

Scheme of Study

Associate Degree Program in Physics

Department of Physics (ULM)



University of Lakki Marwat, Lakki Marwat, KPK.

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HOD
Physics, ULM

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Director Academics,
ULM

Scheme of Studies of Associate Degree in Physics

Semester-wise break up

First Year

Semester I

Course Code	Course Title	Crd Hrs	Pre-Requisite
EW-101	English-I	3	
AH-105	Islamic History	3	
NS-101	Everyday Science	3	
NS-107	ICT	3	
SS-120	Introduction to Sociology	3	
QR-104	Introduction to Statistics	3	
Total Credit Hrs		18	

Semester II

Course Code	Course Title	Crd Hrs	Pre-Requisite
NS-120	Introduction to Physics	3	
QR-101	Basic Mathematics	3	
AH-120	Constitutional Law	3	
SS-113	Introduction to Economics	3	
ENG-121	English II	3	
CC-110	Islamic Studies	3	
Total Credit Hrs		18	

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Semester III

Course Code	Course Title	Crd Hrs	Pre-Requisite
ENG-231	English III	3	
CC-120	Pakistan Study	3	
PHY-101	Mechanics	4	
MATH-211	Calculus-I	3	
PHY102	Electricity & Magnetism	4	
PHY101L	Lab-I (Mechanics)	1	
Total Credit Hrs		18	

Semester IV

Course Code	Course Title	Crd Hrs	Pre-Requisite
MATH-214	Calculus II	3	
PHY-203	Waves and Oscillations	3	
PHY-204	Heat & Thermodynamics	3	
PHY-205	Modern Physics	3	
PHY-351	Mathematical Methods of Physics-I	3	
PHY-102L	Lab-II (Electricity & Magnetism)	1	
Total Credit Hrs		16	

Total Credit Hours= 70

HOD Physics - ULM

Dr. L
Director Academics
ULM

EW-101: English I: Reading & Writing Skills**Chrs:03****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 various grammatical components such as, parts of speech, tenses, voice, narration, modals etc. in practical contexts.

Course Contents

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

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 Books:

1. Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for undergraduates*. Karachi: Oxford University Press.
2. Eastwood, J. (2004). *English Practice Grammar* (New edition with tests and answers). Karachi: Oxford University Press.
3. 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".
- تاريخ الخلفاء (اردو ترجمہ) ----- علامہ جلال الدین سیوطی
- خلافت اندلس ----- نواب ذوالقدر جنگ
- تاريخ اندلس ----- مولانا ریاست علی ندوی
- تاريخ اسلام ----- اکبر شاہ خان نجیب آبادی
- تاريخ الامم والملوک (اردو ترجمہ) ----- ابن جریر طبری

SS-120:

Introduction to Sociology

CHrs: 03

Course Contents

Fundamental of Sociology: Nature, Scope, and subject matter of Sociology, Brief historical development of Sociology, Society and community, Relationship with other social sciences like Economic, Political Science, History, Psychology, and Anthropology, Social interaction processes (Cooperation, Competition, Conflict, Accommodation, Acculturation, and Assimilation), Social Groups, Definition and Functions, Types of Social Groups (In and out group, Primary and Secondary groups, Reference groups. Formal and informal Groups and Pressure groups).

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

Cultural and Related Concepts: Definition and aspects of culture, Material and non-material culture, Ideal and real culture, Elements of culture, Beliefs, values, norms (folkways, mores, laws), Organization of culture, Traits, complexes, and patterns, other related concepts, Cultural relativism, Sub-Culture and ethnocentrism

Socialization and Personality: Role and Status, Socialization, Culture and Personality

Deviance and Social Control: Definition and types of deviance, Formal and informal methods of social control.

Social Stratification: Determinants of Social Stratification (Caste, Class, Ethnicity, Power, Prestige and Authority), Social Mobility, Definition and types, Dynamics of social mobility

Social and Cultural Change: Definition of social change, Dynamics of social change (Education, Innovation, Industrialization, Urbanization and Diffusion). Resistance to change.

