ASSOCIATE DEGREE IN MATHEMATICAL SCIENCE (2 YEARS)

In accordance with HEC's 2020 Undergraduate Policy

DEPARTMENT OF MATHEMATICAL SCIENCE

THE UNIVERSITY OF LAKKI MARWAT

Session 2020 and onwards

HOD, Department of Mathematical Science, ULM

Director Academics,

Two Year Associate Degree Program

University of Lakki Marwat

(Undergraduate Education Policy-2020 Higher Education Commission Pakistan)

	Name of Course		Credits
A. General Education Courses	**A1.** Breadth courses		
	Arts and Humanities	Subject I of Arts and Humanities	03
		Subject II of Arts and Humanities	03
	Social Sciences	Subject I of Social Sciences	03
		Subject II of Social Sciences	03
	Natural Sciences	Subject I of Natural Sciences	03
		Subject II of Natural Sciences	03
	Total Sub-A1	**Courses: 06**	**18**
	A2. Functional Skills Courses		
	Expository Writing	English composition and comprehension (E-I)	03
		Communication and presentation skills (E-II)	03
		Technical report writing	03
	Quantitative Reasoning	Subject I	03
		Subject II	03
	Total Sub-A2	**Courses 05**	**15**
	A3. Civilizational Courses		
		Islamic Studies/Ethics	03
		Pakistan Studies	03
	Total Sub-A3	**Courses: 02**	**06**
B. Disciplinary courses			
	Subject foundation and major subjects	Subject-I	03
		Subject-II	03
		Subject-III	03
		Subject-IV	03
		Subject-V	03
		Subject-VI	03
		Research Methods	03
	Total Sub-B	**Courses: 07**	**21**
	Grand Total (A+B)		**60**
C. Practical Learning (Non-credit courses)	**C1. Internship:** The student shall have to complete 9- weeks summer internship, or 360 hours work during their course **C2. Practical Learning Lab (PLL):** AD students will be allowed to fulfill the PLL requirement by signing up for an extracurricular "lab" of **4 hours a week** for **2 semesters**, in one of the following three areas: entrepreneurship, youth clubs, or sports.		

	Name of Course		Credits
A. General Education Courses	**A1.** Breadth courses		
	Arts and Humanities	1. Aesthetic Studies 2. Introduction to Philosophy 3. Language and Society 4. Urdu Language and Society 5. Islamic History 6. Islamic Morals 7. Creative Arts 8. History of Pakistan 9. Pashtun Language and Society 10. Chinese Language and society 11. Classical Poetry 12. Foundations of Literary Theory & Criticism	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
	Social Sciences	1. CPEC Role in Planning & Development of Pakistan 2. Current Affairs 3. Principles of Psychology 4. Introduction to Political Science 5. International Trade 6. Principles of Management 7. Cultural History of Pakistan 8. Tourism Planning and Development 9. Western Political Philosophy 10. Introduction to Social Work 11. Pakistan Movement and Political History 12. Introduction to Economics 13. Introduction to International Relations 14. Environmental Psychology 15. Muslim Political Philosophy 16. Public International Law 17. Philosophical basis of Physical Education 18. Sports Biomechanics 19. Introduction to Sociology 20. Sociology of Health 21. Gender Studies 22. Introduction to Law and Human Rights 23. Constitutional Development in Pakistan 24. Introduction to Social Anthropology 25. Pakistan's Foreign Policy 26. General Methods of Teaching 27. Class Assessment and Management	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list

		28. Curriculum Development 29. Introduction to Mass Communication 30. Mass Media in Pakistan 31. Introduction to Social Media 32. International Communication and Reporting 33. Muslim Struggle for Pakistan (1857 – 1947) 34. Political History of Pakistan (1947-to date	
	Natural Sciences	1. Every day Science-I 2. Every day science-II 3. Introduction to Chemistry 4. Introduction to Geology 5. Geomorphology 6. Introduction to Biology 7. Introduction to Ecology 8. Introduction to Environmental Sciences 9. Introduction to Geography 10. Introduction to bio-chemistry	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
	Total Sub-A1	**Courses: 06**	**18**
	A2. Functional Skills Courses		
	Expository Writing	1. English composition and comprehension (Eng-I) 2. Communication and presentation skills (Eng-II) 3. Technical report writing (Eng-III)	Three Courses of 9 C.Hs (3 Credit Hours each) will be included in Scheme of Studies by all Departments
	Quantitative Reasoning	1. Basic Mathematics 2. Introduction to Information & Communication Technology 3. Logic & Critical Reasoning 4. Statistics II 5. Introduction to Physics 6. Mathematics I	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
	Total Sub-A2	**Courses 05**	**15**
	A3. Civilizational Courses		
		Islamic Studies/Ethics Pakistan Studies	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
	Total Sub-A3	**Courses: 02**	**06**

B. Disciplinary courses			
	Subject foundation and major subjects	Subject 1:	03
		Subject 2:	03
		Subject 3:	03
		Subject 4:	03
		Subject 5:	03
		Subject 6:	03
		Subject 7: Research Methods	03
	Total Sub-B	**Courses: 07**	**21**
	Grand Total (A+B)		**60**

BS-Scheme of Studies in Mathematics

Semester-wise break up

BS Mathematics (4-years Program) Semester-Wise Breakdown

First Year

Semester-I

S. N	Course Code	Course Title	Cr. Hrs
1	EU-101	English – I	3(3 + 0)
2	AH-105	Islamic History	3(3 + 0)
3	NS-101	Everyday Science	3(3 + 0)
4	QR-102	Information & Communication Technology	3(3 + 0)
5	SS-120	Sociology	3(3 + 0)
6	QR-104	Introduction to statistics	3(3 + 0)
		Total	**18(18 + 0)**

Semester-II

S. N	Course Code	Course Title	Cr. Hrs
1	QR-101	Basic Mathematics	3(3 + 0)
2	SS-113	Introduction Economics	3(3 + 0)
3	NS-120	Introduction Physics	3(3 + 0)
4	CIV-110	Islamiyat history	3(3 + 0)

5	AH-120	Constitutional Law	3(3 + 0)
6	ENG-121	English-II (Communication Skills)	3(3 + 0)
		Total	**18(18 + 0)**

Second Year

Semester-III

S. N	**Course Code**	**Course Title**	**Cr. Hrs**
1	MATH-211	Calculus-I	3(3 + 0)
2	MATH-212	Set Theory and Mathematical Logics	3(3 + 0)
3	MATH-213	Number Theory	3(3 + 0)
4	ENG-231	English-III (Technical Writing and Presentation Skills)	3(3 + 0)
5	PHY-101	Mechanics-I	3(3 + 0)
6	PS-231	Pakistan Study	3(3 + 0)
	Total		**18(18+ 0)**

Semester-IV

S. N	**Course Code**	**Course Title**	**Cr. Hrs**
1	MATH-221	Calculus-II	3(3 + 0)
2	MATH-218	Algebra-1	3(3 + 0)
3	MATH-223	Basic Topology	3(3 + 0)
4	MATH-219	Ordinary Differential Equations	3(3 + 0)
5	PHY-211	Mechanics-II	3(3 + 0)
	Total		**15(15 + 0)**

ENG-101:English I: Reading & Writing Skills
Chrs:3

Course Description:

The course is designed to help students take a deep approach in reading and writing academic texts which involve effective learning strategies and techniques aimed at improving the desired skills. The course consists of two major parts: the 'reading section' focuses on recognizing a topic sentence, skimming, scanning, use of cohesive devices, identifying facts and opinions, guess meanings of unfamiliar words. The 'writing section' deals with the knowledge and use of variousgrammatical components such as, parts of speech, tenses, voice, narration, modals etc. in practical contexts.

