

**Objective:**

The objective of course is to introduce a disciplined approach to Problem solving methods and algorithm development. The aim is to teach the syntax and vocabulary of a modern programming language like C++. The significant philosophies and logical programming, including models for I/O, processing, and all related terminology will be taught. Simple programs will be constructed, using a number of different logical, calculation and algorithm.

**Course Outline:**

Introduction to Computer Programming , Basics of C++ language , Problem Solving and Algorithm Design, Pseudo-codes and Flow charts, Arithmetic Operators and Variables, Exploring input and output statements, Control Structure (Selection and iterative), Functions, Primary data structure of Arrays and its multi-dimensional behavior, Concepts of Pointers, Introductory knowledge of Structures.

**Recommended Books:**

1. Maureen Sprankle, "Problem Solving and Programming Concepts", 7th Ed., Prentice Hall
2. C++ How to Programme by Dietel and Dietel
3. Behrouz A. Forouzan, A Structured Programming Approach Using C++.

**Objectives:** The course is designed to introduce the students with sociological concepts and the discipline. The focus of the course shall be on significant concepts like social systems and structures, socio-economic changes and social processes. The course will provide due foundation for further studies in the field of sociology.

**Course Contents****Unit I: Introduction**

- a. Definition, Scope, and Subject Matter
- b. Sociology as a Science
- c. Historical back ground of Sociology

**Unit II: Basic Concepts**

- a. Group, Community, Society
- b. Associations
  - i. Non-Voluntary
  - ii. Voluntary
- c. Organization
  - i. Informal
  - ii. Formal
- d. Social Interaction
  - i. Levels of Social Interaction
  - ii. Process of Social Interaction
    1. Cooperation
    2. Competition
    3. Conflict
    4. Accommodation

5. Acculturation and diffusion
6. Assimilation
7. Amalgamation

### **Unit III: Social Groups**

- a. Definition & Functions
- b. Types of social groups
  - i. In and out groups
  - ii. Primary and Secondary group
  - iii. Reference groups
  - iv. Informal and Formal groups
  - v. Pressure groups

### **Unit IV: Culture**

- a. Definition, aspects and characteristics of Culture
  - i. Material and non-material culture
  - ii. Ideal and real culture
- b. Elements of culture
  - i. Beliefs
  - ii. Values
  - iii. Norms and social sanctions
- c. Organizations of culture
  - i. Traits
  - ii. Complexes
  - iii. Patterns
  - iv. Ethos
  - v. Theme
- d. Other related concepts
  - i. Cultural Relativism
  - ii. Sub Cultures
  - iii. Ethnocentrism and Xenocentrism
  - iv. Cultural lag

### **Unit V: Socialization & Personality**

- a) Personality, Factors in Personality Formation
- b) Socialization, Agencies of Socialization
- c) Role & Status

### **Unit VI: Deviance and Social Control**

- c) Deviance and its types
- d) Social control and its need
- e) Forms of Social control
- f) Methods & Agencies of Social control

### **Unit VII: Collective Behavior**

- a) Collective behavior, its types
- b) Crowd behavior
- c) Public opinion
- d) Propaganda
- e) Social movements
- f) Leadership

### **Recommended Books:**

1. Anderson, Margaret and Howard F. Taylor. 2001. *Sociology the Essentials*. Australia: Wadsworth.

2. Brown, Ken 2004. *Sociology*. UK: Polity Press
3. Giddens, Anthony 2002. *Introduction to Sociology*. UK: Polity Press.
4. Macionis, John J. 2006. 10<sup>th</sup> Edition *Sociology* New Jersey: Prentice-Hall
5. Tischler, Henry L. 2002. *Introduction to Sociology* 7<sup>th</sup> ed. New York: The Harcourt Press.
6. Frank N Magill. 2003. *International Encyclopedia of Sociology*. U.S.A: Fitzroy Dearborn Publishers
7. Macionis, John J. 2005. *Sociology* 10<sup>th</sup> ed. South Asia: Pearson Education
8. Kerbo, Harold R. 1989. *Sociology: Social Structure and Social Conflict*. New York: Macmillan Publishing Company.
9. Koenig Samuel. 1957. *Sociology: An Introduction to the Science of Society*. New York: Barnes and Nobel.
10. Lee, Alfred Mclung and Lee, Elizabeth Briant 1961. *Marriage and The family*. New York: Barnes and Noble, Inc.
11. Leslie, Gerald et al. 1973. *Order and Change: Introductory Sociology* Toronto: Oxford University Press.
12. Lenski, Gevbard and Lenski, Jeam. 1982. *Human Societies*. 4<sup>th</sup> edition New York: McGraw-Hill Book Company.
13. James M. Henslin. 2004. *Sociology: A Down to Earth Approach*. Toronto: Allen and Bacon.

OR

**GEN-4401  
2(2-0)**

**Introduction to Psychology**

**Credit Hrs**

**Objective**

To describe psychology with major areas in the field, and identification of the parameters of this discipline

Course Contents.

**Unit I: Introduction to Psychology**

- Nature and Application of Psychology with special reference to Pakistan.
- Historical Background and Schools of Psychology (A Brief Survey)

**Unit II: Methods of Psychology**

- Observation
- Case History Method Experimental Method
- Survey Method d. Interviewing Techniques

**Unit III: Biological Basis of Behavior**

- Neuron: Structure and Functions
- Central Nervous System and Peripheral Nervous System
- Endocrine Glands

**Unit IV: Sensation, Perception and Attention**

a. Sensation

- Characteristics and Major Functions of Different Sensations
- Vision: Structure and functions of the Eye.
- Audition: Structure and functions of the Ear.

b. Perception

- Nature of Perception
- Factors of Perception: Subjective, Objective and Social
- Kinds of Perception:

- Spatial Perception (Perception of Depth and Distance)
- Temporal Perception; Auditory Perception.

c. Attention

- Factors, Subjective and Objective
- Span of Attention
- Fluctuation of Attention
- Distraction of Attention (Causes and Control)

**Unit V: Motives** a. Definition and Nature b. Classification

- Primary (Biogenic) Motives

Hunger, Thirst, Defecation and Urination, Fatigue, Sleep, Pain, Temperature, Regulation, Maternal Behavior, Sex

- Secondary (Sociogenic) Motive

Play and Manipulation, Exploration and Curiosity, Affiliation, Achievement and Power, Competition, Cooperation, Social Approval and Self Actualization.

**Unit VI. Emotions**

- Definition and Nature
- Physiological changes during Emotions (Neural, Cardial, Visceral, Glandular), Galvanic Skin Response; Pupillometrics
- Theories of Emotion
- James Lange Theory; Cannon-Bard Theory
- Schechter –Singer Theory

**Unit VII: Learning**

- Definition of Learning
- Types of Learning: Classical and Operant Conditioning Methods of Learning: Trial and Error; Learning by Insight; Observational Learning

**Unit VIII: Memory**

- Definition and Nature
- Memory Processes: Retention, Recall and Recognition
- Forgetting: Nature and Causes

**Unit IX: Thinking**

- Definition and Nature
- Tools of Thinking: Imagery; Language; Concepts
- Kinds of Thinking d. Problem Solving; Decision Making; Reasoning

**Unit X. Individual differences**

- Definition concepts of Intelligence, personality, aptitude, achievement

**RECOMMENDED BOOKS**

1. Atkinson R. C., & Smith E. E. (2000). Introduction to psychology(13thed.). Harcourt Brace College Publishers.
2. Fernald,L.D.,&Fernald,P.S.(2005). Introduction to psychology. USA: WMCBrownPublishers.
3. Glassman, W. E. (2000). Approaches to psychology. Open University Press.
4. Hayes, N. (2000). Foundation of psychology (3rd ed.). Thomson Learning.
5. Lahey, B. B. (2004). Psychology: An introduction (8th ed.). McGraw-HillCompanies, Inc.
6. Leahey, T. H. (2003). A history of psychology: Main currents in psychological thought. New Jersey: Prentice-Hall International, Inc. (7th ed.)
7. Myers, D. G. (1992). Psychology. (3rd ed.). New York: WadsworthPublishers.
8. Ormord, J. E. (1995). Educational psychology: Developing learners. Prentice- Hall, Inc.