Recommended Books:

1. Horton Paul B. and Hunt, Chester L (1990), Sociology Singapore: McGraw Hill Book Company.
2. Sociology 1 by Allama Iqbal Open University, Islamabad
3. Sociology 2 by Allama Iqbal Open University, Islamabad
4. Taga, Abdul Hameed (2000) An Introduction. New York: Harper and Rows
5. Betrnad, Alvin L. (1969). Basic Sociology-An Introduction to Theory and Methods, New York; Appleton Century Crofts.
6. Curran, Jr.(1977).Introductory sociology: A basis Self Instructional Guide
7. Hafeez, Sabeeha (1990), The Changing Pakistan Society. Karachi: Royal Book company, Zaibunisa Street, Sadar.

8. Horton Paul B. and Hunt, Chester I. (1990) Sociology singapore. MacGraw Hill Book Company.
9. Merri, F.E., (latest ed.), Sociology and Culture. N.J. Englewood Cliffs.
10. Philips, Bernard (1990). Sociology-Form Concepts to Practice. New York: McGraw Hill Book Company Inc.
11. Rao, C. Nshaukar (1990), Sociology, New Delhi: S.C Chand and Company Ltd.

QR-104

Introduction to Statistics

CHrs:3

Course Contents

Basic of Statistics: Introduction to Statistics, Scope and importance of statistics, Meaning of Statistics according to the subject, Branches of Statistics, Population and sample, Parameter and Statistic, Variable and Constant, Discrete and continuous variable

Data and its types (Qualitative and Quantitative), Scales of measurements (Nominal, Ordinal, Interval and Ratio), Diagrams and graphs, simple and Multiple bar chart, Histogram, Pie chart.

Frequency distribution (FD): Definition of frequency distribution, Steps in construction of frequency distribution.

Measures of Central Tendency: Arithmetic mean, Real life examples for group and ungroup data, Uses of Median, Applications of Median for simple and frequency data, The Mode, Uses of Mode, Applications of Mode for simple and frequency data.

Measures of Dispersion: Definition and types of dispersion, Range, grouped and ungrouped data Coefficient of range, Standard deviation, variance and Co-efficient of variance

Probability: Definition of probability, Objective and Subjective probability, Experiment and random experiment, sample space and sample point, Event, simple and composite events, Mutually exclusive and independent events, Calculation of probability relative to dice, coins and balls.

Sampling: Sampling and sampling distribution, Probability and non-probability sampling.

Estimation: Definition of Estimation, Estimator and Estimate, Definition of Point and Interval Estimation.

Hypothesis Testing: Hypothesis, Statistical Hypothesis and Testing of Hypothesis, Simple and Composite hypothesis, Steps of hypothesis testing, Definition of Student t-test, Properties of t-test, and Real life examples of t-test for single population mean.

Regression and Correlation: Definition of Regression, Estimated regression line

Solution of Real life Problems for simple regression.

Correlation: Definition of Correlation, Pearson correlation co-efficient, Solution of Real life Problems

Recommended Books

1. Statistical Theory Part-I and Part-II By Sher Mohammad Chaudary, Carwan Publisher.
2. Statistics 4th Edition, "Schaum's Outline Series, McGRAW-HILL
3. Basic Concepts and Methodology for the Health Sciences By Wayne 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.

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, satellites, 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 conversion, 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.
- 4.

ICT-107

Information and Communication Technologies

CHrs:03

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.

Course outline:

Data and Information, Information Processing Cycle, Introduction to Computer, Components of a Computer, Advantages and Disadvantages of Using Computers. Categories of Computers, Computer Applications in Society.

Input Devices: Types of Input, Input for Smart Phones, Game Controllers, Digital Cameras, Voice Input, Video Input, Scanners and Reading Devices, Biometric Input, Printers, Nonimpact Printers, Impact Printers, Speakers, Headphones, Data Projectors. Interactive Whiteboards.

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.

Memory: Data Representation, Memory Sizes, Types of Memory, RAM, Cache, ROM, Flash Memory, Primary and Secondary Memory , Data Communication.,

Internet, World Wide Web

Networks, Internet and Searching Techniques, E-Learning, Freelancing , Enterprise Computing, Computer Security Risks, Viruses

Introduction to MS Word, MS Excel, MS PowerPoint

NS- 120

INTRODUCTION TO PHYSICS

CR 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-plate 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: 03

Course outline:

Numbers systems: Real Numbers, 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.