Course Contents

1. **Reading Skills**

   - Identifying Main Idea / Topic sentences
   - Types of Reading Skills: skimming, scanning, extensive and intensive
   - Active and Passive Reading
   - Strategies for Improving Reading Skills
   - Finding Specific and General Information Quickly
   - Distinguishing Between Relevant and Irrelevant Information According to Purpose for Reading
   - Recognizing and Interpreting Cohesive Devices
   - Distinguishing Between Fact and Opinion
   - Reading Comprehension

2. **Writing Skills**
   - Sentence patterns and structures
   - Phrase, clause
   - Parts of Speech
   - Tenses: meaning and use
   - Modals
   - Use of active and passive voice
   - Reported Speech
   - Writing good sentences
   - Error Free writing
   - Paragraph writing with topic sentence

Recommended Readings

- Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for undergraduates*. Karachi: Oxford University Press.
- Eastwood, J. (2004). *English Practice Grammar* (New edition with tests and answers). Karachi: Oxford University Press.
- Murphy, R. (2003). *Grammar in use.* Cambridge: Cambridge

University Press.

AH-105: Islamic History (Compulsory) **CHrs: 03**

Objectives:

This course is aimed at:

- To provide basic information about Islamic History
- To provide basic information to the students about the life of the Holy Prophet Hazrat Muhammad (S.A.W).
- To inform the students about the administrative system of Califat e Rashida period.
- To inform the students about the rule and administrative system of Umayyad period, Abbasids period and Muslims in Spain.
- To enhance understanding of the students regarding Islamic Culture and Civilization.
- To enhance skills of the students for understanding of issues related to faith and religious life.
- To communicate historical knowledge effectively and pursue higher studies in History and related fields.

Course Contents:

Part. 1 Life of the Holy Prophet Hazrat Muhammad (S.A.W)

1. Land and Geography of Arabia
2. Conditions of Arabia at the advent of Islam
3. Makki Life of the Holy Prophet (S.A.W)
   3.1 Parentage, Birth and Early Childhood
   3.2 Harb ul Fujjar, Half fu Fazool, Nikah and Re-Construction of Kaba
   3.3 Baasat e Nabvi, Preeching of Islam and Hostility of Quraish
   3.4 Emigration to Abyssinia 1st and 2nd , Aam ul Huzn, Pledge of Aqba 1st and 2nd
   3.5 Hijrat e Madina
4. Madni Life of the Holy Prophet (S.A.W)
   4.1 Causes, Events and Importance of Hijrat e Madina
   4.2 Charter of Madina
   4.3 Gazwat e Nabvi, Treaty of Hudaibiya and Conquest of Makkah
5. Last Sermon of the Holy Prophet (S.A.W)
6. Seerat tu Nabi (S.A.W)

Part. 2 Rashidun' Period

1. Hazrat Abu Bakr Saddiq (R. A)
2. Hazrat Umar Farooq (R. A)
3. Hazrat Usman (R. A)
4. Hazrat Ali (R. A)
5. Administration system and main Features of Rashidun Period

Part. 3 Umayyads' Period

1. Hazrat Amir Mu'awiya (R. A)
2. Yazed and Karbala incident
3. Hazrat Abdullah bin Zubair (R. A)

4. Marwan and Abdul Malik bin Marwan
5. Walid bin Abdul Malik and Sulaiman bin Abdul Malik
6. Hazrat Umar bin Abdul Aziz (R. A)
7. Later Rulers of Umayyad Dynasty
8. Administration under Umayyads and causes of their downfall

Part. 4 Abbasids' Period

1. As-Safah and Abu Jafr Al-Mansoor
2. Hadi, Mahdi, Haroon ur Rashid
3. Amin, Mamoon and Moatasim
4. Later Rulers of Abbasids' Dynasty
5. Administration under Abbasids and causes of their downfall
6. Crusades and Sultan Salah ud Din Ayubi
7. Muslims in Spain
8. Administration and Causes of the downfall of Muslims in Spain

Recommended Books:

- Islamic History (P-I and P-II). Published by KP Textbook Board Peshawar.
- Dr. Hameed du Din. "Tareekh e Islam".
- Mazar ul Haq. "History of the Arabs".
- Shah Moeen ud Din. "Tareek e Islam".
- تاریخ الخلفاء (اردوترجمہ)-----علامہ جلال الدین سیوطی
- خلافت اندلس ---------نواب ذوالقدر جنگ
- تاریخ اندلس --------مولانا ریاست علی ندوی
- تاریخ اسلام ----------اکبر شاہ خان نجیب آبادی
- تاریخ الامم والملوک (اردوترجمہ)---ابن جریر طبری

SS-120: Principles of Sociology **CHrs: 03**

Course Contents

1. Fundamental of Sociology

1.1 Nature, Scope, and subject matter of Sociology
1.2 Brief historical development of Sociology
1.3 Society and community
1.4 Relationship with other social sciences like Economic, Political Science, History, Psychology, and Anthropology.
1.5 Social interaction processes (Cooperation, Competition, Conflict, Accommodation, Acculturation, and Assimilation).

2. Social Groups

2.1 Definition and Functions
2.2 Types of Social Groups (In and out group, Primary and Secondary groups, Reference groups. Formal and informal Groups and Pressure groups)

3. Social Institutions

3.1 Definition, Structure and Function of the following Institutions: Family, Religion, Education, Economics, Political Inter-relationship among various social institutions.

