

**CURRICULUM
OF
ARCHITECTURE
B. ARCH (5-YEAR)**

2008



**HIGHER EDUCATION COMMISSION
SECTOR H-9, ISLAMABAD
PAKISTAN**



25 Years
(1983-2008)

**PAKISTAN COUNCIL OF
ARCHITECTS AND TOWN PLANNERS
(Ordinance IX of 1983)**

CURRICULUM DIVISION, HEC

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TABLE OF CONTENT

1.	Introduction	8
2.	Rationale	12
3.	Goals	14
4.	Frame Work/Template for B.Arch (5-YEAR) in Architecture	18
5.	Scheme of Studies for B. Arch (5-YEAR) in Architecture	24
6.	Details of Courses for B. Arch (5-YEAR) in Architecture	28
7.	Recommendations	44
8.	Annexures – A, B, C, D & E.	46

PREFACE

Curriculum development is a highly organized and systematic process and involves a number of procedures. Many of these procedures include incorporating the results from international research studies and reforms made in other countries. These studies and reforms are then related to the particular subject and the position in Pakistan so that the proposed curriculum may have its roots in the socio-economics setup in which it is to be introduced. Hence, unlike a machine, it is not possible to accept any curriculum in its entirety. It has to be studied thoroughly and all aspects are to be critically examined before any component is recommended for adoption.

In exercise of the powers conferred by sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide notification No. D773/76-JEA (cur.), dated December 4th 1976, appointed the University Grants Commission as the competent authority to look after the curriculum revision work beyond class XII at the bachelor level and onwards to all degrees, certificates and diplomas awarded by degree colleges, universities and other institutions of higher education.

In pursuance of the above decisions and directives, the Higher Education Commission (HEC) is continually performing curriculum revision in collaboration with universities. According to the decision of the special meeting of Vice-Chancellor's Committee, the curriculum of a subject must be reviewed after every 3 years.

A committee of experts comprising of conveners from the National Curriculum Revision of HEC in Basic, Applied Social Sciences and Engineering disciplines met in April 2007 and developed a unified template to standardize degree programs in the country to bring the national curriculum at par with international standards, and to fulfill the needs of the local industries. It also aimed to give a basic, broad based knowledge to the students to ensure the quality of education. The new B. Arch degree shall be of 5 years duration, and will require the completion of 171 credit hours.

For the purpose of curriculum revision various committees are constituted at the national level, comprising of senior teachers nominated by universities, degree awarding institutions, R&D organizations and respective accreditation councils. The National Curriculum Revision Committee for Architecture in a meeting held on June 3-4, 2008 at the HEC Regional Center, Karachi in continuation of its earlier meetings held on April 1-3, 2008 at HEC Regional Center, Karachi revised the curriculum in light of the unified template. The final draft prepared by the

National Curriculum Revision Committee, duly approved by the competent authority, is being circulated for implementation in the concerned institutions.

DR. RIAZ-UL-HAQ TARIQ
Member Academics

August 2008

FOREWORD

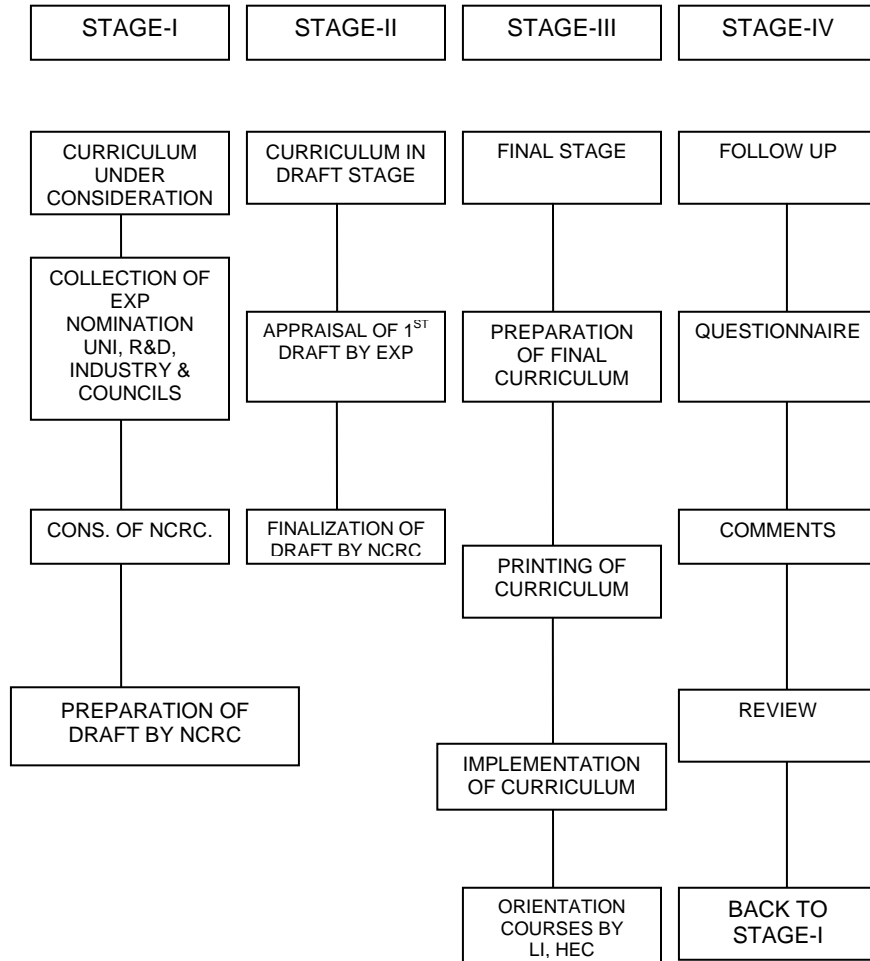
In an era of unprecedented construction boom in a developing country like Pakistan, it has become more imperative than ever before to equip our architects with the right tools to participate in this highly competitive industry. To this end the Higher Education Commission (HEC) meets regularly, revises and updates the curriculum every two years. This year HEC in association with the Pakistan Council of Architects and Town Planners (PCATP) met once again to review and update the curriculum being followed by Architecture Programs in the country. Since the PCATP is a regulatory body for architects and town planners they are best placed to provide the relevant resource people for this effort.

The process appears simple: bring together a group of educators and review, criticize and update the current curriculum. However, setting this in motion required a comprehensive and time consuming sequence of events. While the HEC's role is to continually perform curriculum revision in collaboration with the universities, PCATP assisted them in gathering a diverse yet qualified range of people to perform this task. The ultimate group consisted of academicians, architectural practitioners and PCATP representatives. Furthermore HEC, through PCATP recommendation, invited relevant people from all the architecture programs in the country. The result: an across the board representation of all points of view and consideration of issues particular to each institution.

The end product is a revised curriculum that has been put together by educators and practitioners who have a pulse on the needs of the industry. By ensuring a collaborative process from all programs in the country it is hoped that each institute will have a sense of ownership vis a vis this curriculum and will therefore implement it as required. As always this curriculum is a guideline and each institute must reflect its own vision and special brand within the curriculum to give it its own identity.

Shahab Ghani Khan, FIAP.
Chairman
Pakistan Council of Architects & Town Planners.
July 30, 2008

CURRICULUM DEVELOPMENT



Abbreviations Used:

NCRC.	National Curriculum Revision Committee
VCC.	Vice-Chancellor's Committee
EXP.	Experts
COL.	Colleges
UNI.	Universities
PREP.	Preparation
REC.	Recommendations
LI	Learning Innovation
R&D	Research & Development Organization
HEC	Higher Education Commission

INTRODUCTION

The National Curriculum Revision Committee (NCRC) Final Meeting in Architecture was held on **June 13-14, 2008** at the HEC Regional Centre, Karachi to finalize the draft curriculum for B.Arch. degree programme (5 years) prepared in its preliminary meeting held on April 1st to 3rd 2008. The following attended the meeting:

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Following members could not attend the final NCRC meeting in
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Rationale

In the last revision of the Curriculum of Architecture in 2004, approved by the HEC, the National Curriculum Review Committee for Architecture stated that the Five-year Bachelor of Architecture program at the professional undergraduate level “aims at producing professionals who will assume a major leadership role in shaping the built environment and meet the challenges posed by contemporary development to fulfil the needs of the present day world and the time to come.”