OR

**GEN-4401**

**Introduction to Management**

**Credit Hrs 2(2-0)**

**Objectives:**

- To introduce the concept of principles of management, functions of management: Planning, Organizing, leading and controlling, Practical Learning for the 21<sup>st</sup> century.
- To address the most pertinent issues likely to be encountered in Organizational life and future by professionals especially in Pakistan.

Week #	Lecture #	TOPICS TO BE COVERED
1	1.	Foundation of management. Definition Scope and Functions of Management
	2.	Different Levels Roles and Skills of Management, Management & Organization.
2	3.	Management theories and perspectives, Evolution of Management Theories.
	4.	Scientific Management, Administrative Management, Bureaucratic Management.
3	5.	Behavioral theories, Hawthorne Studies, System Approach, Contingency Approach.
	6.	Current Trends & Issues of Management; workforce diversity, globalization.
4	7.	Organizational culture & environment: Different Views and Sources of Culture.
	8.	External & Internal Environmental Factors, Task & Mega Environment.
5	9.	Corporate social responsibility, Views on CSR, value based management
	10	Ethics in management, factors affecting ethics and improving ethical behaviors.
6	11	Decision making: Decision making process of eight steps and its Conditions.
	12	Decision Making Errors and Biases, Types of Problems & Respective Decisions.
7	13	Foundation of planning: Conceptual View of Planning and its Purpose & importance.
	14	Challenges & Types of planning, Developing Organizational Goals, Types of Goals.
		MID TERM EXAMS
		MID TERM BREAK
8	15	Strategic management: Strategic Management Process & Formulation of Strategies.
	16	Organizational & Environmental Analysis: SWOT & PEST analysis.
9	17	Types of Organizational Strategies: Corporate and business Strategies
	18	Types of Organizational Strategies: Functional strategies, Strategic Flexibility.
10	19	Organizing; Foundation of Organizational Structure & design. Contingency Factors.
	20	Types of Organizational Structure, Departmentalization & Chain of Command.
11	21	Span of Control & Formulization, Centralization & Decentralization, Work division.

	22	Traditional & Contemporary Designs, Mechanistic & Organic Organizations.
12	23	Leadership & management: Who are Leaders? What is Leadership?
	24	Early Leadership Theories: Trait & behavioral theories, Models of Leadership
13	25	Different Leadership Styles, Contingency Theories of Leadership. Today challenges.
	26	Foundation of Control: Importance of Control, Control Process of different steps.
14	27	Elements, Approaches & Types of Controlling, Organizational Performance
	28	Measures to Control Organizational Performance. Control Strategies for deviations.

**Recommended Books:**

- Courtland L. Bovee, John V. Thill, Marian Burk Wood, George P. Thill, Management, international Edition.
- Emerald Case studies for Management practice.
- Activity of "Six Thinking Hat" By Edward DeBono.
- Analytical discussions on "Seven Habits of highly Effective People" by Stephen R. Covey 1989.

OR

**GEN-4401**  
**0)**

**Introduction to Education**

**Credit Hrs 2(2-**

**Unit 1 Ideological Foundation of Education**

Introduction to Education

Concepts and Aims of Education

Modes and Scope of Education

Islamic Foundations

Islamic concept of Peace

Other religions and Islam

Ideology and teachers

**Unit 2 Philosophical Foundations of Education**

Philosophy and Education

Main Philosophical Thoughts

Idealism

Realism

Pragmatism

Re-constructionism

**Unit 3 Psychological Foundations of Education**

Learning and Maturation

Individual Differences

Self-Concept

Academic Aptitude

Instructional Strategies and Psychology

**Unit 4 Socio-Economic Foundations of Education**

Concept of Society and Culture

Social Conditions and Education

Economic Conditions and Education

Politics and Education

**Unit 5 Historical Foundations of Education in Pakistan**

Pre-Pakistan Period (712 A.D. to onward)

Period from 1947-1958

Period from 1959-1971

Period from 1972-1979

Period from 1980 -1991

Period from 1992 – to date

### **Unit 6 Aims of Education**

Aims, Goals and Objectives

Taxonomies of Objectives

Aims and Objectives of Education in Pakistan

### **Unit 7 Problems and Issues in Education in Pakistan**

Universalization of Primary Education

Literacy

Medium of Instruction

Diversification of Education

Environmental Education

Gender and Education

Islamization of Education

Special Education

Health Education / Drug Education

HIV / Aids, STIs, Hepatitis

### **Recommended Books**

Canestrari, A. (2009). *Foundations of Education*. New York: Sage Publications

Eugene, F.P. (2005). *Critical issues in education: Anthology of reading*. New York: Sage

Publications.

Goldblatt, P.F., & Smith, D. (2005). *Cases for teacher development*. New York: Sage

Publications.

Holt, L.C. (2005). *Instructional patterns: Strategies for maximizing students learning*.

Murphy, D. (2005). *Foundations/Introduction to Teaching*. USA: Allyn & Bacon, Inc.

New York: Sage Publications.

Semel, S. F. (2010). *Foundations of education: The essential texts*. USA: Routledge.

OR

**GEN-4401**

**Introduction to Anthropology**

**Credit Hrs 2(2-0)**

#### **1. Introduction**

- a. Definition of Anthropology
- b. Fields of anthropology
- c. Anthropological research methods
- d. Anthropology and other social sciences
- e. Significance of anthropology

#### **2. Culture**

- a. Definition, properties and taxonomy
- b. Evolution and growth of culture
- c. Evolution of man: religious and modern perspectives
- d. Evolution of culture

#### **3. Language and culture**

- a) Communication
- b) Structural linguistics
- c) Historical linguistics
- d) Sociolinguistics
- e) Relationship between language and culture
- f) Sapir Whorf Hypothesis



