SEMESTER BREAK UP SCHEME OF STUDIES
BS PHYSICS (MORNING/EVENING)
Applicable for session 2021-2025 and onward in Main Department and Affiliated Colleges

(Approved in 4th Academic Council Meeting)
Department of Physics, Ghazi University, D.G.Khan

SEMESTER I

S. No.	Course Code.	Title of the course	Credit Hours
1.	ENG-307	English-I (Functional English)	3(3-0)
2.	PST-301	Pakistan Studies	2(2-0)
3.	CS-301	Introduction to Information and Communication Technologies	3(2-1)
4.	MATH-307	Mathematics I (Introduction to Algebra)	3(3-0)
5.	STAT-301	Introduction to Statistics	3(3-0)
6.	PHY-301	Mechanics-1	3(3-0)
7.	PHY-303	Lab I: Mechanics	1(0-1)
8.	IS-301	Translation of Quran-I	1(1-0) Non Credit
	Total		**18(16-2)**

SEMESTER II

S. No.	Course Code.	Title of the course	Credit Hours
1.	ENG-308	English-II (Communication Skills)	3(3-0)
2.	IS-302	Islamic Studies/Ethics	2(2-0)
3.	SOC-301	Introduction to Sociology	3(3-0)
4.	MATH-310	Mathematics II (Introduction to Calculus)	3(3-0)
5.	PHY-302	Mechanics-II	3(3-0)
6.	PHY-304	Electricity & Magnetism	3(3-0)
7.	PHY-306	Lab II: Electricity and Magnetism	1(0-1)
	Total		**18(17-1)**

SEMESTER III

S. No.	Course Code.	Title of the course	Credit Hours
1.	ENG-409	English-III (Technical Writing and Presentation Skills)	3(3-0)
2.	MATH-407	Mathematics III (Introduction to Geometry)	3(3-0)
3.	STAT-401	Basic Statistical Inference	3(3-0)
4.	EDU-301	Introduction to Education	3(3-0)
5.	PHY-401	Waves and Oscillation	3(3-0)
6.	PHY-403	Lab III: Waves and Oscillation	1(0-1)
7.	IS-401	Translation of Quran-II	1(1-0) Non Credit
	Total		**16(15-1)**

SEMESTER IV

S. No.	Course Code.	Title of the course	Credit Hours
1.	FLA-301	Foreign Language Arabic	3(3-0)
2.	MATH-507	Ordinary Differential Equations	3(3-0)
3.	BA-507	Human Resource Management	3(3-0)
4.	PHY-402	Heat & Thermodynamics	3(3-0)
	PHY-404	Modern Physics	3(3-0)
5.	PHY-406	Lab IV: Modern Physics	1(0-1)
	Total		**16(15-1)**

SEMESTER V

S. No.	Course Code.	Title of the course	Credit Hours
1.	PHY-501	Mathematical Methods of Physics- I	3(3-0)
2.	PHY-503	Electromagnetic Theory-I	3(3-0)
3.	PHY-505	Classical Mechanics	3(3-0)
4.	PHY-507	Computational Physics	3(3-0)
5.	PHY-509	Electronics-I	3(3-0)
6.	PHY-511	Lab-V Electronics	2(0-2)

7.	IS-501	Translation of Quran-III	1(1-0) Non Credit
	Total		**17(15-2)**

SEMESTER VI

S. No.	Course Code.	Title of the course	Credit Hours
1.	PHY-502	Mathematical Methods of Physics- II	3(3-0)
2.	PHY-504	Quantum Mechanics-I	3(3-0)
3.	PHY-506	Electromagnetic Theory-II	3(3-0)
4.	PHY-508	Optics	3(3-0)
5.	PHY-510	Electronics-II	3(3-0)
6.	PHY-512	Lab-VI: Optics	2(0-2)
	Total		**17(15-2)**

SEMESTER VII

S. No.	Course Code.	Title of the course	Credit Hours
1.	PHY-601	Quantum Mechanics-II	3(3-0)
2.	PHY-603	Nuclear Physics	3(3-0)
3.	PHY-605	Solid State Physics-I	3(3-0)
4.	PHY-607	Atomic & Molecular Physics	3(3-0)
5.	PHY-609	Statistical Physics	3(3-0)
6.	PHY-611	Lab-VII: Spectroscopy	2(0-2)
7.	IS-601	Translation of Quran-IV	1(1-0) Non Credit
	Total		**17(15-2)**