Reiterating this basic understanding, and trying to take the cause further, this effort in 2008 to create an updated curriculum for architectural education in Pakistan begins with the fact that there is a critical global situation to be responded to through architectural education.

It emphasizes that architecture has always been a multidisciplinary field that tackles a broad range of issues of its age and plays a leading role in its society with a vision for the future, representing its highest values, potential for creativity and facing the toughest of challenges. Commonly known as the ‘Last of the Renaissance Professions’, it has always aspired to be a bridge between the engineering sciences and the arts, the rich and the poor, commercial development and social development, and the natural environment and the built environment.

This tradition of integration and balancing of social ideals through architecture must be reiterated for students in today’s context, together with the scenario of the grave challenges that they must respond to. They should see their roles as Creative Designers as well as Stewards of the environment, Advocates for the disenfranchised segments of society, and Protectors of a rich cultural heritage.

While allowing for the diverse approaches of the respective departments, the curriculum sets minimum standards, guidelines, and common goals across the country, and by definition identifies the most pressing and current issues to be addressed by society with all its resources.

The designing of an architectural curriculum in Pakistan today must respond to the following themes in all aspects of teaching, including the Design Studios, Theory courses, Professional Practice Ethics and Legal Responsibilities:

- A. The crisis of the natural environment;** where vast and adverse impacts of construction projects are experienced in Pakistan, in relation to the environment, social impact and cultural heritage, and where global climate change is a grave reality to be responded to at all levels.

- B. **The growing crisis of poverty, degradation of the built environment, and non-availability of shelter and architecture of standard for large segments of society.**
- C. **The known professional challenges and opportunities for Pakistani architects in an age of globalization;** where Pakistani architects are competing for jobs in international and large scale architectural projects and firms in Pakistan and abroad, and also where architectural design education is being applied in various non-architectural professional capacities and leadership roles as well.
- D. **The aim of making Pakistani architectural academic institutions at par with internationally acclaimed institutions in the field.**
- E. **The ideals of making education accessible to all segments and regions of Pakistani society.**
- F. **The need to foster a common national agenda for architectural education based on a common national agenda for social development;** which creates equal opportunities for all students and access to resources, and deliberate exposure to issues and contexts in the urban and rural context.
- G. **To follow the universal trend in education and especially design a curriculum to move away from didactic teaching to investigation-based learning;** that can integrate growing areas of specialization and broad-based problem-solving, and that equips practitioners of tomorrow to face the unknowns of rapidly expanding and changing sciences and markets.
- H. **New Digital Media and Information Technology;** which are revolutionizing architectural design education, practice and construction, and expanding the parameters of knowledge.

The fact is acknowledged here that each institution while imparting architectural education in Pakistan has its own peculiar strength, circumstances and environment, and therefore specific emphasis/focus in architectural education is distinct from each other. This variety has its own strength, which the Committee has no intention to eliminate or undermine.

However, there is a need to put in place certain mechanisms for Quality Assurance: especially since a number of new architecture school are coming up.

- Monitoring of teaching should be undertaken by Board of Studies and/or a panel comprising of Chairman/Head, teacher in-charge of the course and an expert in the beginning and end of the academic year in order to ascertain the extent of content delivered, strengths and weaknesses in undertaking of the course
- Every institute should invite professionals as external examiners/jurors for the final year's thesis reviews, whose evaluation of students work should have a significant weight age in relation to that of the internal juror.

Goals & Objectives

The objective of the 5 years degree course is to produce professionals with a comprehensive body of knowledge and skills that shape the built environment in order to fulfil the current and future needs worldwide with a specific focus on Pakistan. The aim of the program is to train professionals with:

- the ability to create architectural design incorporating aesthetic and technical requirements that should be environmentally sustainable,
- a comprehensive understanding of the relationship between people, buildings and their environment, and the need to relate buildings and the spaces between them to human needs and scales,
- adequate knowledge of the history and theories of architecture and the related arts, technologies and human sciences.

The above aims would be achieved through a range of pedagogy techniques including studio based teaching, lectures, field trips, workshops and professional internships. We strongly advise all schools to work within studio culture, and to encourage cross fertilization of ideas enabling the instructors to have sound grasp of students, work and efforts.

The curriculum is devised to have three main streams of courses including; core/compulsory, optional, and electives courses. The core/compulsory courses are mandatory and have to be taken by all students. The optional courses will be selected by the institution based

on their academic strength and focus, while elective courses will be selected by the student based on their professional interests. This will ensure certain minimum standards in architectural education in the country.

The curriculum is to have three main subject streams: Core, Optional and Electives courses. The Core courses are compulsory and have to be taken by every student. The Optional courses will be selected by the institution and the Electives will be selected by the student.

This will ensure certain minimum standards through the Core courses, the Optional courses will reflect the strength of the institution, and the selection of the Electives will enable the students to pursue his/her interest.

The five year degree course is a two level program spread over ten semesters: Formative level (Semesters 1-6) and Consolidation level (Semester 7-10) each level having specific objectives.

The objective of the Formative level is to develop the creative ability of the student, as well as to inculcate a sense of inquiry along with oral, written, visual graphic presentation skills and technical knowledge, creating the basis for application in the design studios.

The objective of the Consolidation Level is resolved as an all encompassing activity in which all the components are critically analyzed and the student is in a position to undertake an independent project/research culminating in a thesis. Students are encouraged to take up elective subjects within their sphere of interest to assist in their thesis research.

Scheme of Studies for Bachelors in Architecture

The scheme of studies for Bachelors in Architecture is divided into four knowledge areas, namely: design studios/workshops; allied sciences and technologies; history, theory and critical analysis; and professional practice and communication tools, specified as under:

A. Design Studios/Workshops

A series of courses in this category will use studio project as the primary pedagogy. From year to year the projects will increase through the complexity of architectural functional program and the theoretical issues relevant to the preparation of an architectural practitioner. The specific

scientific, technical and professional inputs will come from courses offered in the other three categories.

B. Allied Sciences and Technologies

A series of course that progressively lay foundation of the scientific and technical knowledge base essential for the beginning of professional architectural career. The scope of such courses cover the physical and social sciences as well as engineering professions like structural, mechanical, electrical, and environmental.

C. History, Theory and Critical Analysis

A series of courses that establish the value of history as a source of inspiration and as a reference system against which the student can critically judge the contemporary architecture as well as the architectural proposals for the future. These courses also awaken the students to the possibility of different interpretations of history caused by changing values and evolving theories in various historic periods and shifting socio-political contexts.

D. Professional Practice and Communication Tools

A series of courses whose primary aim is to equip the future architect with visual, written verbal and computer based communication skills. These courses will also aim to ensure that the architecture graduates demonstrate the ability to use architectural conventions necessary for the preparation of coordinated construction documents. There will also be introductory courses on planning and building regulations, architectural service contracts, project feasibility, and project management.

The course break down is explained in Table 1. This is a suggestive list and institutions may add further optional/elective courses as per their strengths.

FRAMEWORK FOR BACHELOR IN ARCHITECTURE (5 YEAR)

Course Status	A Design Studio/ Workshops	B Allied Sciences And Technologies	C History, Theory And Critical Analysis	D Professional Practice And Communication Tools
Core Courses [Required Offerings By All Institutions]	Architectural Design	Materials And Construction	History Of Architecture	Visual Communication I, II
	Urban Design And Planning	Structures For Architects	Theory Of Architecture	Computer Applications
	Landscape Architecture	Services And Engineering Systems	Islamic Studies	Research Methodology
		Climatology And Thermal Comfort	Pakistan Studies	Professional Practice English I, II, III
Optional Courses*	Interior Design	Mathematics For Art And Architecture	Cultural Heritage	Project Planning And Management
	Sustainable Design	Heritage Conservation	Architecture In Pakistan	
	Human Settlements Studio	Environmental Psychology	Human Settlements	
	Architectonics	Urban Sociology	Landscape Architecture	
	Design For Special Users	Urban Geography	Urban Design/ Urbanization/ Urban Studies	
	Design For Disaster Risk Management	Building Economics	Architecture Of The Muslim World	
		Environmental Impact Analysis	Art Appreciation	
		Low Income Housing	Vernacular Architecture	
			Architectural Analysis	
Electives Courses**	Stage And Set Design	Advanced Surveying Geographical Information Systems For Architects	Architecture And The Performing Arts	Specifications And Quantity Surveying
	Building Crafts	Real Estate/ Business Management	Cultural Anthropology	Architectural Photography

	Fine Arts Studio	Environmental Responsive Technologies		Model-Making For Architects
				Advanced Computer Applications For Architects
				Architectural Signage/ Calligraphic Arts

* selected by the Institutions.