Linear and Quadratic Equations: Equations in two unknowns, Equations in three unknowns, Quadratic Equations,

Functions: Definition of a function, Polynomial functions, Graphs of functions, Exponential function.

Determinants Matrices: Determinants of order, Properties of 2 X 2 determinants, Determinants of order 3, Properties of 3 X 3 determinants.

Differentiation: Fundamentals, Derivatives by Definitions, Power Rule, Properties of Derivatives, Product and Division Rules

Integration: Fundamentals, Basic Integrations, Product Rule

Geometry: Distance and Angles, the Pythagoras theorem. **Area and Applications,** Area of a disc of radius circumference of a circle of radius r, **Coordinates and Geometry,** Coordinate systems, Distance between points, Equation of a circle

Segments, Rays, and Lines: Segments, Rays, Lines, Ordinary equation for a line

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

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

Recommended Books

1. Fundamentals of Economics Part 1 for Intermediate Classes By Habib Ullah Vaseer, edition 2015-2016, Farhan Publishers
2. Samuelson and Nordhaus: Economics 19th edition
3. Welcome to Economics (McConnell) AP Edition, 19th Edition
4. Economic Theory. Vol 2,(2000) by Hussain Ch. M. The carvan press; (Lahore)
5. Walter Nicholson: Micro Economics Theories: Basic Principles and Extensions, 10th Edition.
6. Mankiw, G–Principles of Economics- latest edition.
7. Samulson and Nordrons - Economics –latest edition

AH-120

Constitutional Law

CHrs:03

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

Recommended Books:

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.

EW-121

Composition Writing (English II)

CHrs: 03

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:

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.

Paraphrasing: Cohesion and Coherence, Cohesive Devices, Paragraph unity, Summary and Precise Writing, Creative Writing, 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:

1. Goatly, A. (2000). Critical Reading and Writing: An Introductory Course. London: Taylor & Francis
2. Hacker, D. (1992). A Writer's Reference. 2nd ed. Boston: St. Martin's

- 3 Hamp-Lyons, L. & Heasley, B. (1987). Study writing: A course in written English for academic and professional purposes. Cambridge: Cambridge University Press.
- 4 Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). Oxford English for Undergraduates. Karachi: Hamidullah, Dr. (2000), *Islamic Notion of conflict of Laws*, Dawah Academy, Islamabad.

ENG-231: English III: Communication and Presentation Skills CHrs: 03

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.

CC:120

Pakistan Studies

CHrs:03

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 outline:

Vectors Overview: Vectors and scalars, Vector operators, coordinate systems and Unit Vectors, Vector – Magnitude and direction, Vector decomposition into components

Kinematics: position, velocity and acceleration, constant acceleration, vector description of motion in 2D, projectile motion.

Newton's Laws: Newton's Laws of motion, force laws, constraint forces and free body diagrams for gravity, contact forces, tension and springs, Friction.

Circular Motion: Circular motion, velocity and angular velocity, uniform circular motion, tangential and radial acceleration, period and frequency of uniform circular motion. Newton's second law and Circular motion, Universal Law of gravitation.

Drag Forces, Constrains and Continuous Systems: Pulleys and constraints, Massive rope, continuous systems and Newton's second law as a differential equation, Resistive forces, capstan, drag force in fluids, free fall with air drag.

Momentum and Impulse: Momentum and Impulse, External and Internal forces and the change in momentum of a system, system of particle. Conservation of momentum, constancy of momentum and isolated systems, momentum changes and non-isolated systems, center of mass, translational motion of the center of mass.

Continuous mass Transfer: Relative velocity and recoil, reference frames, continuous mass transfer, momentum and flow of mass

Kinetic Energy and Work: The concept of energy and conservation of energy, kinetic energy, work, work energy theorem, power, work and scalar product, work done by a non-constant force along arbitrary path, work kinetic energy theorem in 3D, conservation of energy, conservative and non-conservative forces.

Potential Energy and Energy conservation: Changes in potential energy of a system, changes in potential energy and zero point of potential energy, mechanical energy and conservation of mechanical energy, change of mechanical energy for closed system with internal non-conservative forces, dissipative forces: friction, potential energy diagrams.