4. Cultural and Related Concepts

4.1 Definition and aspects of culture, Material and non-material culture, Ideal and real culture

4.2 Elements of culture, Beliefs, values, norms (folkways, mores, laws)

4.3 Organization of culture, Traits, complexes, and patterns

4.4 other related concepts, Cultural relativism, Sub-Culture and ethnocentrism

5. Socialization and Personality

5.1 Role and Status

5.2 Socialization

5.3 Culture and Personality

6. Deviance and Social Control

6.1 Definition and types of deviance

6.2 Formal and informal methods of social control

Social Stratification

1.1 Determinants of Social Stratification (Caste, Class, Ethnicity, Power, Prestige and Authority)

1.2 Social Mobility, Definition and types

1.3 Dynamics of social mobility

2. Social and Cultural Change

2.1 Definition of social change

2.2 Dynamics of social change (Education, Innovation, Industrialization, Urbanization and Diffusion)

2.3 Resistance to change

Suggested Readings:

i. *Horton Paul B. and Hunt, Chester L (1990), Sociology Singapore: McGraw Hill Book Company.*

ii. *Sociology 1 by Allama Iqbal Open University, Islamabad*

iii. *Sociology 2 by Allama Iqbal Open University, Islamabad*

iv. *Taga, Abdul Hameed (2000) An Introduction. New York: Harper and Rows*

v. *Betrnad, Alvin L. (1969). Basic Sociology-An Introduction to Theory and Methods, New York; Appleton Century Crofts.*

vi. *Curran, Jr.(1977).Introductory sociology: A basis Self Instructional Guide*

vii. *Hafeez, Sabeeha (1990), The Changing Pakistan Society. Karachi: Royal Book company, Zaibunisa Street, Sadar.*

viii. *Horton Paul B. and Hunt, Chester I.. (1990) Sociology singapore.Macgraw Hill Book Company.*

ix. *Merrii, F.E., (latest ed,), Sociology and Culture. N.J. Englewood Cliffs.*

x. *Philips, Bernard (1990). Sociology-Form Concepts to Practice. New York: McGraw Hill Book Company Inc.*

xi. *Rao, C. Nshaukar (1990), Sociology, New Delhi: S.C Chand and Company Ltd.*

QR-104: Introduction to Statistics CHrs:3

Course Objectives

- The course will impart knowledge and understanding of Statistics. To provide knowledge about the importance and use of statistics in life sciences.
- To familiar students with the methods of data analysis pertaining to their research work and to assess the significance of their experimental designs.

Course Outcomes:

Students who successfully complete this course will be able to:

- **DESCRIBE** the roles Statistics serves in their subject and research.
- **APPLY** numerical, tabular, and graphical descriptive techniques commonly used to characterize and summarize data.
- **EXPLAIN** general principles of study design and its implications for valid inference.
- **ASSESS** data sources and data quality for selecting appropriate data for specific research questions.
- **TRANSLATE** research objectives into clear, testable statistical hypotheses.
- **DESCRIBE** basic principles and the practical importance of key concepts.

Recommended Books

1. "Statistical Theory Part-I and Part-II BySherMohummadChaudary, Carwan Publisher.

2. Statistics 4th Edition, "Schaum's Outline Series, McGRAW-HILL

3. Basic Concepts and Methodology for the Health SciencesByWayne W. Daniel

4. Wayne W. D., (2005). Biostatistics: A foundation for Analysis in the health sciences. Wiley series in Probability and Statistics

5. Earl K. Bowem& Martin starr: Basic Statistics for Business and Economics.

WEEK WISE BREAKDOWN

Week	Description
1	**A)Basic of Statistics:** • Introduction to Statistics • Scope and importance of statistics • Meaning of Statistics according to the subject. • Branches of Statistics
2	• Population and sample, Parameter and Statistic • Variable and Constant • Discrete and continuous variable • Data and its types (Qualitative and Quantitative)

3	• Scales of measurements (Nominal, Ordinal, Interval and Ratio) • Diagrams and graphs • Simple and Multiple bar chart • Histogram, Pie chart
4	**B) Frequency distribution (FD)** • Definition of frequency distribution • Steps in construction of frequency distribution
5	**C) Measures of Central Tendency** • Arithmetic mean • Real life examples for group and ungroup data
6	• The Median • Uses of Median • Applications of Median for simple and frequency data
7	• The Mode • Uses of Mode • Applications of Mode for simple and frequency data
8	**D)Measures of Dispersion** • Definition and types of dispersion • Range, grouped and ungrouped dataCoefficient of range • Standard deviation, variance and Co-efficient of variance
Two Assignments + Test	**Mid Term Exam**
9	**E)Probability** • Definition of probability • Objective and Subjective probability. • Experiment and random experiment, sample space and sample point,
10	• Event, simple and composite events. • Mutually exclusive and independent events Calculation of probability relative to dice, coins and balls.
11	**F) Sampling** • Sampling and sampling distribution • Probability and non-probability sampling
12	**G)Estimation** • Definition of Estimation • Estimator and Estimate • Definition of Point and Interval Estimation

13	**H)Hypothesis Testing** • Hypothesis , Statistical Hypothesis and Testing of Hypothesis • Simple and Composite hypothesis • Steps of hypothesis testing
14	• Definition of Student t-test • Properties oft-test • Real life examples of t-test for single population mean
15	**I)Regression and Correlation** • Definition of Regression • Estimated regression line • Solution of Real life Problems for simple regression
16	**Correlation** • Definition of Correlation • Pearson correlation co-efficient • Solution of Real life Problems
Two Assignments + Two Test+ Presentation	**Final Term**

NS- 101: EVERYDAY SCIENCE CHrs: 03

Course outline:

Introduction, History of Science, Achievements of some giants of Science in Chronological order, Islamic Science, Contribution of Muslim Scientists, Famous muslim scientist, Nature of science, Scientific method, impact of science on society. Introduction, The origin, The Big Bang, The structure, the galaxies, solar system, The sun, the moon, the earth,structure of the earth, earth atmospheres, the greenhouse effect, global warming, ozone depletion, acid rain, stattelites, earthquake, eclipses, the mystery of Stonehenge, day-night and seasons, volcanoes, minerals, glossary of cosmology Introduction and sources of energy, Fossil Fuels, Major oil producing countries, Global search of Crude oil, Petroleum products, natural gas, hydel power or hydro-electric power, solar energy, nuclear energy, the nuclear reactor, heavy water, nuclear safety, nuclear fusion, energy coversion, radiation and living things, Ceramics, Semi-conductors, Communications systems, Laser, Telescope, Camera, Fertilizers, Nanotechnology, Plastics, Computer, Brain, Heart, Tissues, Epithelial Cell, Origin of Modern Humans, Pest Control, Protein, Vertebrate, Invertebrate, Liver, Enzymes, Organisms (Common to all living things), Blood Group system. Plants, Seed, Flower, Gene, Evolution Laws, Nucleic Acid (DNA and RNA), **Diseases and Threats to Living organism:**

Swine flow, Hepatitis, Dengue fever, Corona virus, SARS (Severe acute respiratory syndrome virus), Plants and Crop Diseases (Rust, Smut, Late Blight, Canker).

Recommended Books:

1. Exploring physical science 1977 by walter A. Thurber
2. Exploring Life science 1975 by walter A. Thurber
3. Encyclopedic Manual of everyday science, Author, Dr. Rabnawaz Samo Publisher; Maktab e Faridi.

