have knowledge of difference of OLTP and OLAP and their working.

Course Outline

- Introduction to Data Warehouse and Data Marts,
- Comparison of OLTP Systems & Data Warehousing,
- Data Warehouse Architecture,
- Dimensional Modeling,
- Comparison of DM & ER Models, Extraction,
- Cleansing and Loading process and techniques,
- Designing a Data warehouse, End user tools, OLAP.
  Difference between TPS and DSS environments, data extraction, transformation and loading(ETL and ELT), data marts, difference between data mart and data warehouse, data warehouse design methodology, demoralization, data aggregation, indexing techniques used in data warehousing, hardware and software system consideration for data warehousing, data warehouse maintenance.

Reference Material

1. Berson, A. Smith, S.J**.** (Latest Edition). *Data warehousing, Data mining and OLAP*. Tata McGraw Hill.
2. Ponniah, P., (Latest Edition). *Data warehousing*
3. Anahory, S. and Murray, D. (Latest Edition). *Data warehousing in the real world*

Course Name: Data Mining	**Course Code:** CSC634
Course Structure: Lectures: 3, Labs: 0	**Credit Hours:** 3
Prerequisites: Database System	

Course Objectives:

The course aims to develop a comprehensive coverage of well-known Data Mining topics including classification, clustering and association rules. A number of specific algorithms and techniques under each category will be discussed. Methods for feature selection, dimensionality reduction and performance evaluation will also be covered. Students will learn and work with appropriate software tools and packages in the laboratory.

Intended Learning Outcomes:

After the completion of the course students will be able to:

- Display a comprehensive understanding of different data mining tasks and the algorithms most appropriate for addressing them.
- Evaluate models/algorithms with respect to their accuracy.
- Demonstrate capacity to perform a self-directed piece of practical work that requires the application of data mining techniques.
- Critique the results of a data mining exercise.
- Develop hypotheses based on the analysis of the results obtained and test them.
- Conceptualize a data mining solution to a practical problem.

Course Outline:

- Introduction to Data Mining
    - What is data mining?
    - Related technologies - Machine Learning, DBMS, OLAP, Statistics
    - Data Mining Goals
    - Stages of the Data Mining Process
    - Data Mining Techniques
    - Knowledge Representation Methods
    - Applications
    - Example: weather data
- Data Warehouse and OLAP
    - Data Warehouse and DBMS
    - Multidimensional data model
    - OLAP operations
    - Example: loan data set
- Data preprocessing and premining(noisy and missing data, data normalization)
    - Data cleaning
    - Data transformation
    - Data reduction
    - Discretization and generating concept hierarchies

- Installing Weka 3 Data Mining System
- Experiments with Weka - filters, discretization

- Data mining knowledge representation

  - Task relevant data
  - Background knowledge
  - Interestingness measures
  - Representing input data and output knowledge
  - Visualization techniques
  - Experiments with Weka - visualization

- Attribute-oriented analysis

  - Attribute generalization
  - Attribute relevance
  - Class comparison
  - Statistical measures
  - Experiments with Weka - using filters and statistics

- Data mining algorithms: Association rules

  - Motivation and terminology
  - Example: mining weather data
  - Basic idea: item sets
  - Generating item sets and rules efficiently
  - Correlation analysis
  - Experiments with Weka - mining association rules

- Data mining algorithms: Classification

  - Basic learning/mining tasks
  - Inferring rudimentary rules: 1R algorithm
  - Decision trees
  - Covering rules, patterns and trends
  - Experiments with Weka - decision trees, rules

- Data mining algorithms: Prediction

  - The prediction task
  - Statistical (Bayesian) classification
  - Bayesian networks
  - Instance-based methods (nearest neighbor)
  - Linear models
  - Experiments with Weka - Prediction

- Evaluating what's been learned

  - Basic issues
  - Training and testing

- Estimating classifier accuracy (holdout, cross-validation, leave-one-out)
- Combining multiple models (bagging, boosting, stacking)
- Minimum Description Length Principle (MLD)
- Experiments with Weka - training and testing

- Clustering

  - Basic issues in clustering
  - First conceptual clustering system: Cluster/2
  - Partitioning methods: k-means, expectation maximization (EM)
  - Hierarchical methods: distance-based agglomerative and divisible clustering
  - Conceptual clustering: Cobweb
  - Experiments with Weka - k-means, EM, Cobweb

- Advanced techniques, Data Mining software and applications

  - Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing).
  - Bayesian approach to classifying text
  - Web mining: classifying web pages, extracting knowledge from the web
  - Data Mining software and applications

Reference Material

1. Han, J., Pei, J., & Kamber, M.(Latest Edition). *Data mining: concepts and techniques*. Elsevier.
2. Ian H. Witten, Eibe Frank, and Mark A. Hall. Data Mining: Practical Machine Learning Tools and Techniques (Latest Edition) Morgan Kaufmann
3. Tan, Steinbach, Kumar, Introduction to Data Mining
4. Bramer, M., Principles of Data Mining

Course Name: Computer Vision	**Course Code:** CSC636
Course Structure: Lectures: 2, Labs: 1	**Credit Hours:** 3
Prerequisites: Linear Algebra, Data Structures	

Course Objectives

By the end of this course Students will be able to explain the concepts behind computer based recognition and the extraction of features from images. Students will also be able to illustrate some successful applications of vision systems and will be able to identify the limitations of vision systems.