#### **4. Economic system**

a. Economic anthropology

b. Adaptive Strategies

- Foraging
- Pastoralists
- Horticulture
- Agriculture
- Industrial

c. Distribution and Exchange

- Market exchange
- Redistribution
- Reciprocity (types)
- Barter

d. Kula Ring

e. Pot latching

#### **5. Marriage and family**

a. Marriage its types and functions

b. Forms and functions of family

c. Residence patterns

d. Kinship and descent

e. Descent groups; Rules and types of descent

#### **6. Political organization**

a. Types of political organization

b. Centralized and Un centralized political systems

c. Membership, settlement patterns, decision making in Band Tribes and Chiefdom

d. Leadership/Resolution of conflict in Band Tribes and Chiefdom

#### **7. Religion and magic**

a. Definition, Basic Concepts

b. Animism and Animatism

c. Religious practitioners (Shamans)

d. Rituals and its examples

- Rites of Passage

e. Witchcraft, Magic and sorcery

g. Functions of religion

#### **8. Culture change**

a. Mechanism of cultural change

b. Repressive change

- Acculturation and Ethnocide
- Genocide

c. Cultural change in the modern world

d. Problems of cultural change in Pakistani society

#### **9. The arts**

a. Visual Arts

b. Verbal Art

- Myth
- Legend
- Tale

#### **Recommended Books**



1. Adamson, Hoebel and Everett L. Frost. (1979). Cultural and Social Anthropology, New Delhi: McGraw Hill Publishing Co.
2. Bernard, H. Russell (1994). Research Methods in Anthropology: Qualitative and Quantitative Approaches. London: Sage Publications
3. Bodley, Jhon H. (1994). Cultural Anthropology. California: Mayfield Publishing Co.
4. Clammer, John R. (1983). Modern Anthropological Theory, New Delhi, Cosmo
5. Ember, Carol R. and Ember, Melvin (1990). Anthropology. (6th ed. Englewood Cliffs: Prentice Hall Inc.
6. Harris, Marvin (1987). Cultural Anthropology, New York: Harper and Row.
7. Harris, Morven (1985). Culture, People, Nature; An Introduction to General Anthropology. London: Harper and Row.

**GEN-4402**

**CIVICS & COMMUNITY ENGAGEMENT**

**Credits: 2(2-0)**

**Objective:** To enable students to

1. Demonstrate fundamental understanding of civics, government, citizenship and civil society.
2. Understand the concept of community and recognize the significance of community engagement for individuals and groups.

**Course Contents:**

**1. Civics and Citizenship:**

- Concepts of civics, citizenship, and civic engagement.
- Foundations of modern society and citizenship.
- Types of citizenship: active, participatory, digital, etc.

**2. State, Government and Civil Society:**

- Structure and functions of government in Pakistan.
- The relationship between democracy and civil society.
- Right to vote and importance of political participation and representation.

**3. Rights and Responsibilities:**

- Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973.
- Civic responsibilities and duties.
- Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.)

4. **Community Engagement:**
  - Concept, nature and characteristics of community.
  - Community development and social cohesion.
  - Approaches to effective community engagement.
  - Case studies of successful community driven initiatives.
5. **Advocacy and Activism:**
  - Public discourse and public opinion.
  - Role of advocacy in addressing social issues.
  - Social action movements.
6. **Digital Citizenship and Technology:**
  - The use of digital platforms for civic engagement.
  - Cyber ethics and responsible use of social media.
  - Digital divides and disparities (access, usage, socioeconomic, geographic, etc.) and their impacts on citizenship.
7. **Diversity, Inclusion and Social Justice:**
  - Understanding diversity in society (ethnic, cultural, economic, political etc.).
  - Youth, women and minorities' engagement in social development.
  - Addressing social inequalities and injustices in Pakistan.
  - Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence.

#### Recommended Books

1. "Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education.
2. "Citizenship in Diverse Societies" by Will Kymlicka and Wayne Norman.
3. "Engaging Youth in Civic Life" by James Youniss and Peter Levine.
4. "Digital Citizenship in Action: Empowering Students to Engage in Online Communities" by Kristen Mattson.
5. "Globalization and Citizenship: In the Pursuit of a Cosmopolitan Education" by Graham Pike and David Selby.
6. "Community Engagement: Principles, Strategies, and Practices" by Becky J. Feldpausch and Susan M. Omilian.
7. "Creating Social Change: A Blueprint for a Better World" by Matthew Clarke and Marie-Monique Steckel.

#### GEN-4403

#### IDEOLOGY & CONSTITUTION OF PAKISTAN

Credits: 2(2-0)

Objective	<ul style="list-style-type: none"> <li>• To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan.</li> <li>• To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.</li> </ul>
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#### Course Outline

##### 1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land

- d. Indus Civilization
- e. Muslim advent
- f. 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

### Recommended Books:

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 Bangladesh*, 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.

**STA-4404**

**APPLIED STATISTICS**

**Credits: 3(3-0)**

### **Course Contents**

Introduction to Vital Statistics and its applications, Registration methods in Pakistan, concept of rate and ratio. Sex ratio, Child-Women ratio, Population growth rate, Classification of vital rates, Basic Demographic figures of Pakistan.

Index numbers: construction and uses of index numbers, un-weighted index numbers (simple aggregative index, average of relative price index numbers). Weighted index numbers. Consumer price index (CPI) and Sensitive Price Indicators. Time Series Analysis: Components of time series and their isolation. Vital Statistics and their isolation.

### **Books Recommended**

1. McLave, J. T. Benson, P. G. and Snitch, T. "*Statistics for Business & Economics*" 9<sup>th</sup> Prentice Hall New Jersey (2005).
2. Walpole, P. E. Myers, R. H. Myers S. L. "*Probability and Statistics for Engineers and Scientists*", 8<sup>th</sup> Edition, Prentice Hall (2007).
3. Chaudhry, S. M. and Kamal, S. "*Introduction to Statistical Theory*" Parts I & II, 8<sup>th</sup> edition, IlmiKitabKhana, Lahore, Pakistan (2009).
4. Cochran, W. G. "*Sampling Techniques*" 3<sup>rd</sup> Edition, Wiley (2008).
5. Pollard, A. H. Yousuf, F. and Pollard G. M. "*Demographic Techniques*", Pergamon Press, Sydney (1990).
6. Clark, G. M. and Cooke, D. "*A Basic Course in Statistics*" 4<sup>th</sup> Edition Arnold, London (1998).

**STA-4405 INTRODUCTION TO REGRESSION & EXPERIMENTAL DESIGN Credits: 3(3-0)**

### **Course Contents**

Concepts of Regression and Correlation, Simple Linear regression, Inference regarding regression parameters, Linear correlation: simple, partial and multiple correlation. Inference regarding correlation coefficient. Coefficient of determination. Rank Correlation.

One-Way and Two-Way Analysis of Variance Design of Experiments, Basic Principles of Design of Experiments, Description, Layout and Analysis of Completely Randomized Design, Randomized Complete Block Design and Latin Square Design. Multiple Comparisons (LSD and Duncan's test).

### **Books Recommended**

1. Clark, G. M. and Kempson, R. E. "*Introduction to the Design & Analysis of Experiment*" Arnold London (1997).

2. Weiss, N. A. "Introductory Statistics" 9<sup>th</sup> Edition, Addison-Wesley Pub. Company, Inc (2012).
3. Chaudhry, S. M. and Kamal, S. "Introduction to Statistical Theory" Parts I & II, 8<sup>th</sup> edition. IlmiKitabKhana, Lahore, Pakistan (2009).
4. Cochran, W. C. and Cox, G. M. "Experimental Design" John Wiley and Sons New York, 2<sup>nd</sup> edition, (2006).
5. Montgomery, D. C. "The Design and Analysis of Experiments". John Wiley and Sons, New York, 5<sup>th</sup> Edition, (2010).
6. Gujrati, D. "Basic Econometrics" McGraw Hill Book Company, 4<sup>th</sup> Edition. (2007).
7. Chatterjee, Samprit. "Regression Analysis by Example" 5<sup>th</sup> Edition, Wiley (2013).
8. Montgomery, Douglas C. "Introduction to Linear Regression Analysis" Wiley New York, 3<sup>rd</sup> Edition (2004).