ICT-107: Information and Communication Technologies CHrs:3
COURSE OBJECTIVES:

Students successfully completing this course should be able to:

- Develop a vocabulary of key terms related to the computer and to software programs.
- Identify the components of a personal computer system.
- Demonstrate mouse and keyboard functions.
- Demonstrate window and menu commands and how they are used.
- Demonstrate how to organize files and documents on a USB/hard drive.
- Send email messages and navigate and search through the internet.

Week	Topics
1.	Data and Information, Information Processing Cycle
2.	Introduction to Computer, Components of a Computer, Advantages and Disadvantages of Using Computers.
3.	Categories of Computers, Computer Applications in Society.
4.	**Input Devices**: Types of Input, Input for Smart Phones, Game Controllers, Digital Cameras, Voice Input, Video Input, Scanners and Reading Devices, Biometric Input,
5.	**Output Devices:** Terminals. Display Devices, LCD Monitors and LCD Screens, Plasma Monitors, CRT Monitors,
6.	Printers, Nonimpact Printers, Impact Printers, Speakers, Headphones, Data Projectors. Interactive Whiteboards
7.	**Storage Devices:** Hard disks, Flash Memory Storage, Solid State Drives, Memory Cards, USB Flash Drives, Cloud Storage, Optical Discs, Blue-Ray Discs, Magnetic Tapes, Magnetic Stripe Cards and Smart Cards, Microfilm and Microfiche, Enterprise Storage.
8.	Programming Languages
9.	**Mid Term Exam**
10.	**CPU:** Processor, Control Unit, Arithmetic Logic Unit, Machine Cycle.
11.	**Memory:** Data Representation, Memory Sizes, Types of Memory, RAM, Cache, ROM, Flash Memory, Primary and Secondary Memory
12.	**Software**: System Software, Operating Systems, Utility Programs. Application Software, Business Software, Graphics and Multimedia Software, Software for Home, Personal, and Educational Use, Web Applications
13.	Data Communication
14.	**Internet**, World Wide Web,
15.	**Networks**, Internet and Searching Techniques, E-Learning, Freelancing
16.	Enterprise Computing, Computer Security Risks, Viruses
17.	Introduction to MS Word, MS Excel, MS PowerPoint
18.	**Terminal Examination**

NS- 120: AN INTRODUCTION TO PHYSICS C Hrs: 03

Course outline:

Introduction to Physics: Explore fundamental physics concepts, scientific notations, dimensional analysis, linear relationships and quadratic relationships.

Vectors: Describe types of vectors and the process to add, subtract and multiply vectors. Understand how to get a resultant vector and perform vector operations using components.

Kinematics: Differentiate between displacement and distance and speed and velocity. Determine acceleration using slope of speed and explain projectile, free fall and uniform circular motion.

Force and the Laws of Motion: Examine Newton's Laws of Motion. Explain the differences between mass, inertia and weight and describe action and reaction force pairs. Describe friction, inclined plane, the spring constant and centripetal force.

Work and Energy in Physics: Apply the work-energy theorem and describe relationship between kinetic and potential energy. Examine gravitational potential energy, conservative forces and power.

Linear Momentum in Physics: Describe the impulse-momentum change equation and apply the momentum conservation principle. Discuss elastic and inelastic collisions and isolated systems and find the centre of gravity.

Waves, Sound and Light: Define vibrations and explore wave parameters, electromagnetic waves and pitch and volume in sound waves. Discuss reflection, resonance, color, diffraction and the Doppler Effect.

Thermodynamics in Physics: Explore the relationship between temperature and heat, phase changes and heat transfer. Describe thermal expansion, the ideal gas law, entropy and the first and second laws of thermodynamics.

Electrostatics: Understand electric charge, force fields and Coulomb's Law. Solve parallel-plat capacitor problems and describe electric potential.

Recommended Books

1. College Physics by Raymond A. Serway and Chris Vuille, Volume 10, Publisher: Cengage Learning (2014)
2. University Physics by George Arfken, Academic Press (2012)
3. Fundamentals of Physics by Haliday & Resnick Walker.

QR-101: Basic Mathematics **CHrs: 3**

1. **Numbers systems**
   1.1.Real Numbers
   1.2.Complex numbers
   - The integers
   - Rules for addition
   - Rules for multiplication
   - Even and odd integers; divisibility.
   - Rational numbers
   - Multiplicative inverses
   - Addition and multiplication.

- Real numbers: positivity.
- Powers and roots
- Inequalities
- The complex plane
- Polar form

2. **Linear and Quadratic Equations**
    - Equations in two unknowns
    - Equations in three unknowns
    - Quadratic Equations
3. **Functions**
    - Definition of a function
    - Polynomial functions.
    - Graphs of functions
    - Exponential function.
4. **Determinants Matrices**
    - Determinants of order
    - Properties of 2 X 2 determinants
    - Determinants of order 3
    - Properties of 3 X 3 determinants
5. **Differentiation—Fundamentals**
    - Derivatives by Definitions
    - Power Rule
    - Properties of Derivatives
    - Product and Division Rules
6. **Integration—Fundamentals**
    - Basic Integrations
    - Product Rule
7. **GEOMETRY**
    - Distance and Angles
    - The Pythagoras theorem.

7.1. **Area and Applications**

- Area of a disc of radius r
- Circumference of a circle of radius r

7.2. Coordinates and Geometry

- Coordinate systems
- Distance between points.
- Equation of a circle

7.3. Segments, Rays, and Lines

- Segments
- Rays
- Lines
- Ordinary equation for a line

8. **Trigonometry**

- Radian measure
- Sine and cosine.
- The graphs.
- The tangent

Reference Book

1. **SERGE LANG,** ADDISON -WESLEY PUBLISHING COMPANY Reading, Massachusetts, Menlo Park, California • London Don Mills, Ontario
2. For basic derivative and integrations follow 2nd year book.

SS-113: Introduction Economics **CHrs:3**

Course Objectives

- This course discusses the basic principles of micro and macroeconomics. This course provides the student with a solid grounding in economic principles and familiarize him or her with the institutions and policies that influence economic activity. For those who elect to major in economics, these courses provide the base upon which subsequent courses will build.
- First Introduction to microeconomics studies the economy from the perspective of individual consumers and producers who interact in a market setting. It shows how their choices influence the production and distribution of goods and services and considers the criteria that can be used to assess these outcomes. The course also studies how government intervention can affect the behavior of consumers, producers, and workers and alter market out-comes.
- Second Macroeconomics describes the overall behavior of the economy. In macroeconomics the basic principles of macroeconomics and basic concepts of national income accounting i-e GDP, GNP, NNP, PI, DPI, GDP Deflator etc.
- This also highlights the concepts of money, functions of money, inflation, CPI, impact of inflation on economy and the role of government in an economy

Grading Criteria

Distribution	**Weight**
Quizzes, Assignments, and class participation	10
Mid Term	20
Final Term	70
Total	100

Recommended Books

- Fundamentals of Economics Part 1 for Intermediate Classes By Habib Ullah Vaseer, edition 2015-2016, Farhan Publishers
- Samuelson and Nordhaus: Economics 19th edition