Intended Learning Outcomes:

- Learn about the principles of image acquisition (image acquisition tools).
- Learning various image representation methods.
- Understanding texture, colour and features.
- Learn the concepts of image filtering, segmentation, clustering.
- It covers both theoretical and practical aspects of computer vision and using them to address real life problems.

Course Outline

- Geometric Camera Models, Introduction to Radiometry, Introduction to Sources, Shadows and Shading
- Applications of vision systems and their limitations
- Overview of early, intermediate and high level vision
- Light and Shading, radiometric properties of light sources, sources and their effects, qualitative radiometry, local shading models, photometric stereo, intereflections
- Color, the physics of colour, human perception of colour, colour representation
- Local Image features, elements of differential geometry, edge detection
- Filters as templates
- Texture, representing texture, analysis using oriented pyramids, introduction to shape from texture
- Segmentation by clustering, human vision, applications, simple clustering methods, segmentation by K-means, RANSAC
- Model fitting, fitting lines and curves
- Introduction to tracking, Smooth Surface and their outlines
- Classifying Images
- Object Detection and Recognition
- Concepts behind computer based recognition and extraction of features from raster images, segmentation, region splitting and merging, quadtree structures for segmentation, mean and variance pyramids, computing 1st and 2nd derivatives of images using the sobel and laplacian operators, grouping edge points into straight lines by means of Hough transform, limitations of Hough transform, parameterization of conic sections, perceptual grouping, failure of the Hough transform, improved Hough transform with perceptual features, grouping line segments into curves, 3D vision, triangular principal and stereoscopy.

Reference Material:

1. Forsyth, D., Ponce,J.(Latest edition). *Computer Vision: A Modern Approach*. Prentice Hall.
2. Shapiro, L.G.,Stockman,G.C.(Latest edition). *Computer Vision.* Prentice Hall.
3. Paragios,N., Chen,Y.,Faugeras,O., Birkhäuser. (Latest edition).*Handbook of Mathematical Models in Computer Vision.*

Course Name: Digital Image Processing	**Course Code:** CSC632
Course Structure: Lectures:2, Labs: 1	**Credit Hours:** 3
Prerequisites: Data Structures, Linear Algebra	

Course Objectives

To cover the basic theory and algorithms that are widely used in digital image processing. Expose students to current technologies and issues that are specific to image processing systems. Develop a hands-on experience in using computers to process images.

Intended Learning Outcomes:

The student would be able to:

- Learn principles and techniques of digital image processing and implement image processing algorithms.
- Gain experience in using tools for processing digital images

Course Outline

- Introduction to Image processing, Fundamental steps in DIP, Components of an Image Processing Systems, Digital Image Fundamentals, sampling and quantization.
- Visual perception, image sensing and acquisition, linear and nonlinear operations
- Image processing Techniques, Image enhancement in the Spatial Domain, Basic gray level transformations, histogram processing, Basic spatial filtering, smoothing spatial filters, combining spatial enhancement methods
- Image enhancement in the Frequency Domain, Introduction to Fourier transform and the Frequency Domain, Smoothing Frequency Domain Filters, Homomorphic Filtering
- A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering. Periodic Noise Reduction by Frequency Domain Filtering. Estimating the Degradation Function.
- Band reject Filters, Band pass Filters, Notch Filters.
- Color Image Processing, Color Models. Pseudocolor Image Processing. Basics of Full-Color Image Processing. Color Transformations. Smoothing and Sharpening. Color Segmentation. Noise in Color Images.
- Wavelets and Multiresolution Processing, Multiresolution Expansions. Wavelet Transforms in One Dimension. The Fast Wavelet Transform. Wavelet Transforms in Two Dimensions. Wavelet Packets
- Image Compression Models. Elements of Information Theory. Error-Free Compression. Lossy Compression. Image Compression Standards
- Morphological image processing, Dilation and Erosion. Opening and Closing. The Hit-or-Miss Transformation. Basic Morphological Algorithms. Extensions to Gray-Scale Images.
- Image Segmentation, Detection of Discontinuities. Edge Linking and Boundary Detection. Thresholding. Region-Based Segmentation. Segmentation by Morphological Watersheds
- Representation. Boundary Descriptors. Regional Descriptors. Use of Principal Components for Description
- Detection of Discontinuities, Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection
- Local Processing, Global Processing via the Hough transform, Thresholding, Thresholds Based on Several Variables, image registration.
- Image Transforms
    - Discrete Fourier Transform
    - Discrete Fourier Transform
    - Haar Transform
    - Hadamard Transform

Reference Material

1. Gonzalez, R.C., Woods, R.E.(Latest edition).*Digital Image processing*. Prentice Hall.

Course Name: Distributed Database System	**Course Code:** CSC637
Course Structure: Lectures:2, Labs: 1	**Credit Hours:** 3
Prerequisites: Database System	

Course Objectives

To clearly describe the difference of Centralized database and Distributed database and enable the students to design/model a distributed database.