SEMESTER VIII

S. No.	Course Code.	Title of the course	Credit Hours
1.	PHY-602	Solid State Physics-II	3(3-0)
2.	PHY-XXX	Elective-I	3(3-0)
3.	PHY-XXX	Elective-II	3(3-0)
4.	PHY-XXX	Elective-III	3(3-0)
5.	PHY-699	Project	3(0-3)
	Total		**15(12-3)**

Grand Total: 134 Credit Hours + 04 Non Credit Hours

LIST OF ELECTIVE COURSES OFFERED BY THE DEPERTMENT

S. No.	Course No.	Title of the course	Credit Hours
1.	PHY-608	Introduction to Materials Science	3(3-0)
2.	PHY-610	Introduction to Nanoscience and Nanotechnologies	3(3-0)
3.	PHY-612	Particle Physics	3(3-0)
4.	PHY-614	Plasma Physics	3(3-0)
5.	PHY-616	Laser Physics	3(3-0)
6.	PHY-618	Introduction to Photonics	3(3-0)
7.	PHY-620	Environmental Physics	3(3-0)
8.	PHY-622	Quantum Information Theory	3(3-0)
9.	PHY-624	Surface Physics	3(3-0)
10.	PHY-626	Digital Electronics	3(3-0)
11.	PHY-628	Nanomaterials and Applications	3(3-0)
12.	PHY-630	Physics at Nanoscale	3(3-0)
13.	PHY-632	Methods of Experimental Physics	3(3-0)
14.	PHY-634	Applied Physics	3(3-0)

Course Outline

Course Title: English-I (Functional English)
Course Code: ENG-307
Credit Hours: 3(3-0)

Course Objectives
The course aims to:
- Enhance language skills through grammar, phrases and sentence making.
- Develop skills for English writing and translation.
- Enhance listening and speaking skills for wider use.

Course Contents:
Basics of Grammar: Parts of speech and use of articles, Sentence structure, Active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure Transitive and intransitive verb, Punctuation and spelling.
Comprehension: Answers to questions on a given text.
Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of teacher keeping in view the level of students)
Listening: To be improved by showing documentaries/films carefully selected by subject teachers.
Translation skills: Urdu to English
Paragraph writing: Topics to be chosen at the discretion of the teacher
Presentation skills: Introduction to presentations and deliberations
Note: Extensive reading is required for vocabulary building
Books Recommended:

1. Thomson, Al., Martinet, A.V. 1997. Practical English Grammar and Exercises 3rd Ed. Oxford University Press.
2. Boutin, M-C., Brinand, S., Grellet, F. 1993. Writing. Intermediate and Supplementary Skills. Oxfor. Fourth Impression.
3. Tomlinson, B., Ellis, R. 1992. Reading. Upper Intermediate. Oxford Supplementary Skills. Third Impression.

Course Title: Pakistan Studies
Course Code: PST-301
Credit Hours: 2(2-0)

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

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.

2. **Government and Politics in Pakistan**

Political and constitutional phases:
a. 1947-58 , b. 1958-71 c. 1971-77 , d. 1977-88 , e. 1988-99 , f. 1999 onward

3. **Contemporary Pakistan**

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

Books Recommended

1. Burki, Shahid Javed. State & Society in Pakistan, The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. Issue in Pakistan's Economy. Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: A Historical analysis. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994.
5. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.

Course Title: Introduction to Information and Communication Technologies
Course Code: CS-301
Credit Hours: 3(2-1)

Course Outlines:

Theory:

Basic Definitions & Concepts, Hardware: Computer Systems & Components. Storage Devices, Number Systems, Software: Operating Systems, Programming and Application Software, Introduction to Programming, Databases and Information Systems, Networks, Data Communication, The Internet, Browsers and Search Engines, The Internet: Email, Collaborative Computing and Social Networking, The Internet: E-Commerce, IT Security and other issues, Project Week, Review Week.

Practical:

MS Office complete in all aspects

Recommended Books:

1. Introduction to Computers 6th International Edition, Peter, N. McGraw-Hill Using Information Technology:
2. A Practical Introduction to Computer & Communications, 6th Edition. Williams, S. McGraw-Hills.
3. Computers, Communications & information: A user's introduction, Sarah, E. Hutchinson. Stacey, C. Sawyer.
4. Fundamentals of Information Technology, Alexis L Mathewsleon Leon Press.