**MAT-4406**

**Calculus-III**

**Credit Hrs. 3(3-0)**

**Course Objectives:**

This course extends the study of infinite series, conic sections, and calculus to multivariable functions, including partial differentiation, multiple integration, and vector calculus.

**Course Contents:**

Sequences, Monotone Sequences, Infinite Series, Convergence Tests, The Comparison, Ratio, and Root Tests, Alternating Series, Absolute and Conditional Convergence, Maclaurin and Taylor Polynomials, Maclaurin and

**STA-5501**

**Probability & Probability Distributions-I**

**Credits: 3(3-0)**

**Objectives**

The course covers the laws of probability, expectation, Joint, marginal and conditional distributions. Some standard distributions of random variables both discrete and continuous are studied in this course. The course serves as preparation for later more systematic study of Mathematical Statistics, Statistical Inference and Stochastic Processes.

**Course Contents**

General Concept of Probability; Random Experiment, Sample Space and sample points, Event, Types of Event: Mutually Exclusive, Equally likely, Exhaustive, Compliment, Dependent and Independent. Rules for Counting the Sample Points: Multiplicative rule, Permutation and Combination. Definition of Probability, Axioms of Probability, Probability as a set function. Addition Theorem of Probability (ATP). Conditional Probability, Multiplicative Theorem of Probability (MTP). Bayes'



Theorem (BT). Proofs and application of ATP, MTP and BT. Random Variable (RV). Probability Distribution, and Probability Density Function. Mean or Expected value and variance of RV. Distribution function. Joint distribution, Marginal and conditional distributions, Stochastic independence, Conditional expectation. Probability generating function, Moment generating function, Characteristics function and their existence properties. Relation between moments and cumulants. Probability Distributions: Binomial, Poisson, Hyper geometric, Multinomial, Negative Binomial, Geometric, Uniform, Normal, Exponential distributions with their properties and application.

### **Text Book**

Hogg, R. M. and Craig, A. T. Introduction to Mathematical Statistics. Prentice Hall, Engle wood Cliffs, New Jersey (2008).

### **BOOKS RECOMMENDED**

Hirai, A. S. A Course in Mathematical Statistics, IlmiKutabKhana, Lahore (2012).

1. Ross, S. A first Course in Probability, 8<sup>th</sup> Edition, Prentice Hall, Pearson (2010).
2. Mood, A. M., Graybill, F. A. and Boes, D. C. Introduction to the Theory of Statistics, McGraw Hill, New York (2008).
3. Rice, J. A. Mathematical Statistics and Data Analysis, 3<sup>rd</sup> Edition. Duxbury Press (2006).
4. Ross, S. M. Introduction to Probability, 8<sup>th</sup> editions, Academic Press (2002).
5. Stuart, A. and Kendall's, O. J. K. Advanced Theory of Statistics, Vol. I, Charles Griffin, London (1998).
6. Khan, M. K. Probability with Applications, Maktiballmi, LahorePakistan (1996).
7. Scheaffer, R. L. Introduction to Probability and its Applications, PWS-Kent (1990).
8. Walpole, R. E. Introduction to Statistics (1982).

**STA-5502**

**Regression Analysis-I**

**Credits: 3(3-0)**

### **Objectives**

Students will learn basic techniques, ideas and concepts associated with linear regression. In the context of linear regression, they will learn how to use specific statistical methods and general modes of statistical thinking to make inferences from data, and to support (or refute) an argument or point of view with quantitative information.

### **Course Content**

Simple linear regression: Assumptions and least squares estimates, Gauss Markov Theorem. General linear model: Least squares solution, test of hypotheses and confidence intervals about parameters, Residual Analysis: Testing and dealing with heteroscedasticity and auto-correlation, Estimation under Multicollinearity and Solutions to multicollinearity.

### **Text Book**

Draper, N. R. and Smith, H. Applied Regression Analysis, John Wiley, New York (2011).

## **BOOKS RECOMMENDED**

1. Gujrati, D. Basic Econometrics, John Wiley, New York (2012).
2. Johnston, J. Econometric Method, 4<sup>th</sup> Edition, McGraw Hill, New York (2007).
3. Montgomery, D. C. and Peck, E. Introduction to Liner Regression Analysis, John Wiley, New York (2004).
4. Koutsoyiannis, A. Theory of Economic, McMillan (2011).

**STA-5503**

**Sampling Techniques-I**

**Credits: 3(3-0)**

### **Objectives:**

The objectives of this course are to teach basic ideas of sampling from an applied perspective and to provide experience with life-like problems. The course will cover the main techniques used in actual sampling practice: Simple random sampling, Stratification, Systematic selection, Cluster sampling, multistage sampling, and probability proportional to size sampling. The course will concentrate on problems of applying sampling methods to human populations.

### **Course contents:**

Basic concepts of sampling techniques, advantages and disadvantages of sampling methods, requirements of a good sample, bias, sampling and non-sampling errors. Steps and problems involved in planning and conduct of census and sample surveys. Description and properties of simple random sampling. Sampling for proportions and percentages. Estimation of variances, standard errors and confidence limits. Sample size determination under different conditions. Description and Properties of Stratified random sampling. Formation of Strata, Different methods of allocation of sample size, Systematic sampling. Ratio and regression estimates in simple and stratified random sampling.

### **Text Book**

Cochran, W. G. Sampling Techniques, 3<sup>rd</sup> Edition, John Wiley and Sons, New York (2008).

## **BOOKS RECOMMENDED**

1. Kish, L. Survey Sampling, John Wiley, New York (2014).
2. Raj, D. and Chandhok, P. Sample Survey Theory, Narosa Publishing House, New Delhi (2000).
3. Ferguson, T. S. A Course in large Sample Theory, Chapman and Hall, London (1996).
4. Singh, R. and Singh, N. Elements of Survey Sampling. Kulwar Academic Publisher, Dodrecht (1996).

**STA-5504**

**Mathematical Methods for Statistics**

**Credits: 3(3-0)**

### **Objectives:**

Students will develop a deeper understanding of mathematical concepts and relations using problem solving techniques such as visualization and exploration of patterns. By learning to express mathematical ideas clearly and precisely students will further deepen their understanding and enhance



their mathematical reasoning and communication skills. At the end of the module students will be able to understand, construct, visualize and present a coherent, mathematical argument.

**Course contents:**

Introduction to Set, Set operation. Function, Types of Functions, Review of Matrices and Vectors, Matrix operation, Linear equations, Cramer's rule, linear equation and their application, Newton Raphson method, Bisection Method, Secant Method. Derivatives and their applications, Integration of definite Integrals, Techniques of evaluating indefinite Integrals, Integration by substitutions, Integration by parts, change of variables in indefinite integrals. Likelihood estimates of distributions; Normal, Lognormal, Gamma, Exponential, Poisson, Geometric, etc.

**Text Book**

Anton, H., Bevens, I. and Davis, S. Calculus: A New Horizon, 8<sup>th</sup> Edition, John Wiley, New York (2005).