** selected by the students

Framework for Bachelor in Architecture (5 year) on Formative and Consolidation Level with Credits (continued...)

		KNOWLEDGE AREAS								
	COURSE STATUS	A. Design Studio/ Workshops	CREDITS	B. Allied Sciences and Technologies	CREDITS	C. History, Theory and Critical Analysis	CREDITS	D. Professional Practice and Communication Tools	CREDITS	TOTAL CREDITS
FOR AMATIVE LEVEL	CORE COURSES [required offerings by all institutions]	Architectural and Urban Design 1-VI	48	Materials and Construction 1-IV	8	History of Architecture 1-IV	8	Visual Communication 1-II	6	95
				Structures for Architects 1-III	6	Theory of Architecture	2	Computer Applications	4	
				Services and Engineering Systems-1	3	Islamic Studies	2	Research Methodology	4	
				Climatology		Pakistan Studies	2	English	2	
			48		17		14		16	
	Optional Courses*	Interior Design	2	Mathematics for Art and Architecture	2	Cultural Heritage	2			26
		Sustainable Design	2			Architecture in Pakistan	2			
		Human Settlements Studio	2							
		Architectonics	2							

					Urban Design/Urbanization/Urban Studies	4			
			Building Economics	2	Architecture of the Muslim World	2			
					Art Appreciation	2			
					Vernacular Architecture	2			
Electives Courses *	Stage and Set Design	2	Advanced Surveying	2	Architecture and the Performing Arts	2	Specifications and Quantity Surveying	2	20
	Building Crafts	2					Architectural Photography	2	
	Fine Arts Studio	2	Environmental Responsive Technologies	2			Model-making for Architects	2	
							Architectural Signage/Calligraphic Arts	2	

Core/Compulsory Courses:

75% - 80% of total 170 credits
= 127-136 credits

* Optional and Elective Courses

20% - 25% of total 170 credits
= 34-43 credits

** The design Studio/workshop will constitute a minimum of 80 credits over ten semesters

Course Breakdown bases on Formative and Consolidation Level

KNOWLEDGE AREAS										
	COURSE STATUS	A. Design Studio/Workshops		B. Allied Sciences and Technologies		C. History, Theory and Critical Analysis		D. Professional Practice and Communication Tools		
CONSOLIDATION LEVEL	CORE Courses [Required Offerings By All Institutions]	Architectural Design 7-10	28			Theory of Architecture	2	Professional practice	2	40
		Urban Design	4							
		Landscape Architecture	4							
			36			2		2		
	Optional Courses *	Interior Design	2	Heritage Conservation	2	Cultural Heritage	2	Project Planning and Management	2	
		Human Settlements Studio	2	Environmental Psychology	2					
				Urban Sociology	2	Human Settlements	2			
		Design for Special Users	2	Urban Geography	2	Landscape Architecture	2			
		Design for Disaster Mitigation	2	Environmental Impact Analysis	2	Urban Design/Urbanization/Urban Studies	2			
	ELECTIVES*	Stage and Set Design	2	Real Estate/Business Management	2	Cultural Anthropology	2	Advanced Computer applications for architects	2	

Core/Compulsory Courses: 75% - 80% of total 170 credits
(= 127-136 credits)
*Optional and Elective Courses 20% - 25% of total 170 credits
(= 34-43 credits)

** The design Studio / workshop will constitute a minimum of 80 credits over ten semesters

Note:

- *One credit hour means teaching a theory course for 50-60 minutes each week throughout the semester.*
- *One credit hour in studio/ laboratory or experimental work would require lab contact of at-least two hours per week throughout the semester.*
- *A six week internship at the end of 3^d year or 4th year is mandatory for students for completion their degree program.*
- *The schools of Architecture / Universities should arrange frequent study tours up and down the country for the student to acquaint themselves of the conditions in all region of the country.*

SCHEME OF STUDIES FOR BACHELOR IN ARCHITECTURE (5 YEAR)

Semester-I	Credit Hours
Basic Design-I	6
Visual Communication-I	2
History of Architecture-I	2
Materials & Construction-I	2
English-I (Functional English)	3
Islamic and Pakistan Studies-I	2
Sub-Total	17
Semester-II	Credit Hours
Basic Design-II	6
Visual Communication-II	2
History of Architecture	2
Climatology	3
English-II (Communication Skills)	2
Sub-Total	16
Semester-III	Credit Hours
Architectural Design-I	6
Visual Communication-III	2
History of Architecture-III	2
Materials & Construction-II	3
Structure for Architects-I	2
Islamic and Pakistan Studies-II	2
Sub-Total	17

Semester-IV	Credit Hours
Architectural Design-II	6
Visual Communication-IV	2
History of Architecture-IV Materials and Construction-III	2
Structure for Architects-II	3
Optional Subjects	2
	3
Sub-Total	18

Semester-V	Credit Hours
Architectural Design-III Materials and Construction-III	8
Computer Applications-I	3
Structure for Architects-III	2
Optional Subjects	2
Elective subjects	3
	1
Sub-Total	19

Semester-VI	Credit Hours
Architectural Design-IV	8
Computer Applications-II Services and Engineering Systems	2
Optional Subjects	3
Elective subjects	3
	2
Sub-Total	18

Semester – VII	Credit Hours
Architectural Design–V	8
Urban Design & Planning-I	2
Theory of Architecture	2
Landscape Architecture	2
English-III (Technical Report Writing & Presentation)	3
Sub-Total	17

Semester–VIII	Credit Hours
Architectural Design–VI	8
Urban Design & Planning-II	2
Research Methodology	2
Optional subjects	3
Elective Subjects	2
Sub-Total	17

Semester–IX	Credit Hours
Thesis Design–I	10
Professional Practice	2
Optional subjects	3
Elective subjects	2
Sub-Total	17

Semester-X	Credit Hours
Thesis Design-II	10
Optional subjects	3
Electives subjects	2
Sub-Total	15

Total Credit Hours 171

DETAIL OF COURSES FOR BACHELOR IN ARCHITECTURE (5 YEAR)

1- BASIC DESIGN / ARCHITECTURAL DESIGN

Title of the Course:	ARCHITECTURAL DESIGN
Credit Hours:	Total 76 (Including Basic Design if offered by the institution).
Formative Level	44 Cr
Consolidation Level	32 Cr
Prerequisite:	The permission to begin the consolidation level shall be given after a formal audit at the end of the formative level.
Specific Objective of the course:	<p>Formative level (semester I-VI): to develop the creative ability of the student in terms of 3-D formal and spatial concepts and their expression through oral, written and graphic representation skills. (44 Cr)</p> <p>Consolidation level (semester VII-X): to develop the ability to critically analyze the increasingly complex architectural design issues so that the student is in a position to undertake an independent project/ research project. (32 Cr)</p>
Course Outline:	<p>Formative Level: Introduction to architectural design, design parameters and criteria (site, orientation, building form, and scale), design of the built environment involving simple functions and building materials.</p> <p>Distinction between client's brief and architect's brief, development of design concept, site analysis, functional and formal implications of a design brief, design proposals for small to medium-scale buildings to demonstrate understanding of functional relationships, materials, structures, technology, contextual issues, and climatic response inclusive of initial understanding of sustainable architecture.</p> <p>Consolidation Level: Projects involving multiple functions and complex spatial organizations with comprehension of issues related to project program, site selection, users needs, materials, and technology, identification of structure systems, services and engineering systems. Students are also to be introduced to survey methodologies, research and documentation techniques.</p> <p>Large-span structures, high-rise buildings with comprehension of structure, services and engineering systems. Projects focusing on</p>

thermal comfort and understanding services and construction details. Design projects to involve conservation/adaptive re-use, urban design, planning and landscaping. Design to be evolved and justified through its contextual concerns such as historical significance; natural, built, socio-economic and cultural environment; including pedestrian and vehicular movements.

Design of complex buildings or group of buildings giving due respect to urban design and planning issues whilst considering the social, economic, physical & technological factors.

Studio

The course is conducted in the form of a “studio” where students present their work and receive a critique from a tutor also known as a “studio critic”. Studio work consists of oral presentation, written works, and visual graphic presentations, which in turn will reflect the technical knowledge and students understanding of design processes. This may also include 2-D and 3-D presentations put together with the aid CAD (computer aided design), 3-D Max, Photoshop and Sketch-up.