- Welcome to Economics (McConnell) AP Edition, 19th Edition
- Economic Theory. Vol 2,(2000) by Hussain Ch. M. The carvan press; (Lahore)
- Walter Nicholson: Micro Economics Theories: Basic Principles and Extensions, 10th Edition.
- Mankiw, G–Principles of Economics- latest edition.
- Samulson and Nordrons - Economics –latest edition

CIV-110: Constitutional Law **CHrs:3**

Course Contents:

The following concepts shall be covered with special reference to the constitutions of United Kingdom and United States of America:

This course shall cover the nature, sources and fundamental principles of the United Kingdom and the United States Constitutions. The course will examine the remarkable unwritten constitution of the UK, the Separation of Powers, Rule of Law, Parliamentary Supremacy and the Independence of Judiciary under the British constitutional conventions. The course apart from other aspects will cover the concepts of federalism, separation of powers, the functions of the Congress and the legislative procedure, the election of the President and the judicial review under the US Constitution. To understand these concepts with reference to the UK and US constitutions, the following contents order shall be followed:

1. **British Political System**
   a. Nature of the Constitution
   b. Nature of the Conventions in British Constitution
   c. The Institution of Monarchy: Role, Power & Functions and Importance.
   d. The British Legislature: The Structure and Powers & Functions of the British Parliament, the Concept of Parliament Supremacy & Ministerial Responsibility.
   e. The British Executive; Cabinet and the Prime Minister.
   f. The Law-Making Process and Rule of Law
   g. Committee System in UK
   h. British Judicial System
2. **US Political System**
   a. Nature of the Constitution
   b. Nature of the US Federation
   c. The Theory of Separation of Powers and Check and Balance
   d. The American Legislature: Structure and Powers & Functions of US Congress.
   e. The US Executive: Election, Role and Powers & Functions of the US President
   f. Committee System in US
   g. The US Supreme Court: Structure and Powers & Functions
   h. Judicial Review

Suggested Readings

1. Modern Constitutions by Mazhar Ul Haq, 2017
2. America's Constitution by Akhil Reed Amar, 2005
3. World Constitutions by S.L Kelly
4. British Politics by F. N Forman and N. D.J Baldwin, 1991.
5. American Government: Institutions and Politics, 3rd edition by G.Q. Wilson,
6. Parliamentary Government in England by Harold J. Laski, 1960.
7. Political Institutions in Europe by J. M. Colomer, 1996.
8. Major Foreign Powers, New York: Harcourt, Brace & World, INC, 1967.
9. Comparative Constitutional Law by Hamid Khan & M.W. Rana
10. Introduction to the Study of the Law of the Constitution by Dicey
11. Elgar Encyclopedia of Comparative Law by J.M. Smits.

ENG-121: English II: Composition Writing **CHrs:3**

The course focuses on the basic strategies of composition and writing skills. Good writing skills not only help students obtain good grades but also optimize their chances to excel in professional life. The course includes modes of collecting information and arranging it in appropriate manner such as chronological order, cause and effect, compare and contrast, general to specific etc. It enables the students to write, edit, rewrite, redraft and proofread their own document for writing effective compositions. Because of the use of a significant amount of written communication on daily basis, sharp writing skills have always been valued highly in academic as well as professional spheres.

Course Contents:

1. Writing Process
- Invention
  - Generating Ideas (collecting information in various forms such as mind maps, tables, lists, charts etc)
  - Identifying Audience, Purpose, and Message

Ordering Information

- ❖ Chronology for a narrative
- ❖ Stages of a process
- ❖ From general to specific and vice versa
- ❖ From most important to least important
- ❖ Advantages and disadvantages
- ❖ Comparison and contrast
- ❖ Problem solution pattern

- Drafting
- ❖ Free Writing
- ❖ Revising
- ❖ Editing

2. Paraphrasing
3. Cohesion and Coherence
   - Cohesive Devices
   - Paragraph unity
4. Summary and Precis Writing
5. Creative Writing
6. Essay Writing
   - ❖ developing a thesis
   - ❖ organizing an essay
   - ❖ writing effective introduction and conclusion
   - ❖ different types of essays
   - ❖ use of various rhetorical modes including exposition, argumentation and analysis

Recommended Books:

- Goatly, A. (2000). *Critical Reading and Writing: An Introductory Course*. London: Taylor & Francis
- Hacker, D. (1992). *A Writer's Reference*. 2nd ed. Boston: St. Martin's
- Hamp-Lyons, L. & Heasley, B. (1987). *Study writing: A course in written English for academic and professional purposes*. Cambridge: Cambridge University Press.
- Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for Undergraduates.* Karachi: Oxford University Press.

AH-120: ISLAMIC STUDIES CHrs:3

Objectives

This course is aimed:

- To provide basic information about fundamental beliefs and Pillars of Islam
- To enhance understanding of the students regarding Quran and Sunnah
- To inform the students about the practical life of Prophet Muhammad (SAW)
- To provide the students with the sufficient knowledge about economic, social and cultural systems of Islam
- To boost up the balanced, enlightened and broad minded information of Islam in students
- To enable the students for adopting Islamic ethics and moral values
- To enable the students to live peacefully in a pluralistic and diversified society
- To promote the feelings of human sympathy in students without the condition of race or religion

Course Contents

1. **Study of Fundamental Religious Beliefs & Practices**

1.1 Islamic Beliefs:

i. Importance of Beliefs in personality building (general discussion)
ii. Study of the Islamic Beliefs: (Beliefs in Almighty Allah, Angles, Revealed Books, Prophet hood as well as Finality of Prophet hood, Destiny, Day of Judgment (Resurrection), desired effects of Islamic beliefs on Individual and Society

1.2 Practices (Ibadaat) of Islam

Philosophical Study of *Ibadaat*:

i. Definition and Scope of *Ibadah*
ii. Physical Submissions i.e. prayer and fasting : its rationale and its desired effects on Individual and society
iii. Financial Submissions i.e. Zakat and alms giving: its rationale and its desired effects on Individual and society

iv. Collective Submissions [Physical cum Financial] i.e. performing Hajj and Umarh: its rationale and its desired effects on Individual and society

v. Scope of chain of various *Ibadah*

2. Study of Basic Sources of Religion

2.1 Study of Quran:

i. Sources of Knowledge

ii. Need for Revelation

iii. Division of Surahs in Makki and Madani Titles

iv. Brief introduction of various kinds of Ayaa (verses) i.e. Ayaat ul Ahkaam, Ayaat Anfusi, Ayaat Kawnia.

v. Special focus on the behavior of Qura'n with other divine books and prophets in the lights of Qura'nic texts

vi. Textual & Thematic Study of Holy Quran:

a. Surah Hujarat (Complete) with special focus on ethics and morality

b. Surah Israa verses 23-40with special focus on ethics and morality

2.2 Study of Sunnah:

i. Meaning of Hadith & Sunnah and its kinds (Qawli, Feli, Taqreeri)

ii. Need, Importance of Hadith and its authority

iii. Important Books of Hadith (*Sihah Sitta* and *Kutub-e-Arbah*)

iv. Textual & Thematic Study of Hadith:Study of 20 Selected Hadiths (attached as Annex-1)