**BOOKS RECOMMENDED**

1. Kaufmann, J.E. College Algebra and Trigonometry, PWS-Kent Company, Boston (1987).
2. Swokowski, E. W. Fundamentals of Algebra and Trigonometry, 6<sup>th</sup> Edition, PWS-Kent Company, Boston (1986).
3. Swokowski, E. W. Calculus and Analytic Geometry, PWS- Kent Company, Boston (1983).
4. Dolciani, M. P., Wooton, W., Beckenback, E. F. and Sharron, S. Algebra 2 and Trigonometry, Houghton and Mifflin, Boston (1978).

**STA-5505**

**Statistical Methods**

**Credits: 3(3-0)**

**Objectives:**

This course introduces the basic concepts of statistical inference through a careful study of several important procedures. Topics include 1- and 2-sample location problems, the one-way analysis of variance and simple linear regression. Most assignments involve applying probability models and/or statistical methods to practical situations and actual data sets. It is the gateway to more advanced courses offered by the Department of Statistics.

**Course contents:**

Basic concepts of Statistics, Branches of Statistics, Data; Types, Major sources, Populations, Sample, Parameter, Statistic, Sampling; Introduction and types. Basic concept of probability and application of Probability distribution (Binomial, Poisson, normal). Type I and II errors, confidence interval (CI), derivation of CI, estimation, testing of simple and composite hypotheses about mean, proportions, variances, (Z, t, F, Chi-square etc.), p-value of the test, Power and O.C. functions. Regression analysis and Correlation coefficient, ANOVA and its applications, Non-parametric tests.

### **Text Book**

Steel, R. and Torrie, J. H. Principles and procedures of Statistics, Megraw Hill (1983).

### **BOOKS RECOMMENDED**

1. Zar, J. H. Bio statistical Analysis, Prentice-Hall, Int. (2011).
2. Dixon, W. J. and Massey, F. J. Introduction to Statistical Analysis, Megraw Hill (1983).
3. Snedecor, G. and Cochran. W. G. Statistical Methods, Iowa State Press (1962).

**STA-5601**

**Probability & Probability Distributions-II**

**Credits: 3(3-0)**

### **Objectives:**

The course covers the transformation techniques which are useful for determining the sampling distribution of statistic e.g. mean, range, midrange, variance etc. Some standard distributions are considered with their application and properties in this course. The course serves as preparation for later more systematic study of Statistical inference.

### **Course contents:**

Probability Distributions: Gamma, Beta, Laplace, Cauchy, Rayleigh, Pareto, Maxwell, Weibull and bivariate normal distributions with properties and applications. Chi-Square, t and F distributions, their derivations and properties. Transformation of variable techniques; change of variable, m.g.f and distribution function (Univariate, Bivariate and Multivariate techniques). Central limit and Chebyshev's theorems and other inequalities. Weak and Strong Laws and their applications. Order statistics. Distribution of  $r^{\text{th}}$  and  $s^{\text{th}}$  order statistics. Independence of sample mean and variance.

### **Text Book**

Hogg, R. M. and Craig, A. T. Introduction to Mathematical Statistics. Prentice Hall, Engle wood Cliffs, New Jersey (2008).

### **BOOKS RECOMMENDED**

1. Mood, A. M., Graybill, F. A. and Boss, D. C. Introduction to the Theory of Statistics, McGraw Hill, New York (2008).
2. Stirzaker, D. Probability and Random Variables, Cambridge University press, Cambridge (1999).
3. Stuart, A. and Kendall's, O. J. K. Advanced Theory of Statistics, Vol. I, Charles Griffin, London (1998).
4. Fridett, B. and Gray, L. A Modern Approach to Probability Theory Birkhallser, Boston (1997).
5. Freund, J. E. Mathematical Statistics, Prentice Hall, New Jersey (1997).
6. Khan, M. K. Probability with Applications, Maktiballmi, Lahore (1996).

**STA-5602**

**Regression Analysis-II**

**Credits: 3(3-0)**

**Objectives:**

This course deals with the advanced techniques of econometrics and their applications.

**Course contents:**

Model Selection Procedures; Backward, Forward, Step-wise, all possible regression, Polynomial regression, orthogonal polynomials, Ridge regression, Lagged variables, Dummy variables, System of Simultaneous equation, Identification problem and Estimation methods, Indirect least square (ILS), two stages (2SLS) and three stages least square method (3SLS), test of identifying restrictions, Generalized least square estimator.

**Text Book**

Gujrati, D. Basic Econometrics, John Wiley, New York. (2012).

**BOOKS RECOMMENDED**

1. Draper, N. R. and Smith, H. Applied Regression Analysis, John Wiley and sons (2011).
2. Koutsoyiannis, A. Theory of Econometric, McMillan (2011).
3. William, H. G. Econometric Analysis, 5<sup>th</sup> Edition. Prentice hall International, London (2008).
4. Johnston, J. McGraw Hill, New York (2007).
5. Maddala, G. S. Econometrics, McGraw Hill, New York (2007).
6. Montgomery, D.D. and Peck, E. Introduction to Liner Regression Analysis, John Wiley, New York. (2004).

**STA-5603**

**Sampling Techniques-II**

**Credits: 3(3-0)**

**Objectives:**

This course deals with the advanced techniques of sampling and their applications.

**Course contents:**

Cluster Sampling, Sub Sampling, PPS-Sampling, Double Sampling, Multistage and Multiphase Sampling. Thomson Hurwitz estimator. Definition of Research, Types of Research, Components of scientific report, selection of problem, literature review, hypotheses formulation, Questionnaire construction, collection of data; Data presentation, Data analysis, Interpretation of results, Non-response, their sources and bias. Randomized Response. References, Research report project, publication procedures. Research Report writing.

**Text Book**

Cochran, W. G. Sampling Techniques, 3<sup>rd</sup> Edition, John Wiley and Sons, New York (2008).

### **BOOKS RECOMMENDED**

1. Kish, L. Survey Sampling, John Wiley, New York (2014).
2. Des Raj. and Chankhok, P. Sample Survey Theory, Narosa Publishing House, New Dehli (2000).
3. Des Raj. Design of Sample Survey, McGraw Hill, New York (2000).
4. Ferguson, T. S. A Course in Large Sample Theory, Chapman & Hall, London (1996).
5. Singh, R. and Singh, N. Elements of Survey Sampling, Kulwar, Dodrecht (1996).
6. Sukhatme, P. V, Sukhatme, B., Sukhatme, S., and Asok, A. Sampling Theory of Survey with Application, IowaStateUniversity Press (1985).
7. Various publications of FBS, ACO and PCO.

**STA-5604**

**Statistical Inference-I**

**Credits: 3(3-0)**

#### **Objectives:**

The student will acquire a solid exposition of modern ideas in statistical inference. The fundamentals of point and interval estimation will be presented from both frequentist and non-frequentist perspectives. Alternative philosophical approaches to inference such as likelihood methods, Bayesian methods, and fiducial methods will be described. The intellectual challenge and excitement of various current controversies in statistical inference will be conveyed to the student.

#### **Course contents:**

Basic concept of statistical inference; types of statistical Inference, Estimation, Estimates, Estimator. Properties of Estimators: Unbiasedness, consistency, sufficiency, efficiency, completeness. Cramer-Rao inequality, Rao-Blackwell and Lehmann- Scheffe Theorems. Methods of Estimation: Moments, Maximum likelihood, least-squares, minimum Chi-square and Bayes' method.