Recommendation: Focus of the studio should be declared at the onset of the semester; e.g. 7th and 8th semesters are “Urban responsive studios” thereby dictating the focus of theory course for that particular semester. Teacher-student ratio should be no more than 1:15, recommended is 1:12.

Recommended Books

- Francis Ching, *Space, form and Order.*
- Robert Krier, *Architectural Composition.*
- Simon Unwin, *Analysing Architecture.*
- Amos Rappoport, *House Form and Culture.*
- Kevin Lynch, *The Image of the City.*
- Calender, *Time Saver Standards* vol. 1-4.
- Time Savers Standards, Urban Design.

Journals/Periodicals

- Architectural Record
- Architectural Digest
- Domus
- The Plan
- Perspecta

2- VISUAL COMMUNICATION

Title of the Course	VISUAL COMMUNICATION I & II
Credit Hours	SIX
Prerequisite	NONE
Specific Objective of the course	To learn tools and techniques to present design ideas through drawings and models incorporating architectural drawing conventions.
Lab/ Studio Outline	Introduction to photography; model making.
Course Outline	Freehand drawing; lettering; drafting – point, line, shape and form. Solid geometry, sectional solid geometry, sciagraphy, and orthographic projections; understanding and preparation of plans, elevations, and sections of a building. Introduction to perspectives (one point, and multiple points), rendering techniques in different mediums.
Recommended Books	<ul style="list-style-type: none">• Jefferies, <i>Architectural Drafting and Design</i> (4th edition).• Greusel, <i>Architects Essentials of Presentation Skills</i>.• Yee, <i>Architectural Drawing; A Visual Compendium of types and methods</i> (2nd edition).• Kopoaz, <i>Colour in Three Dimensional Design</i>.• Strunk & White, <i>The Elements of Style</i>.• Edward Rblivs, <i>Why Architects Draw</i>.• Mckims. R.H, <i>Experiences in Visual Thinking</i>.

3 - HISTORY OF ART & ARCHITECTURE

Title of the Course	HISTORY OF ART & ARCHITECTURE
Credit Hours:	Eight
Prerequisite:	None
Specific Objective of the course : An intellectual framework for critical analysis of the past in order to re-evaluate/reinterpret from historical precedence to critique present architectural issues and the future potential for design.	
Course Outline: A systematic survey of the arts and architecture of the major periods of history and regions of the world: Ancient Mesopotamia, Egypt, Indus Valley, Greece , Rome, Byzantine, Gandhara, Islamic, Gothic, Renaissance, Baroque, Pre-Modern, Modern , Contemporary including Architecture in Pakistan	
Studio	Theory
Recommended Books: Books: Banister Fletcher; Spiro Kostoff, Nicholos Pevsner; Kamil Khan Mumtaz Koch	

4 – THEORIES / CRITICISM OF ARCHITECTURE

Title of the Course	THEORIES / CRITICISM OF ARCHITECTURE
Credit Hours:	Four
Prerequisite:	None
Specific Objective of the course : To develop the analytical and critical faculty of the student, encouraging an integrated approach to design, to face the challenges of an ever-changing world.	

Course Outline: Graphic analysis of buildings and architectural complexes to develop the ability of the student to theoretically understand architectural issues which are later studied verbally in the form of architectural treatises. The model used throughout is the city which has proved throughout history to be an enduring architectural archetype.

Studio

Recommended Books:

- Ching (Graphic analysis of building complex / lecture in sketch books)
- Ching (Graphic analysis of city / urban district lecture in sketch book)
- Kevin Lynch – Image of the city
- Vitruvius (Ten Books on architecture --- Roman)
- Wittkower (Architecture Principle in the Age of Humanism – Renaissance)
- Le Corbusier: Towards a New Architecture (Modern) +
- Venturi: Complexity & Contradictory (Post Modern)
- Edward Bacon: Design of Cities
- Aldo Rossi: The Architecture of the City
- Rob Krier: Urban Space
- Jane Jacobs: The Death & Life of Great American Cities

5 - MATERIALS AND CONSTRUCTION

Title of the Course	MATERIALS AND CONSTRUCTION
Credit Hours	ELEVEN
Prerequisite	NONE
Specific Objective of the course	To study the properties of traditional and contemporary materials, their selection criteria and use in construction structural and non-structural as well as in interior and exterior,

Course Outline

The study of building components, types of foundations, types of roofs, traditional construction with local materials such as bricks, stone, and timber. Types of floors, sub-floors/ screeds, floor finishes and laying techniques. Study of building construction in concrete, steel, glass, fibre glass and other materials, internal and external finishes, insulation techniques etc.

The study of construction details of building components like windows, doors, and staircases. Expansion and construction joints. Preparation of working drawings

Lab / Studio Outline

Each institution is encouraged to develop a materials lab with the assistance of HEC

Preparation of working drawings, details and specifications.

Recommended Books

- Merritt, *Building Design and Construction Handbook*.
- Simmons, *Construction: Principles, Materials and Methods* (7th edition).
- Ching, *Building Construction illustrated* (3rd edition).
- Allen, *Fundamentals of Building Construction Handbook* (4th edition).
- Bary, *The Construction of Buildings* (Vol 1-5).
- Doran, *Construction Materials Reference Book*.
- Hombostal, *Construction Materials: Types, Uses and Applications*.
- Z H Syed, *Materials for Construction*.
- Barnes, *Materials for Architects and Builders*.

6- STRUCTURE FOR ARCHITECTS

Title of the Course	STRUCTURE FOR ARCHITECTS
Credit Hours	SIX
Prerequisite	MATERIALS & CONSTRUCTION I & II
Specific Objective of the course	
To study principals of mechanics leading to a conceptual understanding of basic structural systems and their behavior under	

different loading conditions (imposed and induced like earth quake forces) for any architectural design.

Course Outline

Special attention has to be paid to both the integration of Architecture and structure to achieve an expressive quality of structure that becomes architecture itself. Special effort has to be made to use the modeling laboratory to demonstrate the relationships between structure and architecture.

Historical development of structural systems in buildings, types of loads in buildings, structural requirements. Cantilever beams, simply supported beams, fixed and continuous beams, Post and lintel. The simple frame, multiple frames. Arches and arched roofs. Cables and cabled roofs. Trusses and space frames. Load transfer in two directions, rectangular beam grids, skew grids. Plates, ribbed plates, folded plates.

Membranes stresses, principal curvatures and stresses in membranes. Thin shells, form resistant structures and application to rotational surfaces, translational surfaces, complex surfaces, membrane action in domes, cylinders etc.

Lab / studio Outline:

Display structural drawing to prepare study models for different types of structures eg. foundations, retaining walls, frame structures, space frames and folded plates etc.

Recommended Books

- Salvadori and Heller, *Structure in Architecture*.
- Chilton, *Space Grid Structure*.
- MacDonald, *Structure and Architecture* (2nd edition).
- Mainstone, *Developments in Structural Form*.
- Barnes, *Wide Span Roof Structures*.
- Hanaor, *Principles of Structure*.
- French, *Fundamentals of Structural Analysis*.
- Sam, *Theory and Practice of Foundation Design*.

Journals/Periodicals

World Wide Web

7- CLIMATOLOGY

Title of the Course	CLIMATOLOGY & THERMAL COMFORT
Credit Hours	THREE
Prerequisite	NONE
Specific Objective of the course This course aims at an in-depth study of climatic and other environmental factors having an impact on design decisions affecting the thermal performance of the buildings,	
Course Outline Study of building as a thermal system / thermal store house, passive design strategies and passive/renewable source of energy for an environmentally sustainable architecture for the various climatic zones of Pakistan. Insulation materials, screening systems, passive ventilation, issues of global warming, carbon trading, renewable energy etc.	
Lab / Studio Outline Computer simulation of thermal performance of building design	
Recommended Books <ul style="list-style-type: none"> • Enercon: <i>Handbook on Energy Conservation</i>. • Jones, <i>Architecture and the Environment, Bioclimatic Building Design</i>. • Krishnen, <i>Climate Responsive Architecture: A design Handbook for Energy Efficient Buildings</i>. • Michel, <i>Light the Shape of Space: Designing with Space and Light</i>. • Egan, <i>Architectural Lighting</i> (2nd edition). • Coaton, <i>Lamps and Lighting</i> (4th edition). • Grehant, <i>Acoustics in Building</i>. • Everest, <i>Master Handbook of Acoustics</i> (4th edition). • Acentech, <i>Architectural Acoustics, Design Guide</i>. 	