3. Brief Study of Biography of Prophet Muhammad (SAW)

3.1 Year wise Summary of Prophet's Life

3.2 Lessons learnt from life at Makkah

3.3 Lessons learnt from His life at Madinah with special reference to pact of Madina and Hudaibiyyah

3.4 *Hijrat*(Migration): its philosophy in general, causes and results

3.5 Jihad: Definition, Philosophy, justification (with special reference to *Badr*, *Uhad* and *Khandaq*)

4. Study of Islam in Multi-dimensional Aspects

4.1 Cultural and Social System of Islam**:** Introduction of Society and Culture, Salient features of Islamic culture and Society

4.2 Economic System of Islam: Basic concepts of Islamic economic system, Means of distribution of wealth in Islam

4.3 Political System of Islam: Basic concepts of Islamic political system, Qualities of Islamic political System

5. Pluralism, Diversity and Islam

5.1 Introduction of Pluralism and diversity, with special reference to diversity in Universe

5.2 Diversity in humans (personalities, gender, interests, hobbies, languages etc.)

5.3 Religious diversity, with special focus on various religions and sects

6. Human Rights and Islam

6.1 Concept and significance

6.2 Human Rights in Islam

6.3 Human Rights in the constitution of Pakistan

6.4 Human Rights in UNO Charter

7. Peace Education and Conflict Resolution

7.1 Peace: Concept, its significance in personal, domestic, social, national and International level

7.2 Religious instructions regarding peace in various dimensions of life

7.3 Conflict:Reasons and Stages of conflict, Reconciliation

7.4 Role of Communication in Peace building: Concept of Communication, Effective Communication, Rehabilitation of peace through communication

7.5 The role of inter and intra faith dialogue in maintaining peace as well as religious Harmony on national and international level

Recommended Books

1. Hamidullah, Dr. (2000), *Introduction to Islam*, Dawah Academy, Islamabad
2. Khan, Rafique Ali(2001), *Freedom of Thought in Islam*, Royal Book Company, Karachi
3. Ali, Syed Amir (2009), *The Spirit of Islam*, Islamic Book Service, Lahore
4. Hamidullah, Dr. (2005), *Muhammad Rasulullah: A concise survey of the life and work of the founder of Islam*, Dawah Academy, Islamabad

5. Hamidullah, Dr. (2000), *Islamic Notion of conflict of Laws*, Dawah Academy, Islamabad
6. UNO Charter of International Human Rights of 1948

ENG-231:English III: Communication and Presentation Skills CHrs: 3

Description:

For professional growth and future development, effective presentation skills and interactive and interpersonal communicative skills are very important. This course offers methods, techniques, and drills significant and useful in optimising communication and presentation skills of the learners, enabling them to face divergent groups of audience with poise and confidence. The course has been divided into modules relating to the essentials, contents, gestures, technology, and variety associated with communication and presentations skills. The presentation skills part focuses on preparing students for long-life skill of preparing and giving presentations. Communication is a vital part of our daily routine. The communication skills part focuses on developing good communication skills among students.

Course Contents

1. Introduction
   - Components of Communication
   - Types of Communication
   - Understanding the purpose of Communication
   - Analyze the Audience
   - Communicating with words as well as with body language
   - Writing with a Purpose
   - Barriers to Communication
2. Presentation skills
3. Delivering your presentation
4. Speaking with Confidence
5. Communicating Effectively
6. Job Interviews and Communicating Skills
7. Communicating with Customers
8. Communication in a Team

Recommended Readings:

1. Carnegie, Dale. ( ). *How to Win Friends & Influence People.*
2. Giblin, Les. *Skill with People.*
3. Newton, Paul. *How to communicate effectively*.

PHY- 101: Mechanics-I CHrs: 03

Course outline:

Review of Newtonian Mechanics: Frame of reference, orthogonal transformations, angular velocity and angular acceleration, Newton's laws of motion, Galilean transformation, conservation laws, systems of particles, motion under a constant force, motions under variable force, time-varying mass system.

The Lagrange Formulation of Mechanics and Hamilton Dynamics:

Generalized co- ordinates and constraints, D-Alembert's principle and Lagrange's Equations, Hamilton's principle, integrals of motion, non-conservative system and generalized potential, Lagrange's multiplier method, the Hamiltonian of a dynamical system, canonical equations, canonical transformations, Poisson brackets, phase space and Liouville's theorem.

Central Force Motion: The two-body problem, effective potential and classification of orbits, Kepler's laws, stability of circular orbits, hyperbolic orbits and Rutherford scattering, center of mass co-ordinate system, scattering cross-sections.

Motion in Non- inertial Systems: Accelerated translational co -ordinate system, dynamics in rotating co-ordinate system, motion of a particle near the surface of the earth.

The Motion of Rigid Bodies: The Euler angles, rotational kinetic energy and angular momentum, the inertia tensor, Euler equations of motion, motion of a torque-free symmetrical top, stability of rotational motion.

Recommended Books:

3. T. L. Chow, "Classical Mechanics", John Wiley, 1995.
4. T. Kibble and F. Berkshire, "Classical Mechanics", World Scientific, 5th ed. 2004.C
5. Classical Mechanics, H. Goldstein, 3rd Ed., Addison Wesley Reading, Massachusetts, 2006
6. Classical Dynamics of Particles and System, Jerry B. Marian, Stephen T.
7. Thornton, 4th Ed., Harcourt Brace & Company, 1995
8. Classical Mechanics, A. Douglas Davis, Academics Press, 1986HEME

TEXT/REFERENCE BOOKS/WEBSITES LINKS:

Text Books:

1. Shelly, G. B., & Vermaat, M. E. (2012). *Discovering computers fundamentals: your interactive guide to the digital world (Latest ed.)*. Cengage Learning.

Reference Books:

1. Sawyer, S. C., & Williams, B. (2000). *Introduction to Using Information Technology (Latest ed.)*. McGraw-Hill Higher Education
2. Brookshear, G. G., & Brookshear, J. G. (2002). *Computer science: an overview (Latest ed.)*. Addison-Wesley Longman Publishing Co., Inc.

Website Links:

1. https://www.tutorialspoint.com/computer_fundamentals/index.htm
2. https://codescracker.com/computer-fundamental/

PHY- 311: Mechanics-II **CHrs: 03**

Course Contents:

Review of Newtonian Mechanics: Frame of reference, orthogonal transformations, angular velocity and angular acceleration, Newton's laws of motion, Galilean transformation, conservation laws, systems of particles, motion under a constant force, motions under variable force, time-varying mass system.