Intended Learning Outcomes

The students would be able to :

- Design a distributed database
- Demonstrate an understanding of optimization of databases and issues related to concurrency and recovery
- Demonstrate understanding regarding cost modeling and designing algorithms for query evaluation

Course Outline

- Introduction,
- Overview of relational DBMS and Normalization,
- Distributed DBMS architecture,
- Distributed database design and Data Distribution Strategies,
- Replication/Fragmentation,
- Distributed Transaction Management,
- Distributed Query Processing,
- Distributed Concurrency Control,
- Distributed Data Security,
- Distributed Database Recovery.

Reference Material

1. Tamer,O.(Latest Edition).*Principals of Distributed Database Systems.*
2. Connolly,T..*Database Systems*.

Course Name: Signals and Systems	**Course Code:** CSC620
Course Structure: Lectures:2, Labs: 1	**Credit Hours:** 3
Prerequisites: Calculus and Analytical Geometry, Multivariate Calculus	

Course Objectives

This course comprises of topics related to the spectral analysis of discrete-time systems. It also encompasses the design and implementation of digital systems such as digital filters. The use of various transforms is also incorporated in this course.

Intended Learning Outcomes

Knowledge and understanding of

- Mathematical tools relevant to signals and systems.
- Fundamental technology concepts.
- Cognitive skills (thinking and analysis).

- Develop a strong grounding in the fundamentals of signals and systems

Course Outline

- Introduction to signal, Analog and digital/discrete signal
- Transformation Of independent variable, Basic continuous and discrete-time signals, Introduction to systems, and Properties of systems, basic system properties, exponential and sinusoidal signals. The unit impulse and unit step functions, continuous-time and discrete-time systems
- Discrete-time and Continuous-time LTI Systems: The sum Convolution
- Continuous-Time LTI Systems: The convolution Integral
- Impulse response of an LTI system, Examples of an LTI system, Properties of an LTI system
- Examples of Systems described by differential and difference equations
- Response of LTI Systems to Complex Exponentials, Fourier series representation of Continuous-Time periodic signals (CTFT), Convergence of the Fourier series
- Properties of Continuous-Time Fourier Transform (CTFT). Fourier Series and LTI systems
- Representation of Aperiodic signals: the Continuous-time Fourier transform, the Fourier transform for periodic signals, properties of the continuous-time Fourier transform, the convolution property, the multiplication property.
- Tables of Fourier properties and Basic Fourier transform pairs, Systems characterized by linear constant coefficient differential equations
- The Discrete-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Discrete-Time Fourier Transform. The convolution Property, The multiplication property, Tables of Fourier Transform Properties and Basic Fourier Transform Pairs. Duality. Systems Characterized by linear constant-coefficient difference equations

Reference Material

1. Oppenheim,A.V.(Latest edition). *Signals and systems.* Prentice Hall
2. Oppenheim,A.V.(Latest edition). *Discrete time signal Processing*. Prentice Hall

Course Name: Web Based Programming	**Course Code:**CSC633
Course Structure: Lectures:2, Labs: 1	**Credit Hours:** 3
Prerequisites: Programming Fundamentals, Object Oriented Programming II	

Course Objectives

The World Wide Web continues to provide a foundation for the development of a broad range of increasingly influential and strategic technologies, supporting a large variety of applications and services, both in the private and public sectors. There is a growing need for management and decision makers to gain a clearer understanding of the application development process, from planning through to deployment and maintenance. This module will give you an insight into architectures, protocols, standards, languages, tools and techniques; an understanding of approaches to more dynamic and mobile content; and demonstrate how you can analyze requirements, plan, design, implement and test a range of web applications.

Intended Learning Outcomes

- By the end of the course students will have a good idea what a web-related career entails.
- Whether it's a design, development or programming role, this course provides students with the technical and transferable skills needed to work in varied roles across the web, new media and the internet.

Course Outline

- HTML(Hypertext Markup Language):
- Internet, web & HTMLK Fundamentals, The world Wide Web & Web Servers,
- Creating Static Web Pages with HTML, Advanced HTML
- Web script programming:
- Java Script: Data Type, Control Structures, Object & Function, Event Handling,
- VB Script: Introduction, Data Types, Syntax, Control, etc,
- Active Server Pages:
- Common Gateway Interface (CGI) Script:
- Database Connectivity**:** Using ASP, Using CGI

Reference Material

1. Navarro,A ., Stauffer,T.(Latest Edition). *HTML by Example*, Que Corp
2. Wooldrige, A.Morgan, M.,Everett,M., Walter,S.J.(Latest Edition). *Special Edition Using Java Script, Que Corp.*

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