Collision Theory: Types of collision, Elastic collisions, center of mass reference frame.

Rotational Motion: Motion of a rigid body, two-dimensional rotational kinematics, moment of inertia, Torque, static equilibrium, rotational dynamics.

Angular momentum: Angular momentum of a point particle, angular momentum of a rigid body about a fixed axis, Torque and angular impulse.

Rotations and Translations -Rolling: Rolling Kinematics, rolling dynamics, rolling kinetic energy and angular momentum, gyroscopes

Recommended Books:

1. Halliday, D. Resnick, Krane, Physics, Vol. I & II, John Wiley, 5th ed. 1999.
2. R. A. Serway and J. W. Jewett, "Physics for Scientists and Engineers", Golden Sunburst Series, 8th ed. 2010.
3. R. A. Freedman, H. D. Young, and A. L. Ford (Sears and Zeemansky), "University Physics with Modern Physics", Addison-Wesley-Longman, 13th International ed. 2010.
4. F. J Keller, W. E. Gettys and M. J. Skove, "Physics: Classical and Modern, McGraw Hill. 2nd ed. 1992.
5. D. C. Giancoli, "Physics for Scientists and Engineers, with Modern Physics", Addison-Wesley, 4th ed. 2008.
6. Classical Mechanics: MIT 8.01" by Peter Dourmashkin

PHYS-102

ELECTRICITY AND MAGNETISM

Credit Hrs: 04

Course Contents:

Electric charge (properties/quantization/conservation), Coulombs law in free space, Electric field due to discrete/continuous charges distributions, Electric dipole, Electric flux, Gauss's law and its applications, Electric potential due to discrete/continuous charges distributions, Work and Electric potential energy, Capacitors and capacitance, Capacitance for various geometries, Capacitance with Dielectrics, Electric Current, current density, Resistance and resistivity, Microscopic and macroscopic forms of Ohm's Law, Energy transfer in electric circuit, Power in electric circuits, Calculating current in a single loop and multiple loop by using Kirchoff laws, Circuit analysis, Growth and decay of current in RC-circuits and its analytical treatment. Magnetic field, Magnetic forces on a single point charge/current carrying conductor, Torque on a current carrying loop and magnetic dipole, Biot & Savart Law and its analytical treatment and application, Ampere's law and its applications, Electromagnetic induction and its laws, Inductance, Inductance for various configurations, LR circuits, Growth and decay of current in RL circuits, Electromagnetic Oscillation (Qualitative and Quantitative analysis using differential equations), Forced electromagnetic oscillations and resonance, Alternating current circuits, Single loop RLC circuits (series and parallel), Power in AC circuits and phase angles, Maxwell's

equations (integral/differential forms), Electromagnetic waves, Poynting vector, Magnetic properties of materials.

Recommended Books:

1. D. Halliday, R. Resnick and K. S. Krane, "Fundamentals of Physics", John Wiley & Sons Inc., 5th Ed. (2003).
2. R. A. Freedman, H. D. Young and A. L. Ford (Seers and Zemansky's), "University Physics", Pearson Education Inc, 11th (2006).
3. D. C. Giancoli, "Physics for Scientist and Engineers with Modern Physics", 2nd ed. Prentice Hall Inc. (1988).

PHYS-204

HEAT AND THERMODYNAMICS

Credit Hrs: 03

Course Contents:

Basic Concepts and Definitions in Thermodynamics, Properties and state of the substance, Extensive and Intensive properties, Equilibrium, Mechanical and Thermal Equilibrium, Processes and Cycles: Isothermal, Isobaric and Isochoric., Zeroth Law of Thermodynamics, Consequence of Zeroth law of, Thermodynamics. The state of the system at Equilibrium, Heat and Temperature: Temperature, Kinetic theory of ideal gas, Work done on an ideal gas, Internal energy of an ideal gas: Equipartition of Energy, Intermolecular forces, Qualitative discussion, The Virial expansion, The Van der Waals equation of state. Thermodynamics: First law of thermodynamics and its applications to adiabatic, isothermal, cyclic and free expansion. Reversible and irreversible processes, Second law of thermodynamics, Carnot theorem and Carnot engine. Heat engine, Refrigerators, Calculation of efficiency of heat engines, Thermodynamic temperature scale: Absolute zero, Entropy, Entropy in reversible process, Entropy in irreversible process, Entropy and Second law of thermodynamics, Entropy and Probability. Thermodynamic Functions: Thermodynamic functions (Internal energy, Enthalpy, Gibb's functions, Entropy, Helmholtz functions), Maxwell's relations, TdS equations, Energy equations and their applications. Low Temperature Physics, Joule-Thomson effect and its equations. Thermoelectricity: Thermocouple, Sebeck's effect, Peltier's effect, Thomson effect, Introduction to Statistical Mechanics: Statistical distribution and mean values, Mean free path and microscopic calculations of mean free path. Distribution of Molecular Speeds, Distribution of Energies, Maxwell distribution, Maxwell Boltzmann energy distribution, Internal energy of an ideal gas, Brownian Motion Legvaian equation, Qualitative description.

Recommended Books:

1. B. N. Roy, "Principles of Modern thermodynamics", Institute of Physics, London (1995).
2. D. Halliday, R. Resnick K. S. Krane, "Fundamentals of Physics", John Wiley & Sons Inc., 5th Ed. (2003).
3. M. W. Zemansky, Heat and Thermodynamics, McGraw Hill, 7th ed. (1997).
4. M. Sprackling, "Thermal Physics", McMillan (1991).

PHYS-203**WAVES AND OSCILLATIONS****Credit Hrs: 03****Course Contents:**

Harmonic Oscillator Equation, Complex Number Notation, Simple Pendulum, Transverse Waves: Transverse Standing Waves, Normal Modes, General Time Evolution of a Uniform String, Phase velocity, Group Velocity. Longitudinal Waves: Spring Coupled Masses, Sound Waves in an Elastic Solid, Sound Waves in an Ideal Gas, Traveling Waves: Standing Waves in a Finite Continuous Medium, Traveling Waves in an Infinite Continuous Medium, Energy Conservation, Reflection and Transmission at Boundaries, Electromagnetic Waves, Wave Pulses: Multi-Dimensional Waves: Plane Waves, Three-Dimensional Wave Equation, Waveguides, Cylindrical Waves, Interference and Diffraction of Waves: Double-Slit Interference, Single-Slit Diffraction.

Recommended Books:

1. J. Pain, "The Physics of Vibrations and Waves", John Wiley, 6th ed. 2005.
2. P. French, "Vibrations and Waves", CBS Publishers (2003).
3. F. S. Crawford, Jr., "Waves and Oscillations", Berkeley Physics Course, Vol. 3, McGraw-Hill, 1968.
4. A. Hirose, and K. E. Lonngren, "Introduction to Wave Phenomena", Krieger Publications, 2003.

PHYS-205**MODERN PHYSICS****CREDIT Hrs: 03****Course Contents:**

Motivation for Non--Classical Physics: Quantum interference, black body radiation and ultraviolet catastrophe, Planck's quantization. Photoelectric effect, Compton effect, production and properties of X-rays, diffraction of X-rays, concept of matter waves, de Broglie relationship, electrons are waves, electron diffraction, particulate nature of matter, contributions of Faraday (atoms exist), Thomson (electron exists), Rutherford (nucleus exists) and Bohr (quantization of

energies inside an atom), wave packets and wave groups, dispersion, Heisenberg uncertainty principle, direct confirmation of quantization through Franck-Hertz experiment and spectroscopy, working of electron microscopes. Quantum Mechanics in One Dimension: The concept of a wave function, time independent Schrodinger equation and interpretation of the equation, solving the Schrodinger equation for a free particle, for a particle inside an infinite box, relationship between confinement and quantization, working of a CCD camera. Concept of tunneling, reflection and transmission of wave functions from barriers, applications: radioactivity, scanning tunneling microscope, decay of black holes. The Hydrogen atom, orbitals, angular momentum and its quantization, orbital magnetism, Zeeman effect, concept of spin, Pauli's exclusion principle, Building of the periodic table, magnetic resonance and MRI, why is iron magnetic? White dwarfs and neutron stars. From Atoms to Molecules and Solids: Ionic bonds, covalent bonds, hydrogen bonds, molecular orbitals, how crystals are different from amorphous solids? Why and how do metals conduct electricity? Bands in solids, semiconductors, introduction to ED's and lasers, in traducing graphene. Nuclear Structure: Size and structure of nucleus, nuclear forces, radioactivity and nuclear reactions, radiocarbon dating.