The Lagrange Formulation of Mechanics and Hamilton Dynamics: Generalized co- ordinates and constraints, D-Alembert's principle and Lagrange's Equations, Hamilton's principle, integrals of motion, non-conservative system and generalized potential, Lagrange's multiplier method, the Hamiltonian of a dynamical system, canonical equations, canonical transformations, Poisson brackets, phase space and Liouville's theorem.

Central Force Motion: The two-body problem, effective potential and classification of orbits, Kepler's laws, stability of circular orbits, hyperbolic orbits and Rutherford scattering, center of mass co-ordinate system, scattering cross-sections.

Motion in Non- inertial Systems: Accelerated translational co -ordinate system, dynamics in rotating co-ordinate system, motion of a particle near the surface of the earth.

The Motion of Rigid Bodies: The Euler angles, rotational kinetic energy and angular momentum, the inertia tensor, Euler equations of motion, motion of a torque-free symmetrical top, stability of rotational motion.

Recommended Books:

1. T. L. Chow, "Classical Mechanics", John Wiley, 1995.
2. T. Kibble and F. Berkshire, "Classical Mechanics", World Scientific, 5th ed. 2004.C
3. Classical Mechanics, H. Goldstein, 3rd Ed., Addison Wesley Reading, Massachusetts, 2006
4. Classical Dynamics of Particles and System, Jerry B. Marian, Stephen T. Thornton, 4th Ed., Harcourt Brace & Company, 1995
5. Classical Mechanics, A. Douglas Davis, Academics Press, 1986HE

PS:321: Pakistan Studies **CHrs:3**

Course Contents:

Introduction/Objectives:

To develop vision of historical perspective, government, politics,

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-e-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.

1. 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

Recommended Books:

1. Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998
2. Akbar, S. Zaidi. Issue in Pakistan's Economy. Karachi: Oxford University Press, 2000.
3. Amin, Tahir. Ethno - National Movement in Pakistan, Islamabad: Institute of Policy Studies, Islamabad.
4. Aziz, K.K. Party, Politics in Pakistan, Islamabad: National Commission on Historical and Cultural Research, 1976.
5. Burki, Shahid Javed. State & Society in Pakistan, the Macmillan Press Ltd 1980.
6. Haq, Noor ul. Making of Pakistan: The Military Perspective. Islamabad: National Commission on Historical and Cultural Research, 1993.
7. Mehmood, Safdar. Pakistan Kayyun Toota, Lahore: Idara-e- Saqafat-e-Islamia, Club Road, nd.
8. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994.
9. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.
10. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.

11. Sayeed, Khalid Bin. The Political System of Pakistan. Boston: Houghton Mifflin, 1967.
12. Wilcox, Wayne. The Emergence of Bangladesh., Washington: American Enterprise, Institute of Public Policy Research, 1972.
13. Zahid, Ansar. History & Culture of Sindh. Karachi: Royal Book Company, 1980.
14. Ziring, Lawrence. Enigma of Political Development. Kent England: WmDawson & sons Ltd, 1980.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-211	CALCULUS-I	MATHEMATICS AT INTERMEDIATE LEVEL

SPECIFIC OBJECTIVES OF THE COURSE:

This is the first course of the basic sequence, Calculus I-III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. Calculus I & II focus on the study of functions of a single variable.

COURSE OUTLINE:

Equations and inequalities: Solving linear and quadratic equations, linear inequalities. Division of polynomials, synthetic division. Roots of polynomial, rational roots, Viete Relations. Descartes rule of signs. Solutions of equations with absolute value sign. Solution of linear and non-linear inequalities with absolute value sign.

Functions and graphs: Domain and range of a function. Examples: polynomial, rational, piecewise defined functions, absolute value functions, and evaluation of such functions. **Operations with functions:** sum, product, quotient and composition. Graphs of functions

Lines and systems of equations: Equation of a straight line, Slope and intercept of a line, parallel and perpendicular lines. Systems of linear equations, Solution of system of linear equations. Nonlinear systems: at least one quadratic equation.

Limits and continuity: Functions, limit of a function. Graphical approach, properties of limits. Theorems of limits. Limits of polynomials, rational and transcendental functions. Limits at infinity, infinite limits, one-sided limits. Continuity.

Derivatives: Definition, techniques of differentiation. Derivatives of polynomials and rational, exponential, logarithmic and trigonometric functions. The chain rule. Implicit differentiation. Related rates. Linear approximations and differentials. Higher derivatives,

Applications of derivatives: Increasing and decreasing functions. Relative extrema and optimization. First derivative test for relative extrema. Convexity and point of inflection. The second derivative test for extrema. Curve sketching. Mean value theorems. Indeterminate forms and L'Hopitals rule. Inverse functions and their derivatives.

Integration: Anti derivatives and integrals. Riemann sums and the definite integral, properties of Integral, the fundamental theorem of calculus, the substitution rule.

Recommended Books

1. J Stewart, Calculus (7th edition), Brooks/Cole 2011
2. Thomas, Calculus, 11th Edition. Addison Wesley Publishing Company, 2005
3. H. Anton, I. Bevens, S. Davis, "Calculus, (Early Transcendental)", (9th edition), John Wiley, New York, 2009.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-212	SET THEORY AND MATHEMATICAL LOGICS	CALCULUS-I

SPECIFIC OBJECTIVE OF COURSE:

Everything mathematicians do can be reduced to statements about sets, equality and membership which are basics of set theory. This course introduces these basic concepts. The course aims at familiarizing the students with cardinals, relations and fundamentals of propositional and predicate logics.

COURSE OUTLINE:

Set theory: Sets, subsets, operations with sets: union, intersection, difference, symmetric difference, Cartesian product and disjoint union. Functions: graph of a function, composition; injections, surjection, bijections, inverse function.

Computing cardinals: Cardinality of Cartesian product, union, cardinality of all functions from a set to another set. Cardinality of all injective, surjective and bijective functions from a set to another set. Infinite sets, finite sets, countable sets, properties, examples (Z, Q). R is not countable. R, RxR, RxRxR have the same cardinal, operations with cardinal numbers, cantor-Bernstein theorem.

Relations: Equivalence relations, partitions, quotient set; examples, parallelism, similarity of triangles. Order relations, min, max, inf, sup; linear order. Examples: N, Z, R, P(A). Well-ordered sets and induction, inductively ordered sets and Zorn's lemma.

Mathematical logic: Propositional calculus, truth tables, predicate calculus.

Recommended Books

1. M. Liebeck, A Concise Introduction to Pure Mathematics, CRC Press, 2011.
2. N. L. Biggs, Discrete Mathematics, Oxford University Press, 2002.
3. R. Garnier, J. Taylor, Discrete Mathematics, Chapters 1,3,4,5, CRC Press, 2010.
4. A.A. Fraenkal, Abstract Set Theory, North-Holland Publishing Company, 1966.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-213	NUMBER THEORY	CALCULUS I, DISCRETE MATHEMATICS

SPECIFIC OBJECTIVE OF COURSE:

The focus of the course is on study of the fundamental properties of integers and develops ability to prove basic theorems. The specific objectives include study of division algorithm, prime numbers and their distributions, Diophantine equations, and the theory of congruences.