#### **Text Book**

Mood, A. M., Graybill, F. A. and Boss, D. C. Introduction to the Theory of Statistics, McGraw Hill, New York (2008).

### **BOOKS RECOMMENDED**

1. Hogg, R. V. and Craig, A. T. Introduction to Mathematical Statistics, Prentice Hall, New Jersey (2008).
2. Rao, C. R. Linear Statistical Inference and its Applications, John Wiley, New York (2002).

3. Bickel, P. J. and Docksum, K. A. Mathematical Statistics, 2<sup>nd</sup> Edition, Vol. I, Prentice Hall, N. J. (2001).
4. Lindgeen, B. W. Statistical Theory, Chapman and Hall, New York (1998).

**STA-5605**

**Experimental Design-I**

**Credits: 3(3-0)**

**Objectives:**

The objective of this course is to introduce basic techniques and methodology for designing and analysis of experiments commonly encountered in the field of Health Sciences, Industrial Engineering and Agricultural Sciences. The emphasis would be given on foundation of the theory of experimental designs and the analysis with their interpretation of results as they relate to experimental objectives.

**Course contents:**

Analysis of variance and its assumptions. Basic Experimental Design. Completely Randomized, Randomized Completed Block, Latin square, Graeco-Latin square and cross-over designs. Fixed, random and mixed effect models. Effect of Violation of Assumptions and transformations. Missing observations. Relative efficiency of designs. Estimation of mean squares and their expectations. Multiple Comparisons. Analysis of covariance in CR and RCB designs. Estimation of missing values in analysis of covariance.

**Text Book**

Montgomery, D. C. Design and Analysis of Experiments, John Wiley, New York (2014).

**BOOKS RECOMMENDED**

1. Cochran, W. G. and Cox, G. M. Experimental Design, John Wiley, New York (2010).
2. Glarke, G. M., and Kempton, R. E. Introduction to the Design and Analysis of Experiments, Edward Arnold (1997).
3. Boniface, D. R. Experimental Design and Statistical Methods, Chapman & Hall (1995).
4. Clarke, G. M. Statistics and Experimental Design. Edward Arnold (1994)
5. Harold, R. L. Analysis of Variance in Experimental Design. Springer Verlage (1992).
6. Maxwell, S. E. and Delaney, H. D. Designing Experiments and Analysis of Data. A Model comparison perspective. Belmont and Wadeson (1990).

**STA-6701**

**Quality Control and Quality Management**

**Credits: 3(3-0)**

**Objectives:**

This course deals with statistical techniques and its applications for Statistical Quality Control and Quality Management.

**Course contents:**

Statistical quality control: measurement and control of quality, control charts for variables ( $X$ ,  $\bar{X}$ ,  $R$ ,  $S$ ,  $S^2$ ) and control charts for attributes ( $P$ ,  $nP$ ,  $C$  and  $U$  charts etc.). O.C Curves associated with control charts, CUSUM Charts, EWMA chart. Geometric moving average with applications; stem and leaf plots, Box plot, P-P plot, Q-Q Plot etc. Producer's risk, Acceptance sampling: Single and double sampling plans. Introduction to multiple sampling plans. Multivariate control charts; Hotelling's  $T^2$  Control chart with applications, Process capability analysis. International quality standards and their certification, Quality management through quality circles, Philosophy of Deming's and cross by 14 points regarding quality improvement.

**Text Book**

Montgomery, D. C. Introduction to Quality Control, John Wiley and Sons (2007)

**BOOKS RECOMMENDED**

1. Thomas, P. R. Quality Control and Quality Improvement. 3<sup>rd</sup> Ed. John Wiley, New York (2011).
2. Grant, E. L. and Leavenworth, R. S. Statistical Quality Control, McGrawHill, New York (2006)
3. Begehi, T. P. ISO 9000 Concepts, Methods and Implementations. (1994).

**STA-6702****Research Methodology****Credits: 3(3-0)****Objectives:**

In this course research techniques and survey methodology are studied.

**Course contents:**

Definition of Research, Types of Research, Selection of problem, Search of References, Formation of Hypothesis and Objectivity, Principles of Experimental Design, Steps in Experimentation, Collection of Data, Data Analysis to Determine Functional Relationship Between Variables, Interpretation of Results, components of Scientific Report and various Methods of Data Presentation, Preparation of Scientific Reports, Publication Procedures.

**Practical:**

Survey of Literature on a Given Topic, collection of References from Various Sources Including SD-ROM Data Base. Collection of Primary and Secondary Data, Arrangement of Primary and Secondary Data, Preparation of Scientific Report for Publication, if Possible.

**Text Book**

Andrew, C. O. and Hildebrand, P. E. Applied Agricultural Research, Foundations and Methodology, Western Press (1993).

### **BOOKS RECOMMENDED**

1. Hashmi, N. Style Manual of Technical Writings, USAID, NARC, Islamabad (1989).
2. Gimbaled, J. and Acuter W. S. MLA handbook for Writers of Research Paper, McGraw, the Modern Language Association of America (1988).

**STA-6703**

**Statistical Packages**

**Credits: 3(2-1)**

#### **Objectives:**

Students will be able to produce and interpret basic and intermediate descriptive and inferential statistics using three Statistical Packages. As a result they will be able to take raw data, clean them, summarize them, analyze them and take appropriate action. They will also be able to interpret published research results for needed action.

#### **Course Content**

Three statistical packages will be offered from the following Statistical Packages for the application of statistical techniques.

- |               |                |
|---------------|----------------|
| 1. SAS        | 2. SPSS        |
| 3. MINITAB    | 4. The R       |
| 5. GENSTAT    | 6. STATGRAPHIC |
| 7. STATISTICA | 8. E-VIEWS     |

### **BOOKS RECOMMENDED**

1. SAS 9.2 User Guide Second Edition.
2. SPSS Statistics Base 17.0 User Guide
3. Minitab manual for Introduction to Practice of Statistics.
4. Eviews Illustrated for version 8.

**STA-6704**

**Statistical Inference-II**

**Credits: 3(3-0)**



**Objectives:**

This course deals, in detail, with test statistics for simple and composite hypotheses and their applications, in real life.

**Course contents:**

Interval Estimation: Pivotal and other methods of finding Confidence Interval, Confidence Interval in large Samples, Shortest Confidence Interval, Optimum Confidence Interval, Bayes' Interval Estimation.

Tests of Hypotheses: Simple and Composite Hypotheses, Critical Regions. Neyman Pearson Lemma Theorem, Power Functions, Uniformly Most Powerful Tests. Dervng Tests of Hypothesis concerning Parameters in Normal, Exponential, Gamma and UnivormDistributins. Randomized Tests, Unbiased Testes, Likelihood Ratio Test and Their Asymptotic Properties. Sequential Tests: SPRT and its Properties, A.S.N. And O.C Functions.

**Text Book**

Mood, A. M., Grabill, F. A. and Boes, D. C. Introduction to the Theory of Statistics, McGraw Hill (2008).

**BOOKS RECOMMENDED**

1. Hogg, A. V. Probability and Statistical Inference, McMillan Co. (2008).
2. Lindgren, B. W. Statistical Theory, Chapman and Hall, New York (1998).
3. Lehman, E. L. Testing Statistical Hypotheses, Springer-Volga, New York (1997).
4. Stuart, A. and Kendall's, O. J. K. Advanced Theory of Statistics (Vol-II), Charles Griffin and Co. (1994).