8 – SERVICES AND ENGINEERING SYSTEMS

Title of the Course	SERVICES AND ENGINEERING SYSTEMS
Credit Hours	THREE

Prerequisite	None
Specific Objective of the course	To study Engineering Systems and Techniques that are essential in the functioning of buildings.
Course Outline	Introduction to different systems and techniques of heating, ventilation, air conditioning (HVAC), water supply, sanitation, fire fighting system and equipments for buildings, safety and security systems. Access and facilities for disabled, provision of gender and age related facilities. Vertical and horizontal transportation systems such as elevators, escalators, conveyors/power walks, techniques for acoustics and noise control.
Lab / Studio Outline:	Preparation of working drawing of water supply, sanitation and electrification
Recommended Books	<ul style="list-style-type: none"> • Porges, <i>HVAC Engineers Handbook</i> (11th edition). • Kreider, <i>Heating and Cooling of Buildings: Design for Efficiency</i> (2nd edition). • Clifford, <i>Modern Heating, Ventilating and Air Conditioning</i>. • Mcquisto, <i>Heating, Ventilating and Air conditioning, Analysis and Design</i>. • Falla Moore, <i>Heating, Cooling and Ventilating Systems</i>. • Garrett, <i>Hot and Cold Water Supply</i> (2nd edition). • Mays, <i>Water Distribution Systems Handbook</i>. • Treloar, <i>Planning, Heating and Gas Installations</i> (2nd edition). • Steims, <i>Building Technology: Mechanical and Electrical Systems</i> (2nd edition).

9- COMPUTER APPLICATIONS

The outline given below is suggestive in nature. The course coordinator may adjust and amend as per his/ her discretion.

Title of the Course	COMPUTER APPLICATIONS
Credit Hours	FOUR

Prerequisite
<p>Specific Objective of the course This course is intended to train of students to use computer as a design analysis and presentation tool .</p>
<p>Course Outline Software such as Autocad, Sketch-up, Revit, 3-D studio Max, Photoshop, Freehand</p>
<p>Lab/ Studio Outline To develop basic skills of students in 2-D & 3-D drawings, rendering and animation software.</p>
<p>Recommended Books</p> <ul style="list-style-type: none"> • George Omura, <i>Mastering AutoCAD</i>. • Laker Daniel, <i>Inside AutoCAD</i>. • R. A. Rejnolds, <i>Computing for Architects</i>. • Pipes Alan, <i>Computer-Aided Architectural Design Features</i>. • Mitchell, William. J, <i>Computer-Aided Architectural Design</i>.

10- RESEARCH METHODOLOGY

The outline given below is suggestive in nature. The course coordinator may adjust and amend as per his/ her discretion.

Title of the Course	RESEARCH METHODOLOGY
Credit Hours	TWO
Prerequisite	English writing I-III
Specific Objective of the course	To study systematic modes of inquiry.
<p>Course Outline Casual vs. systematic modes of inquiry, distinction between research, social research, and research methods, critical reading; types of research, research proposal, research design, sampling, development of questionnaire, methods of data collection from primary and secondary sources, analysis and interpretation; research writing, plagiarism, citation, and referencing.</p>	

Lab/ Studio Outline

Sample Design, Questionnaire preparation, Data Collection, Analysis and Presentation

Recommended Books:

- Kumar, Ranji. "*Research Methodology*"
- Babbie, Earl. "*Practice of Social Research*"
- Bryman, Alan. "*Social Research Methods*"
- Booley, David. "*Social Research Methods*"
- Bordens, Kenneth and Bruce Abbot. "*Research Design and Methods*"
- Kothari, B.L. "*Research Methodology – Tools and Techniques*"
- Krathwohl, David. "*How to Prepare a Research Proposal*"
- Freeman, Rossi. "*Evaluation*"
- Holliday, Adrian. "*Doing and Writing Qualitative Research*"
- Kirk, Jerome and Marc Millar. "*Reliability and Validity in Qualitative Research*"
- Cochran. "*Sampling Techniques*" Cash, Phyllis. "*How to write Research Paper – Step by Step*"
- Ranjit Kumar, *Research Methodology*.
- Earl Babbie, *Social Research Methods*.

Basic concepts, theories and approaches of urban design taking into consideration three dimensional aspects of physical design, socio-cultural, visual and non-visual aspects of built environment, urban design projects on different scales, problems of circulation, case studies and analysis of existing urban contexts. Katchi abadi, settlements and development of factors leading to the Mandi towns, also studying various master plans of Islamabad, Karachi, Lahore and their impact on the built environment.

Historical development of structural systems in buildings, types of loads in buildings, structural requirements. Cantilever beams, simply supported beams, fixed and continuous beams, Post and lintel. The simple frame, multiple frames.

Arches and arched roofs. Cables and cabled roofs. Trusses and space frames.

Load transfer in two directions, rectangular beam grids, skew grids. Plates, ribbed plates, folded plates.

Membranes stresses, principal curvatures and stresses in membranes. Thin shells, form resistant structures and application to rotational

surfaces, translational surfaces, complex surfaces, membrane action in domes, cylinders etc.

11- PROFESSIONAL PRACTICE

The outline given below is suggestive in nature. The course coordinator may adjust and amend as per his/ her discretion.

Title of the Course	PROFESSIONAL PRACTICE
Credit Hours	THREE
Prerequisite	ARCHITECTURAL DESIGN-Formative Level
Specific Objective of the course	To understand various aspects of professional practice and ethics.
Course Outline	Study of different aspects of office management, financial management, site management, building bye laws, regulations and legal aspects; role of professional bodies in regulating the profession. Preparation of Contract Documents
Recommended Books	<ul style="list-style-type: none"> • Hackett, <i>Pre-Contract Practice and Contract Administration for the Building Team</i>. • Fryer, <i>The Practice of Construction Management</i> (3rd edition).

12- THESIS DESIGN

In the fifth year (semesters IX and X) students are required to focus on thesis design which has to be a comprehensive architectural solution developed on the basis of an in-depth study/research on a project of the students' own choice.

Selection of thesis topic, designing and conducting research and case studies, and concluding in the form of design criteria, research methodology, data, analysis and conclusions to be presented in the form of thesis report at the end of semester IX.

In the final semester (X), each student is required to develop comprehensive architectural design solution for the selected project on

the basis of the research done in the earlier semester. As the culmination of their under-graduate architectural education at the institution, the students are required to synthesize the accumulated knowledge and skills acquired during the previous semesters and demonstrate it through a comprehensive design. Thesis design is to be assessed by a panel of external jurors.

List of Recommended Reading Material

Basic Design

- Lawson, *Language of Space*.
- Kapaz, *Colour in Three Dimensional Design*.
- Schulz, *Architecture: Presence Language, Place*.
- Giddings, Artist, *Impressions in Architectural Design*.
- Charles Wallschlaeger & Cynthia Busic,-Snyder, *Basic Visual Concepts and Principles for Architects & Design*.
- Stean Eiler Rasmussam, *Experiencing Architecture*.
- Francis D K Ching, *Architecture: Form, Space, and Order*.
- *Fundamentals of Design*
- *An Invitation to Design*.
- *Elements of Architecture*.

Architectural Design

- Struzehecher, *Architecture for Sports*.
- Neuman, *Building Type: Basics for College and University Facilities*.
- Kobus, *Building Type: Basics for Healthcare Facilities*.
- Rosenblett, *Building Type: Basics for Museums*.
- Kohu, *Building Type Basics for Office Buildings*.
- Calender, *Time Saver Standards* vol. 1-4.
- Izenour, *Theatre Design*.
- Weston, *A House in the Twentieth Century*.
- Rutes, *Hotel Design, Planning and Development*.
- Edwards, *Libraries and Learning Resource Centres, Planning and Design*.
- John, *Handbook of Sports and Environments, Building Design*, Vol 1-3.
- Lawson, *Hotels and Restaurants Planning, Design and Refurbishment*.
- Fawcett, *Architecture: Design Notebook* (2nd edition).

Visual Communication

- Jefferies, *Architectural Drafting and Design* (4th edition).
- Greusel, *Architects Essentials of Presentation Skills*.
- Yee, *Architectural Drawing; A Visual Compendium of types and methods* (2nd edition).