Course Title: Mathematics I (Introduction to Algebra)
Course No: MATH-307
Credit Hours: 3(3-0)

Course Title:

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

Course Outline: *Preliminaries:* Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions. *Matrices:* Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.

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

Sequences and Series: Arithmetic progression, geometric progression, harmonic progression. *Binomial Theorem:* Introduction to mathematical induction, binomial theorem with rational and irrational indices. *Trigonometry:* Fundamentals of trigonometry, trigonometric identities.

Recommended Books:

1. Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin, Boston (suggested text)
2. Kaufmann JE, College *Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
3. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

Course Title: Introduction to Statistics
Course Code: STAT-301
Credit Hours: 3 (3-0)

Course Objectives:

- To have introduction of statistics as a field of knowledge and its scope and relevance to other disciplines of natural and social sciences.
- To equipped and prepare students for advance courses in the field of statistics.
- To achieve the capability of critical thinking about data and its sources; have idea about variables and their types and scale measures.
- Be able to calculate and interpret descriptive statistics (able to classify, tabulate, describe and display data using software).

Course Contents:

The nature and scope of the Statistics, Variables and their types, Data and its sources, Scales of measurements, Tabulation and classification of data, Graphs and Charts: Stem-and leaf diagram, Box and Whisker plots and their interpretation. Measures of Central Tendency, Quantiles, Measures of Dispersion: Their properties, usage, limitations and comparison. Moments, Measures of Skewness and Kurtosis and Distribution shapes. Rates and ratios, Standardized scores.

Index numbers: construction and uses of index numbers, un-weighted index numbers (simple aggregative index, average of relative price index numbers), weighted index numbers (Laspayer's, Paasche's and Fisher's ideal index numbers), Consumer price index (CPI) and Sensitive Price Indicators

Recommended Books:

1. Clarke, G. M., & Cooke, D. (1978). A basic course in statistics (No. 519.5 C53).
2. Chaudhry, S.M. and Kamal, S. (2008), "Introduction to Statistical Theory" Parts I & II, 8th ed, Ilmi Kitab Khana, Lahore, Pakistan.
3. Mann, P. S. (2010) Introductory Statistics. Wiley.
4. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2000) "Probability and Statistics", 2nd ed. Schaums Outlines Series. McGraw Hill. NY.
5. Walpole, R.E., Myers, R.H and Myers, S.L. (1998), "Probability and Statistics for Engineers and Scientist" 6th edition, Prentice Hall, NY.

Course Title: Mechanics-I
Course Code: PHY-301
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to understand different motions of objects on a macroscopic scale and to develop simple mathematical formalisms to analyze such motions. This is a calculus-based introductory course with maximum emphasis on applying the acquired knowledge to solving problems.

Course Outline:

Theory:

Basic Concepts: Units and Dimensions, SI Units, Changing Units, Scalars and Vectors, Adding Vectors: Graphical as well as Component Method, Multiplying Vectors: Dot and Cross Products.

Motion in One, Two and Three Dimensions: Position & Displacement, Velocity and Acceleration, Motion under Constant Acceleration, Projectile Motion, Uniform Circular Motion, Relative Velocity and Acceleration in One and Two Dimensions, Inertial and Non-Inertial Reference Frames

Newton's Laws: Newton's Laws of Motion and their Applications involving some particular forces including Weight, Normal Force, Tension, Friction, and Centripetal Force, Newton's Law of Gravitation, Gravitational Potential Energy, Escape Velocity, Kepler's Laws, Satellite Orbits & Energy

Work and Kinetic Energy: Work done by Constant and Variable Forces: Gravitational and Spring Forces, Power, Conservative and Non-conservative Forces, Work and Potential Energy, Isolated Systems and Conservation of Mechanical Energy, Work Done by External Forces including Friction and Conservation of

Energy

System of Particles: Motion of a System of Particles and Extended Rigid Bodies, Center of Mass and Newton's Laws for a System of Particles, Linear Momentum, Impulse, Momentum & Kinetic Energy in One and Two Dimensional Elastic and Inelastic Collisions

Recommended Books:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley & Sons, 9th ed. 2010.
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.