COURSE OUTLINE:

Preliminaries: Well-ordering principle. Principle of finite induction.
Divisibility theory: The division algorithms. Basis representation theorem. Prime and composite numbers. Canonical decomposition. The greatest common divisor. The Euclidean algorithm. The fundamental theorem of arithmetic. Least common multiple.
Linear Diophantine equations: Congruence's. Linear congruence's. System of linear congruence's. The Chinese remainder theorem. Divisibility tests. Solving polynomial congruencies. Fermat's and Euler's theorems. Wilson's theorem.
Arithmetic functions: Euler's phi-function. The functions of J and sigma. The Mobius function. The sieve of Eratosthenes. Perfect numbers. Fermat and Mersenne primes.
Primitive Roots and Indices: The order of integer mod n. Primitive roots for primes. Composite numbers having primitive roots**.**

Recommended Books

1. D.M. Burton, Elementary Number Theory, McGraw-Hill, 2007.
2. S.B. Malik, Basic Number Theory, Vikas Publishing house, 1995.
3. K.H. Rosen, Elementary Number Theory and its Applications, 5th edition.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-221	CALCULUS-II	CALCULUS-I

SPECIFIC OBJECTIVES OF THE COURSE:
This is the second course of the basic sequence Calculus I-III serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. As continuation of Calculus-I, it focuses on the study of functions of a single variable.

COURSE OUTLINE:
Techniques of integration: Integrals of elementary, hyperbolic, trigonometric, logarithmic and exponential functions. Integration by parts, substitution and partial fractions. Approximate integration. Improper integrals. Gamma functions.
Applications of integrals: Area between curves, average value, volumes, arc length, area of a surface of revolution.
Infinite series: Sequences and series. Convergence and absolute convergence. Tests for convergence, divergence test, integral test, p-series test, comparison test, limit comparison test, alternating series test, ratio test, roots test. Power series. Convergence of power series. Representation of functions as power series. Differentiation and integration of power series. Taylor and McLaurin series. Approximations by Taylor polynomials.
Conic section, parameterized curves and polar coordinates: Curves defined by parametric equations. Calculus with parametric curves: tangents, areas, arc length. Polar coordinates. Polar curves, tangents to polar curves. Areas and arc length in polar coordinates.

Recommended Books

1. Thomas, Calculus, 11th Edition. Addison Wesley Publishing Company, 2005
2. H. Anton, I. Bevens, S. Davis, "Calculus, (Early Transcendental)", (9th edition), John Wiley, New York, 2009.
3. J Stewart, Calculus (7th edition), Brooks/Cole 2011

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-218	ALGEBRA-I	

SPECIFIC OBJECTIVES OF COURSE:

This course introduces basic concepts of groups and their homomorphisms. The main objective of this course is to prepare students for courses which require a good back ground in group theory like Rings and Modules, Linear Algebra, Group Representation, Galois Theory etc.

COURSE OUTLINE:

GROUPS: Definitions and Consequences, Subgroups, Relations Between Groups, Cyclic Groups, Groups and Symmetries, Exercises*

CO EXMAPLEXES IN GROUPS: Complexes and Cosets, Decomposition of a Group, Lagrange's Theorem, Normalizers and Centralizers, Conjugacy Relations in Groups, Double Cosets, Exercises*

NM SUBGROUPS, FACTOR GROUPS: Normal Subgroups, Quotient/Factor Groups, Automorphism Group of a Group, Commutator or Derived Subgroup, Characteristic and Fully Invariant Subgroups, Exercises*

GROUPS OF PERMUTATIONS: Symmetric or Permutation Groups, Per-mutability of Permutations, Cyclic Permutations and Orbits, Order of a Permutations, Transpositions, Even and Odd Permutations, Exercises*

Note: * is used for few and related exercises.

Recommended Books

1. Dr. Abdul Majeed. "Theory of Groups", Latest Edition (2012), ILMI KITAB KHANA
2. J. Rose, A Course on Group Theory, Cambridge University Press, 1978.
3. J. B. Fraleigh, A First Course in Abstract Algebra, Addison Wesley Publishing Company, 2002.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-223	BASIC TOPOLOGY	CALCULUS-I

SPECIFIC OBJECTIVE OF COURSE:

The aim of this course is to introduce the students to metric spaces and topological spaces. They would be able to determine whether a function defined on a metric or topological space is continuous or not.

COURSE OUTLINE:

Metric Space, Examples of metric spaces, Open balls, Topological Space and different types of topological spaces, Open and Closed sets, Interior points, Exterior points, Boundary points,

Closure of a set, Limit points, Neighborhoods and Neighborhood system, Subspace Topology, Bases and sub-bases, Continuous functions and Homeomorphisms.

Recommended Books

1. C. Wayne Patty; Foundations of Topology, 2nd Edition.
2. A. Majeed; Elements of Topology and Functional analysis, Ilmikitabkhana, 1990.
3. H. Anton, C. Rorres , Elementary Linear Algebra: Applications Version, 10th Edition, John Wiley and sons, 2010.

COURSE CODE	COURSE TITLE	PREREQUISITES
MATH-219	ORDINARY DIFFERENTIAL EQUATION	CALCULUS-I

SPECIFIC OBJECTIVE OF COURSE:

To introduce students to the formulation, classification of differential equations. To provide skill in solving first order and second order linear homogeneous and non-homogeneous differential equations and solving initial and boundary value problems.

COURSE OUTLINES:

Preliminaries: Introduction and formulation, classification of differential equations, existence and uniqueness of solutions, introduction to initial value and boundary value problems.

First order ordinary differential equations: Basic concepts, formation and solution of differential equations, Separation of variables, Homogeneous equations, Exact equations, Solution of linear equations by integrating factor, Some special non-linear first order differential equations like Bernoulli's equations Ricatti equations and Clairaut equations, Basic theory of system of first order linear differential equations, Homogeneous linear system with constant coefficients.

Second and higher order linear differential equations: Initial value and boundary value problems, linearly independence and Wronskian, Superposition principle, Homogeneous and non-homogeneous equations, Reduction of order, Solution of homogeneous equations with constant coefficients, Particular solution of non-homogeneous equations, Method of Undetermined coefficients, Variation of parameters and Cauchy-Euler equations

Recommended Books

1. Dennis G. Zill and Michael R., Differential equations with boundary-value problems by Cullin 5th Edition Brooks/Cole, 1997.
2. William E. Boyce and Richard C. Diprima, Elementary differential equations and boundary value problems, Seventh Edition John Wiley & Sons, Inc
3. V. I. Arnold, Ordinary Differential Equations, Springer, 1991.
4. T. Apostol, Multi Variable Calculus and Linear Algebra, 2nd ed., John Wiley and sons, 1997.