- Kopoaz, *Colour in Three Dimensional Design*.
- Strunk & White, *The Elements of Style*.
- Edward Rblivs, *Why Architects Draw*.
- Mckims. R.H, *Experiences in Visual Thinking*.

History of Architecture

- Fletcher, *History of Architecture on Comparative Methods*.
- Jenson, *Indus Civilization*.
- Frankel, *Gothic Architecture*.
- Melon, *Baroque Architecture*.
- Watkin, *A History of Western Architecture*.
- Doordan, *Twentieth Century Architecture*.
- Blundell, *Modern Architecture through Case Studies*.
- Frampton, *Modern Architecture, A Critical History*.
- Perner, *The Sources of Modern Architecture and Design*.
- Blair, *The Art and Architecture of Islam 1250-1800*.
- Koch, *Mughal Architecture*.
- Khan, A N, *Islamic Architecture of Pakistan*.
- Brown, *Indian Architecture (Hindu Buddhist Period)*.
- Brow, *Indian Architecture (Muslim Period)*.
- Grabar, *The Formation of Islamic Art*.
- William Curtis, *Modern Architecture Since 1900*.
- Marylin Stokatad, *Art a Brief History*.

Materials and Construction

- Merritt, *Building Design and Construction Handbook*.
- Simmons, *Construction: Principles, Materials and Methods* (7th edirtion).
- Ching, *Building Construction illustrated* (3rd edition).
- Allen, *Fundamentals of Building Construction Handbook* (4th edition).
- Bary, *The Construction of Buildings* (Vol 1-5).
- Doran, *Construction Materials Reference Book*.
- Hombostal, *Construction Materials: Types, Uses and Applications*.
- Z H Syed, *Materials for Construction*.
- Barnes, *Materials for Architects and Builders*.

Computer Applications

- George Omura, *Mastering AutoCAD*.
- Laker Daniel, *Inside AutoCAD*.
- R. A. Rejnolds, *Computing for Architects*.
- Pipes Alan, *Computer-Aided Architectural Design Features*.

- Mitchell, William. J, *Computer-Aided Architectural Design*.

Structure for Architects

- Salvadori and Heller, *Structure in Architecture*.
- Chilton, *Space Grid Structure*.
- MacDonald, *Structure and Architecture* (2nd edition).
- Mainis One, *Developments in Structural Form*.
- Barnes, *Wide Span Roof Structures*.
- Hanaor, *Principles of Structure*.
- French, *Fundamentals of Structural Analysis*.
- Sam, *Theory and Practice of Foundation Design*.

Services and Engineering Systems

- Porges, *HVAC Engineers Handbook* (11th edition).
- Kreider, *Heating and Cooling of Buildings: Design for Efficiency* (2nd edition).
- Clifford, *Modern Heating, Ventilating and Air Conditioning*.
- Mcquisto, *Heating, Ventilating and Air conditioning, Analysis and Design*.
- Falla Moore, *Heating, Cooling and Ventilating Systems*.
- Garrett, *Hot and Cold Water Supply* (2nd edition).
- Mays, *Water Distribution Systems Handbook*.
- Treloar, *Planning, Heating and Gas Installations* (2nd edition).
- Steims, *Building Technology: Mechanical and Electrical Systems* (2nd edition).

Urban Design & Planning

- Kevin Lynch, *Image of the City*.
- Speregan, *Urban Design: Architecture of Towns and Cities*.
- Cullen, *Concise Townscape*.
- Thomas, *Architecture and the Urban Environment*.
- Moughtin, *Urban Design: Methods and Techniques*.
- Burden, *Site Planning Handbook*.

Theory of Architecture

- Rahim, *Contemporary Techniques in Architecture*.
- Burden, *Visionary Architecture*.
- Kulin, *Architectural Programming*.
- Fancett, *Architecture, Design Notebook*.
- Steale, *An Architecture for People*.
- Schestyen, *New Architecture and Technology*.
- Mark Geleanter, *Sources of Architectural Forms*.
- Fil Hearn, *Ideas That Shaped Buildings*.
- Vale, *Architecture, Power and National Identity*.

- Bloomer, *Body, Memory and Architecture*.
- Wiseman, *Architecture of I M Pie*.
- Harbison, *The Built, The Un-built and the Un-buildable*.
- Jacobs, James Stirling, *Buildings and Projects 1950-74*.
- Venturi, *Complexity and Contradiction in Architecture*.
- Powley, Norman Foster; *A Global Architecture*.
- Burden, *Visionary Architecture*.

Landscape Architecture

- Simonds, *Landscape Architecture* (3rd edition).
- Littlewood, *Landscape Detailing: Surfaces* (3rd edition).
- Littlewood, *Landscape Detailing: Structure* (3rd edition).

Professional Practice

- Buckam, *Estimating for Builders and Surveyors* (2nd edition).
- Aqua Group, *Tenders and Cost Control for Buildings*.
- Hackett, *Pre-Contract Practice and Contract Administration for the Building Team*.
- Willis, *Specification Writing for Architects and Surveyors* (11th edition).
- Fryer, *The Practice of Construction Management* (3rd edition).

Climatology

- Enercon: *Handbook on Energy Conservation*.
- Jones, *Architecture and the Environment, Bioclimatic Building Design*.
- Krishnen, *Climate Responsive Architecture: A design Handbook for Energy Efficient Buildings*.
- Michel, *Light the Shape of Space: Designing with Space and Light*.
- Egan, *Architectural Lighting* (2nd edition).
- Coaton, *Lamps and Lighting* (4th edition).
- Grehant, *Acoustics in Building*.
- Everest, *Master Handbook of Acoustics* (4th edition).
- Acentech, *Architectural Acoustics, Design Guide*.

Research Methodology

- Ranjit Kumar, *Research Methodology*.
- Earl Babbie, *Social Research Methods*.

RECOMMENDATIONS

Specialist Study for designing an updated Pakistani Architectural Curriculum

The draft curriculum presented on June 13-14, 2008 is the result of sincere deliberations by representatives of several departments of architecture and professionals in practice in Pakistan present at this meeting, and represents their experience and expertise. However, it is strongly recommended that to keep abreast with rapid changes, there should be an annual review of the curriculum. It is also strongly recommended that there should be a more researched proposal for a curriculum that is a result of specialist study of contemporary international developments in architectural education, as well as new approaches to Pakistani university education, in the following areas:

- Environmentally Responsive Design,
- Digital Media and Information Technology in Design,
- Contemporary Teaching Methods, Materials and Resources for university education that incorporate multilingualism, multimedia and multiculturalist approaches in the context of Pakistan,
- Creation of a Professional Code of Ethics for Architects and formally introduced to architecture students, such that they are familiar with and uphold the highest principles of international law and Pakistan law, such as the Pakistan Environmental Protection Act 1997, regarding the protection of the environment, social groups and cultural heritage, when affected by construction and development,
- Pakistani Cultural and Folk Heritage, its relevance in contemporary studio teaching, history teaching, and the current relevance of teaching about its protection mechanisms and management strategies for social, educational and economic development locally,
- Teacher Training and Professional Development for Architectural Educators,
- Student Internship requirements, possibilities and priorities, in the context of the current Pakistani industry,
- And any other areas which might be identified through a researched study by experts, both national and international

In terms of institutional strengthening of the teaching institutions, it is felt strongly that the following aspects should be considered:

- Admissions Criteria for architecture should be reviewed and based on the distinct multidisciplinary requirements for the discipline,
- Teacher to Student Ratio in architecture must be 1:15,
- Studios, facilities and labs must be continuously upgraded based on the updated curriculum, and support from the HEC must respond to this need,
- Continual faculty development facilitated through trainings, scholarships and exchange between institutions in the country and abroad is essential, and support from the HEC must respond to this.

**COMPULSORY COURSES IN ENGLISH
FOR BS (4 YEAR) IN BASIC & SOCIAL SCIENCES**

Functional English

Objectives: Enhance language skills and develop critical thinking.

Course Contents

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

Comprehension

Answers to questions on a given text

Discussion

General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening

To be improved by showing documentaries/films carefully selected by subject teachers

Translation skills

Urdu to English

Paragraph writing

Topics to be chosen at the discretion of the teacher

Presentation skills

Introduction

Note: *Extensive reading is required for vocabulary building*

Recommended books:

1. **Functional English**
 - a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
 2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- b) Writing
1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- c) Reading/Comprehension
1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking

Communication Skills

Objectives: Enable the students to meet their real life communication needs.