**STA-6705****Experimental Design-II****Credits: 3(3-0)****Objectives:**

This course deals with the methods that have widely useful in professional practice in the general areas of products in process designs, process improvement and quality engineering.

**Course contents:**

Factorial Experiments:  $2^k$ ,  $3^k$ , series and mixed level factorial experiments and their analysis. Confounding in factorial experiments, Complete and partial confounding, Confounding in Fractional

replications, Quasi-Latin square designs. Split-plot, split-split plot design, strip plot and nested designs.  
Missing observations in Split plot design.

Incomplete block designs: BIBD and PBIBD with recovery of intra-block information, Lattice designs, and Youden squares.

### **Text Book**

Montgomery, D. C. Design and Analysis of Experiments, John Wiley, New York (2014).

### **BOOKS RECOMMENDED**

1. Cochran, W. G. and Cox, G. M. Experimental Design, John Wiley, New York (2010).
2. Clarke, G. M. and Kempton, R. E. Introduction to the Design and Analysis of Experiments, Edward Arnold (1997).
3. Boniface, D. R. Experiment Design and Statistical Methods, Chapman & Hall (1995).
4. Clarke, G. M. Statistics & Experimental Design. Edward Arnold (1997).
5. Harold, R. L. Analysis of Variance in Experimental Design. Springer Verlag (1992).
6. Maxwell, S. E. and Delaney, H. D. Designing Experiments and Analysis of Data. A Model comparison perspective. Belmont and Wadson (1990).

**STA-6802**

**Multivariate Analysis**

**Credits: 3(3-0)**

#### **Objectives:**

By the end of the course students will be able to perform simple graphical representations of multivariate data and statistical methods for situations in which there is more than one response variable. We will develop multivariate extension of t-tests and analysis of variance procedures. Since these extensions are based on the multivariate normal distribution, we will briefly explore properties of the multivariate normal distribution. We will explore ordination techniques for selecting low dimensional summaries of high dimensional data. These include principal component analysis, factor analysis, canonical correlations, correspondence analysis, projection pursuit, multidimensional scaling and related graphical techniques.

#### **Course contents:**

Multivariate Normal Distribution, Distribution of linear function of normal variates, Distribution of Quadratic forms, Wishart distribution, Hotelling's  $T^2$ -distribution, Canonical Correlation Analysis, Discriminant Analysis, Principal Component and Factor Analysis, Factor analysis versus principle component analysis, Cluster Analysis, Multivariate Analysis of Variance (MANOVA).

### **Text Book**

Johnson, R. A. and Wichern, D. W. Applied Multivariate Statistical Analysis, prentice Hall (2014).

### **BOOKS RECOMMENDED**

1. Anderson, T. W. An Introduction to Multivariate Statistical Analysis, John Wiley (2014).
2. Gnanadesikan, R. Methods for Data Analysis of Multivariate observations, 2<sup>nd</sup> Edition, John Wiley and Sons (1997).

**STA-6803**

**Time Series Analysis and Forecasting**

**Credits: 3(3-0)**

#### **Objectives:**

This course explores the statistical methods and their applications on the data generated chronologically and forecasting from fitted models.

#### **Course contents:**

Stochastic Process, Stationary Time-Series, Exponential Smoothing Techniques, Auto-correlation and auto-covariance. Functions and standard error of the auto-correlation functions (ACF) and partial autocorrelation function (PACF), Periodogram, spectral density functions, comparison with ACF, Linear stationary models and testing of stationary: Auto regressive, Moving Average and mixed models, Non-stationary models, general ARIMA model, minimum mean square forecasting. ARIMA Seasonal Models (SARIMA).

### **Text Book**

Chatfield, C. The Analysis of Time Series: An Introduction, Chapman and Hall, London (2009).

### **BOOKS RECOMMENDED**

1. Box, G. E. P. and Jenkins, G. M. Time Series Analysis: Forecasting and control, San Francisco (2007).
2. Brockwell, P. J. and Davis R. A. Time Series Theory and Methods, Springer Verlag, New York. (2006).

3. Cox, D. R., Hinckley, D. V. and Nielsen, O. E. B. Time Series Models-In Econometrics, finances and other fields, Chapman & Hall, London (1996).
4. Andy, P., West, M. and Harrison, P. J. Applied Bayesian Forecasting and Time Series Analysis, Chapman & Hall New York (1994).
5. Harvey, A. C. Forecasting Structural Time Series Models and the Calamander, Cambridge University Press, Cambridge (1990).

**STA-6804**

**Population Analysis and Official Statistics**

**Credits: 3(3-0)**

**Objectives:**

This course deals with the basic concepts of Population study and demographic components.

This course also provides the information about behavior and living of the population.

**Course contents:**

Population and Demographic Methods, Sources of Demographic Data. Testing of Accuracy of Demographic Data, Basic Demographic Measure, Life tables. Population estimates and projections. Application of Stationary Population Models, Official Statistics Statistical systems in Pakistan Statistics divisions and Bureaus of Statistics: their functioning and publications. National Accounts: measures of production, income and expenditure. National income and product. Gross domestic product, saving and Wealth. Index numbers, Social Indicators.

**Text Book**

Pollard, A. H. and Yausaf, F. Demographic Techniques, Pergaman press (1982).

**BOOKS RECOMMENDED**

1. Speigleman, M. Introduction to Demographic, CambridgeUniversity Press Revised Edition (1982).
2. Publications of Statistic Division I, State Bank of Pakistan, Provisional Bureau of Statistics and other Departments.
3. Barclay, G. W. Techniques of Populations Analysis, John Wiley, New York (1958).

**STA-6806**

**Biostatistics**

**Credits: 3(3-0)**

**Objectives:**

This course Deals with the analysis and application of statistical techniques in the experiments conducted in medical Sciences as well as in plant sciences.

**Course contents:**

Definition of Biostatistics, viz-a-viz the type of variables and observations in biological, health and medical sciences, Uniqueness in terms of behavior of variables their domain, and units; Categorical, Numerical and Censored data. Role of sampling biostatistics, Size of Samples of Various types of studies, Proportions, rates and ratios; incidence, prevalence and odds. Distributional behavior of biological variables (Binomial, Poisson and Normal), Role of transformation for analysis of biological variables. Probit and Logit transformations and their analysis, P values, its importance and role. Confidence Interval and hypothesis testing in medical sciences.

**Text Book**

Zar, J. Biostatistics Analysis, 5<sup>th</sup> Edition, John Wiley and Sons (2011).

**BOOKS RECOMMENDED**

1. Danicel, W. W. Biostatistics: A Foundation for the Health Sciences (2011).
2. Lee, E. T. Statistical Methods for Survival Data Analysis. 2<sup>nd</sup> Edition, John Wiley, New York (2003).
3. Dunn, G. and Everit, B. Clinical Biostatistics Edward Arnold, London (1995).
4. Rosner, B. Fundamentals of Biostatistics, 4<sup>th</sup> Edition, Duxbury Press (1994).
5. Zolman, J. F. Biostatistics: Experimental Design and Statistical Inference, Oxford University Press, New York (1993).
6. Harris, E. K. and Albert, A. Survivorship Analysis for Clinical Studies. MareelDecker, New York (1991).