Recommended Books:

1. R.A. Serway, C.J. Moses, C.A. Moyer, "Modern Physics", BrooksCole, 3rd ed. (2004).
2. P. A. Tipler, R. A. Llewellyn, "Modern Physics", W H Freeman and Company 6th ed. (2012).
3. A.Beiser, "Concepts of Modern Physics", McGraw-Hill, 6th ed. (2002).
4. R. M. Eisberg and R. Resnick, "Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles", John Wiley, 2nd ed. (2002).

PHY- 351

Mathematical Methods of Physics-I

Credit Hrs: 03

Course Contents:

Vector Analysis:

Review of vectors Algebra, Vector operations, Physical significance of DEL operator, Line integrals, Surface and Volume Integrals, Gradient of a scalar, Divergence of a vector , Directional derivatives and gradients, Curl of a vector , Gauss's divergence theorem, Green's theorem, Vector differentiation and gradient, Vector integration, , Stokes's Curl theorem, , Cartesian coordinates systems, Polar coordinates systems, Spherical polar and Cylindrical coordinates systems.

Matrices:

Determinants, Matrices, Linear vector spaces, orthogonal matrices, Hermitian matrices, Unitary Matrices, Orthogonalization, Eigenvalues and eigenvectors of matrices, , Similarity transformations, Diagonalization of matrices.

Complex Variables:

Complex numbers , Functions of a complex variable, analytic functions of complex variables, De Moivre's theorem, Taylor and Laurent series, Cauchy Riemann conditions and analytic functions, Cauchy integral theorem, Cauchy integral formula, Euler's formula, harmonic functions, complex integration, Contour integrals, singularities and residues, residue theorem.

Recommended Books:

1. G. Arfken, Mathematical Physics, 2nd ed, Academic Press, 1970.
2. Dass H.K, R. Verma, 2011, 6th Edition, Mathematical Physics, S. Chand & Company Ltd. New Delhi.
3. E. Butkov, Mathematical Physics, Addison-Wesley 1968.
4. Pipes and Harvill, Applied Mathematics for Engineers and Physicists, McGraw Hill, 1971.
5. M. L. Boas, Mathematical Methods in Physical Sciences, John Wiley & Sons, New York (1989)
6. M. R. Spiegel, Complex Variables Schaum's Outline Series, McGraw Hill 1979

MATH-211**CALCULUS-I****Credit Hrs: 03****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, Viète 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.

MATH-221

CALCULUS-II

Credit Hrs: 03

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

PHYS-101L LAB-I (MECHANICS) Credit Hrs: 01

Course outline:

Experiments with pendulums, stop watches, one-dimensional motion and verification of Newton's laws of motion, measurement of forces, speed, acceleration and linear momentum, collisions and conservation of momentum, impacts, free fall and acceleration due to gravity, gyroscopes, rotational motion, conservation of angular momentum, friction, static and dynamic equilibrium, compound pendulum, rolling motion along inclined planes, simple harmonic motion, masses attached to springs and Hooke's law, damped motion and the regimes of damping (over damped, underdamped and critically damped), pressure in fluids, experiments demonstrating continuity, Bernoulli's principle, buoyancy and Archimedes' principle, Atwood machine, fluid viscosity, surface tension.

PHYS-103L LAB-II (ELECTRICITY AND MAGNETISM) Credit Hrs: 01

Course outline:

Static charge and electric fields, direct and alternating currents, electrical measurement instrumentation (voltmeters, ammeters, power supplies, variable transformers, cathode ray oscilloscope, electrometer), passive electronic components (resistors, capacitors, inductors),

measurement of resistance, capacitance and inductance, electromagnetic induction, inductors and transformers, motors, magnetic fields due to currents and permanent magnets, ferromagnetism and ferroelectricity, determination of hysteresis curves, determination of Curie point, magnetic susceptibility and its temperature dependence, dielectric properties measurement, mapping of magnetic fields using Hall sensors, experiments on noise, properties of the light bulb