Course Contents

Paragraph writing

Practice in writing a good, unified and coherent paragraph

Essay writing

Introduction

CV and job application

Translation skills

Urdu to English

Study skills

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

Academic skills

Letter/memo writing, minutes of meetings, use of library and internet

Presentation skills

Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Recommended books:

Communication Skills

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

- b) Writing
 - 1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 45-53 (note taking).
 - 2. Writing. Upper-Intermediate by Rob Nolasco. 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. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
 - 2. Reading and Study Skills by John Langan
 - 3. Study Skills by Richard Yorky.

Technical Writing and Presentation Skills

Objectives: Enhance language skills and develop critical thinking

Course Contents

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:

Technical Writing and Presentation Skills

- a) Essay Writing and Academic Writing
 1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
 2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.
 3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- b) Presentation Skills
- c) Reading
The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

Pakistan Studies (Compulsory)

(A Compulsory Subject for Degree Students)

Introduction / Objectives

Objectives

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

2. Government and Politics in Pakistan

Political and constitutional phases:

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

3. Contemporary Pakistan

- a. Economic institutions and issues
- b. Society and social structure
- c. Ethnicity
- d. Foreign policy of Pakistan and challenges
- e. Futuristic outlook of Pakistan

Books Recommended

1. Burki, Shahid Javed. *State & Society in Pakistan*, The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Banglades.*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

ISLAMIC STUDIES (Compulsory)

Objectives:

This course is aimed at:

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

DETAIL OF COURSES

INTRODUCTION TO QURANIC STUDIES

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

STUDY OF SELLECTED TEXT OF HOLLY QURAN

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

STUDY OF SELLECTED TEXT OF HOLLY QURAN

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

SEERAT OF HOLY PROPHET (S.A.W) I

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)

- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

SEERAT OF HOLY PROPHET (S.A.W) II

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

INTRODUCTION TO SUNNAH

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

SELLECTED STUDY FROM TEXT OF HADITH

INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

ISLAMIC CULTURE & CIVILIZATION

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

ISLAM & SCIENCE

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

ISLAMIC ECONOMIC SYSTEM

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

POLITICAL SYSTEM OF ISLAM

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

ISLAMIC HISTORY

- 1) PERIOD OF KHLAFT-E-RASHIDA
- 2) PERIOD OF UMMAYYADS
- 3) PERIOD OF ABBASIDS

SOCIAL SYSTEM OF ISLAM

- 1) BASIC CONCEPTS OF SOCIAL SYSTEM OF ISLAM
- 2) ELEMENTS OF FAMILY
- 3) ETHICAL VALUES OF ISLAM

Reference Books:

- 1) Hameed ullah Muhammad, "**Emergence of Islam**", IRI, Islamabad
- 2) Hameed ullah Muhammad, "**Muslim Conduct of State**"
- 3) Hameed ullah Muhammad, "**Introduction to Islam**"
- 4) Mulana Muhammad Yousaf Islahi,"
- 5) Hussain Hamid Hassan, "**An Introduction to the Study of Islamic Law**" leaf Publication Islamabad, Pakistan.
- 6) Ahmad Hasan, "**Principles of Islamic Jurisprudence**" Islamic Research Institute, International Islamic University, Islamabad (1993)
- 7) Mir Waliullah, "**Muslim Jrisprudence and the Quranic Law of Crimes**" Islamic Book Service (1982)
- 8) H.S. Bhatia, "**Studies in Islamic Law, Religion and Society**" Deep & Deep Publications New Delhi (1989)
- 9) Dr. Muhammad Zia-ul-Haq, "**Introduction to Al Sharia Al Islamia**" Allama Iqbal Open University, Islamabad (2001)

Annexure “D”

Note: One course will be selected from the following six courses of Mathematics.

BS COMPULSORY MATHEMATICS COURSES (FOR STUDENTS NOT MAJORING IN MATHEMATICS)

1. MATHEMATICS I (ALGEBRA)

Prerequisite(s): Mathematics at secondary level

Credit Hours: 3 + 0

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of algebra to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions.

Matrices: Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.

Quadratic Equations: Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.

Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.

Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.

Trigonometry: Fundamentals of trigonometry, trigonometric identities.

Recommended Books:

Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin, Boston (suggested text)

Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston

Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

2. MATHEMATICS II (CALCULUS)

Prerequisite(s): Mathematics I (Algebra)

Credit Hours: 3 + 0

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of calculus to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities.

Limits and Continuity: Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

Derivatives and their Applications: Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.

Integration and Definite Integrals: Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

Recommended Books:

Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York

Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)

Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston

Thomas GB, Finney AR, *Calculus* (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

3. MATHEMATICS III (GEOMETRY)

Prerequisite(s): Mathematics II (Calculus)

Credit Hours: 3 + 0

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of geometry to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Geometry in Two Dimensions: Cartesian-coördinate mesh, slope of a line, equation of a line, parallel and perpendicular lines, various forms of equation of a line, intersection of two lines, angle between two lines, distance between two points, distance between a point and a line.

Circle: Equation of a circle, circles determined by various conditions, intersection of lines and circles, locus of a point in various conditions.
Conic Sections: Parabola, ellipse, hyperbola, the general-second-degree equation

Recommended Books:

Abraham S, Analytic Geometry, Scott, Freshman and Company, 1969
 Kaufmann JE, College *Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
 Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

4. RSE FOR NON-MATHEMATICS MAJORS IN SOCIAL SCIENCES

<i>Title of subject</i>	MATHEMATICS	
<i>Discipline</i>	: BS (Social Sciences).	
<i>Pre-requisites</i>	: SSC (Metric) level Mathematics;	
<i>Credit Hours</i>	: 03 + 00	<i>Minimum</i>
<i>Contact Hours</i>	: 40	
<i>Assessment</i>	: written examination;	<i>Effective:</i>
	2008 and onward	

Aims : To give the basic knowledge of Mathematics and prepare the students not majoring in mathematics.

Objects : After completion of this course the student should be able to:

- Understand the use of the essential tools of basic mathematics;
- Apply the concepts and the techniques in their respective disciplines;
- Model the effects non-isothermal problems through different domains;

Contents :

1. *Algebra* : *Preliminaries*: Real and complex numbers, Introduction to sets, set operations, functions, types of functions. *Matrices*: Introduction to matrices, types of matrices, inverse of matrices, determinants, system of linear equations, Cramer's rule. *Quadratic equations*: Solution of quadratic equations, nature of roots of quadratic equations, equations reducible to

quadratic equations. *Sequence and Series*: Arithmetic, geometric and harmonic progressions. *Permutation and combinations*: Introduction to permutation and combinations, *Binomial Theorem*: Introduction to binomial theorem. *Trigonometry*: Fundamentals of trigonometry, trigonometric identities. *Graphs*: Graph of straight line, circle and trigonometric functions.

2. *Statistics* : *Introduction*: Meaning and definition of statistics, relationship of statistics with social science, characteristics of statistics, limitations of statistics and main division of statistics. *Frequency distribution*: Organisation of data, array, ungrouped and grouped data, types of frequency series, individual, discrete and continuous series, tally sheet method, graphic presentation of the frequency distribution, bar frequency diagram histogram, frequency polygon, cumulative frequency curve. *Measures of central tendency*: Mean median and modes, quartiles, deciles and percentiles. *Measures of dispersion*: Range, inter quartile deviation mean deviation, standard deviation, variance, moments, skewness and kurtosis.

Books Recommended:

1. Swokowski. E. W., '*Fundamentals of Algebra and Trigonometry*', Latest Edition.
2. Kaufmann. J. E., '*College Algebra and Trigonometry*', PWS-Kent Company, Boston, Latest Edition.
3. Walpole, R. E., '*Introduction of Statistics*', Prentice Hall, Latest Edition.
4. Wilcox, R. R., '*Statistics for The Social Sciences*',

5. HEMATICS FOR CHEMISTRY

Credit Hours: 3

Prerequisites: Mathematics at Secondary level

Specific Objectives of Course: To prepare the students not majoring in mathematics with the essential tools of Calculus to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real Numbers and the Real Line, *Functions and their graphs:* Polynomial Functions, Rational Functions, Trigonometric Functions, and Transcendental Functions. Slope of a Line, Equation of a Line, Solution of equations involving absolute values, Inequalities. *Limits and Continuity:* Limit of a Function, Left Hand and Right Hand Limits, Continuity, Continuous Functions. *Derivatives and its Applications:* Differentiation of Polynomial, Rational and Transcendental Functions, Extreme Values of Functions. *Integration and Indefinite Integrals:* Integration by Substitution, Integration by Parts, Change of Variables in Indefinite Integrals. Least-Squares Line.