**STA-6807**

**Operations Research**

**Credits: 3(3-0)**

**Objectives:**

The main objective of this course is course is optimization i.e. to do things under the best circumstances. Different statistical & mathematical techniques are used to improve quantitative decision making procedure in almost all the disciplines of studies.

**Course contents:**

Historical study of operation research, Linear Programming: Methods to solve LP models. The simplex methods: Degeneracy and cycling, artificial variables, Further topics in linear programming: Duality the dual simplex methods, sensitivity analysis, Methods of solving transportation and assignment problems, Game theory, Network analysis: Solution of CMP and PERT Problems by mathematical methods and using CP model queuing theory.

**Text Book**

Taha, H. A. Operations Research, Mamillan, London (2014).

**BOOKS RECOMMENDED**

1. Gupta, P. K. and Hira, D. S. Operations Research, S. chand&Co.New Delhi. (2006).
2. Hillier, F. and Lieberman, G. Introduction to Operations Research, Hoklen Day (2005).
3. Bhatti, S. A. and Bhatti, N. A. Operations Research, An Introduction, A one publishers, London (2002).

**STA-6808**

**Bayesian Statistics**

**Credits: 3(3-0)**

**Objectives:**

The student will gain an appreciation of the importance of conditional independence in subjective (Bayesian) statistical modeling. The student will be provided with techniques for eliciting quantitative preference structures from a client which may involve competing objectives. The student will obtain an appreciation of the foundational arguments that justify expected utility maximization as a paradigm for rational action. The student will obtain practice in implementing these techniques.

**Course contents:**

Prior information, Prior distribution, Posterior distributions: The posterior means, medians (Bayes estimators under loss functions) and variances of univariate and bivariate posterior distributions, Non-informative priors, Methods of elicitation of hyper-parameters of informative priors, Bayesian Hypotheses Testing: Bayes factor; the highest density region; Posterior probability of the hypothesis.

**Text Book**

Berger, J. O. Statistical Decision Theory and Bayesian analysis, 2<sup>nd</sup> Edition., New York, Springer-Verlag (1985).

**BOOKS RECOMMENDED**

1. William, M. B. Introduction to Bayesian Statistics, John Wiley, New York (2007).
2. Lee, P. M. Bayesian Statistics, An Introduction, OxfordUniversity Press, New York (1991).

3. Hagan, O. and Kendall, A. S. Advanced Theory of Statistics (V2B) Bayesian Inference, University Press, Cambridge, (1994).
4. Bernardo, J. M. and Smith, A. F. M. Bayesian Theory, John Wiley, N. Y. (1994).
5. Box, G. E. P and Tiao, G. C. Bayesian Inference in Statistical Analysis, Reading Addison-Wesley (1973).

**STA-6809**

**Non-Parametric Methods**

**Credits: 3(3-0)**

**Objectives:**

In the course the distributions free tests and their application in the real life data are studied.

**Course contents:**

Scales of measurements, Non-Parametric problems. Situations to use non-parametric procedures. Parametric versus nonparametric tests. Trimmed and Winsorized means, One sample tests: Binomial test, Sign test, Wilcoxon signed ranks test, Rank Sum Test, Kolmogorov- Smirnov test, run test. Tests for two related sample: sign test run test. Chi-square test Wald-Wolfowitz Kolmogorov-Smirnov test.

**Text Book**

Conover, W. J. Practical Non-Parametric Statistic, John Wiley & Sons, New York (2011).

**BOOKS RECOMMENDED**

1. Dobson, A. J. Introduction to Generalized Linear Models, Chapman & Hall (1991).
2. Anderson, E. B. The Statistical Analysis of Categorical Data, Springer Verlag (1990).
3. Sprent, P. Applied non-Parametric Statistic, John Wiley&Sons, New York (1984).
4. Everitt, B. S. The Analysis of contingency Table (1977).
5. Randless, R. H. and Wolfe, D. An Introduction to Theory of Non-Parametric
6. Statistics, John Wiley & Sons, New York (1919).

**STA-6810**

**Actuarial Statistics**

**Credits: 3(3-0)**

**Objectives:**

The aim of this course is to introduce and expose students to application of Statistics in actuarial field.

**Course contents:**



Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality. Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables. Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions evaluation for special mortality laws. Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations. Distribution of aggregate claims, compound Poisson distribution and its applications.

### **Text Book**

Bowers, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A. and Nesbitt, C. J. Actuarial Mathematics, 2<sup>nd</sup> Edition, Society of Actuarial, Ithaca, Illinois, U.S.A. (1997).

### **BOOKS RECOMMENDED**

1. Neill, A. Life contingencies, Heineman. (1977).
2. Spurgeon, E. T. Life contingencies, Cambridge University Press. (1972).

**List of External Examiners (Statistics)**  
**Department of Statistics**  
**The University of Poonch, Rawalakot**

Sr. No.	Name, Designation & Address	Qualification		Phone No.
1	Prof. Dr. JavedShabbir, Chairman Department of Statistics, Q.A.U Islamabad	Ph.D.	avidshabbir@gmail.com	Mob: 0300-5273086 Off: 051-90642180 Off: 051-90642140 Res: 051-2211320
2	Prof. Dr. Irshad Ahmad Arshad, Chairman, Department of Statistics, AllamaIqbal Open University.	Ph.D.	irshad.ahmad@aiou.edu.pk	Off: 051-9019731 Res: 051-2280746 Mob: 0333-5181807
3	Prof. Dr. Azar Saleem Department of Statistics, UAJ&K Muzaffarabad.	Ph.D.	drazharsaleem@yahoo.com	Mob: 0306-7120441
4	Prof. Dr. Zakria Department of Statistics, AllamaIqbal Open University.		zakria@aiou.edu.pk	Off: 051-9057372
5	Dr. Ishfaq Ahmad Assistant Professor Department of Mathematics & Statistics, IIU, Islamabad.	Ph.D.	ishfaq.ahmad@iiu.edu.pk	Off:051-9019733 Mob:0345-4612656
6	Dr. Atif Akbar Department of Statistics, Bahauddin Zakria University, Multan	Ph.D.	atifakbar@bzu.edu.pk	Mob: 0333-5336982
7	Dr. Kamran Abbas Chairman Department of Statistics, UAJ&K Muzaffarabad.	Ph.D.	kamiuajk@gmail.com	Mob: 0333-5794062
8	Dr. AamirSaghir Department of Mathematics, Mirpur University of Science & Technology: (A.K)	Ph.D.	aamir.stat@must.edu.pk	Mob: 0334-5269871
9	Dr. TassadiqHussainKiani	Ph.D.	taskho2000@yahoo.com	Mob: 0333-8264078

	Department of Mathematics, Mirpur University of Science & Technology. (A.K)			
10	Mr. Masroor Anwar Department of Statistics, UAJ&K Muzaffarabad.	M.Phil.	masroor_anwar2001@yahoo.com	Mob: 0345-5575558
11	Mr. AtifAbbasi Department of Statistics, UAJ&K Muzaffarabad.	M.Phil.	atifbbs3@gmail.com	Mob: 0345-5933349
12	Aamar Abbas Department of Mathematics University of Poonch Rawalakot. (A.K)	M.S	aamarabbas@upr.edu.pk	Mob: 0333-5795250