Recommended Books:

1. Thomas, Calculus, 11th Edition. Addison Wesley publishing company, 2005.
2. H. Anton, I. Bevens, S. Davis, Calculus, 8th edition, Jhon Willey & Sons, Inc. 2005.
3. Hughes-Hallett, Gleason, McCallum, et al, Calculus Single and Multivariable, 3rd Edition. John Wiley & Sons, Inc. 2002.
4. Frank A.Jr, Elliott Mendelson, Calculus, Schaum's Outline Series, 4th edition, 1999.
5. E. W. Swokowski, Calculus and Analytic Geometry PWS Publishers, Boston, 1983.
6. John H. Mathews, Numerical Methods for Mathematics Science and Engineering, Prentice-Hall, Second Edition 1992.

6. **HEMATICS FOR PHYSICS**

Contents

1. **Preliminary calculus.**

- **Differentiation**
Differentiation from first principles; products; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz' theorem; special points of a function; theorems of differentiation.
- **Integration**
Integration from first principles; the inverse of differentiation; integration by inspection; sinusoidal function; logarithmic integration; integration using partial fractions; substitution

method; integration by parts; reduction formulae; infinite and improper integrals; plane polar coordinates; integral inequalities; applications of integration.

2. Complex numbers and hyperbolic functions

- **The need for complex numbers**

- **Manipulation of complex numbers**

Additions and subtraction; modulus and argument; multiplication; complex conjugate; division

- **Polar representation of complex numbers**

Multiplication and division in polar form

- **de Moivre's theorem**

Trigonometrical identities; finding the n th roots of unity; solving polynomial equations

- **Complex logarithms and complex powers**

- **Applications to differentiation and integration**

- **Hyperbolic functions**

Definitions; hyperbolic-trigonometric analogies; identities of hyperbolic functions; solving hyperbolic equations; inverses of hyperbolic functions; calculus of hyperbolic functions

3. Series and limits

- **Series**

- **Summation of series**

Arithmetic series; geometric series; arithmetico-geometric series; the difference method; series involving natural numbers; transformation of series

- **Convergence of infinite series**

Absolute and conditional convergence; convergence of a series containing only real positive terms; alternating series test

- **Operations with series**

- **Power series**

Convergence of power series; operations with power series

- **Taylor series**

Taylor's theorem; approximation errors in Taylor series; standard Maclaurin series

- **Evaluation of limits**
- 4. Partial differentiation**
- **Definition of the partial derivative**
 - **The total differential and total derivative**
 - **Exact and inexact differentials**
 - **Useful theorems of partial differentiation**
 - **The chain rule**
 - **Change of variables**
 - **Taylor's theorem for many-variable functions**
 - **Stationary values of many-variable functions**
 - **Stationary values under constraints**
- 5. Multiple integrals**
- **Double integrals**
 - **Triple integrals**
 - **Applications of multiple integrals**
Areas and volumes; masses, centers of mass and centroids; Pappus' theorems; moments of inertia; mean values of functions
 - **Change of variables in multiple integrals**
Change of variables in double integrals;
- 6. Vector algebra**
- **Scalars and vectors**
 - **Addition and subtraction of vectors**
 - **Multiplication by a scalar**
 - **Basis vectors and components**
 - **Magnitude of a vectors**
 - **Multiplication of vectors**
Scalar product; vector product; scalar triple product; vector triple product
 - **Equations of lines and planes**
Equation of a line; equation of a plane
 - **Using vectors to find distances**
Point to line; point to plane; line to line; line to plane
 - **Reciprocal vectors**

7. Matrices and vector spaces

- **Vectors spaces**
Basic vectors; the inner product; some useful inequalities
- **Matrices**
- **The complex and Hermitian conjugates of a matrix**
- **The determinant of a matrix**
Properties of determinants
- **The inverse of a matrix**
- **The rank of a matrix**
- **Simultaneous linear equations**
 N simultaneous linear equations in N unknowns
- **Special square matrices**
Diagonal; symmetric and antisymmetric; orthogonal; Hermitian; unitary normal
- **Eigen vectors and eigen values**
Of a normal matrix; of Hermitian and anti-Hermitian matrices; of a unitary matrix; of a general square matrix
- **Determination of eigen values and eigen vectors**
Degenerate eigen values

8. Vector calculus

- **Differentiation of vectors**
Composite vector expressions; differential of a vector
- **Integration of vectors**
- **Space curves**
- **Vector functions of several arguments**
- **Surfaces**
- **Scalar and vector fields**
- **Vector operators**
Gradient of a scalar field; divergence of a vector field; curl of a vector field
- **Vector operator formulae**
Vector operators acting on sums and products; combinations of grad, div and curl
- **Cylindrical and spherical polar coordinates**
Cylindrical polar coordinates; spherical polar coordinates

INTRODUCTION TO STATISTICS

Credit hrs: 3(3-0)

- Unit 1. **What is Statistics?**
Definition of Statistics, Population, sample Descriptive and inferential Statistics, Observations, Data, Discrete and continuous variables, Errors of measurement, Significant digits, Rounding of a Number, Collection of primary and secondary data, Sources, Editing of Data. Exercises.
- Unit 2. **Presentation of Data**
Introduction, basic principles of classification and Tabulation, Constructing of a frequency distribution, Relative and Cumulative frequency distribution, Diagrams, Graphs and their Construction, Bar charts, Pie chart, Histogram, Frequency polygon and Frequency curve, Cumulative Frequency Polygon or Ogive, Histogram, Ogive for Discrete Variable. Types of frequency curves. Exercises.
- Unit 3. **Measures of Central Tendency**
Introduction, Different types of Averages, Quantiles, The Mode, Empirical Relation between Mean, Median and mode, Relative Merits and Demerits of various Averages. properties of Good Average, Box and Whisker Plot, Stem and Leaf Display, definition of outliers and their detection. Exercises.
- Unit 4. **Measures of Dispersion**
Introduction, Absolute and relative measures, Range, The semi-Inter-quartile Range, The Mean Deviation, The Variance and standard deviation, Change of origin and scale, Interpretation of the standard Deviation, Coefficient of variation, Properties of variance and standard Deviation, Standardized variables, Moments and Moments ratios. Exercises.
- Unit 5. **Probability and Probability Distributions**
Discrete and continuous distributions: Binomial, Poisson and Normal Distribution. Exercises
- Unit 6. **Sampling and Sampling Distributions**
Introduction, sample design and sampling frame, bias, sampling and non sampling errors, sampling with and without replacement, probability and non-probability sampling, Sampling distributions for single mean and proportion, Difference of means and proportions. Exercises.
- Unit 7. **Hypothesis Testing**
Introduction, Statistical problem, null and alternative hypothesis, Type-I and Type-II errors, level of significance, Test statistics,

acceptance and rejection regions, general procedure for testing of hypothesis. Exercises.

Unit 8. **Testing of Hypothesis- Single Population**

Introduction, Testing of hypothesis and confidence interval about the population mean and proportion for small and large samples, Exercises

Unit 9. **Testing of Hypotheses-Two or more Populations**

Introduction, Testing of hypothesis and confidence intervals about the difference of population means and proportions for small and large samples, Analysis of Variance and ANOVA Table. Exercises

Unit 10. **Testing of Hypothesis-Independence of Attributes**

Introduction, Contingency Tables, Testing of hypothesis about the Independence of attributes. Exercises.

Unit 11. **Regression and Correlation**

Introduction, cause and effect relationships, examples, simple linear regression, estimation of parameters and their interpretation. r and R^2 . Correlation. Coefficient of linear correlation, its estimation and interpretation. Multiple regression and interpretation of its parameters. Examples

Recommended Books

- 1 Walpole, R. E. 1982. "Introduction to Statistics", 3rd Ed., Macmillan Publishing Co., Inc. New York.
- 2 Muhammad, F. 2005. "Statistical Methods and Data Analysis", Kitab Markaz, Bhawana Bazar Faisalabad.