Course Title: English-II (Communication Skills)
Course Code: ENG-308
Credit Hours: 3(3-0)

Course Objectives:

The purpose to introduce this course is to develop the ability to communicate effectively, to enable the students to read effectively and independently any intermediate level text, to make the experience of learning English more meaningful and enjoyable and to enable the students to use grammar and language structure in context. The focus will be on teaching of language skills rather than content using a variety of techniques such as guided silent reading, communication tasks etc. Moreover, a process approach will be taken for teaching writing skills with a focus on composing, editing and revising drafts both individually and with peer and tutor support.

Course Contents:

1: Listening and Speaking Skills*

Towards the end of the successful completion of the course, the following objects have to be achieved: [To develop the ability to]:

- To understand and use English to express ideas and opinions related to students" real life experiences inside and outside the classroom.
- To give reasons (substantiating) justifying their view
- To understand and use signal markers
- To extract information and make notes from lectures
- To ask and answer relevant questions to seek information, clarification etc.
- Oral presentation skills (prepared and unprepared talks)
- Preparing for interviews (scholarship, job, placement for internship, etc.)

2: Reading Comprehension Skills

To enable the students to read a text to:

- identify main idea/topic sentences
- find specific information quickly
- distinguish between relevant and irrelevant information according to purpose for reading
- recognize and interpret cohesive devices
- distinguish between fact and opinion

3: Vocabulary Building Skills

To enable the students to:

- guess the meanings of unfamiliar words using context clues
- use word formation rules for enhancing vocabulary
- use the dictionary for finding out meanings and use of unfamiliar words

4**: Writing skills**

To enable students to write descriptive, narrative and argumentative texts with and without stimulus input

- Writing formal letters
- Writing different kinds of applications (leave, job, complaint, etc.)

- Preparing a Curriculum Vitae (CV), (bio-data)
- Writing short reports

5: Grammar in context

- Tenses: meaning & use
- Modals
- Use of active and passive voice

Note: Listening and Speaking skills will be assessed informally only using formative assessment methods till such time that facilities are available for testing these skills more formally.

Recommended Readings:

Eastwood, J. (2004). *English Practice Grammar* (New edition with tests and answers). Karachi: Oxford University Press.
Ellen, K. (2002) *Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top*
Hargie, O. (ed.)*Hand book of Communications Skills*
Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for undergraduates*. Karachi: Oxford University Press.
Mandel, S. (2000) *Effective Presentation Skills: A Practical Guide Better Speaking*
Mark, P. (1996) *Presenting in English*. Language Teaching Publications.
Murphy, R. (2003). *Grammar in use*. Cambridge: Cambridge University Press.

Course Outline

Course Title: **Islamic Studies**
Course Code: **IS-302**
Credit Hours: 2 (2-0)
Course Objectives: This course is aimed at:

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

Course Outline:

Theory: Introduction to Quranic Studies

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

Study of Selected Text of Holly Quran

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

Study of Selected Text of Holly Quran

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

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

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

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

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

Introduction To Sunnah

1) Basic Concepts of Hadith
2) History of Hadith
3) Kinds of Hadith

4) Uloom –ul-Hadith
5) Sunnah & Hadith
6) Legal Position of Sunnah

Selected Study from Text of Hadith Introduction to Islamic Law & Jurisprudence
1) Basic Concepts of Islamic Law & Jurisprudence
2) History & Importance of Islamic Law & Jurisprudence
3) Sources of Islamic Law & Jurisprudence
4) Nature of Differences in Islamic Law
5) Islam and Sectarianism

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

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

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

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

Islamic History
1) Period of Khlaft-E-Rashida
2) Period of Ummayyads
3) Period of Abbasids

Social System of Islam
1) Basic Concepts of Social System of Islam

Recommended Books:

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

Course Title: Introduction to Sociology
Course Code: SOC-301
Credit Hours: 3(3-0)

Course Objectives:

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

Course Outline:

Theory:

An overview of Sociology; Introduction; Definition; Scope; and Subject Matter; Sociology as a Science , Historical back ground of Sociology;

Basic Concepts: Group; Community; Society; Associations ; Non-Voluntary; Voluntary ;Organization; Informal; Formal ;Social Interaction; Levels of Social Interaction; Process of Social Interaction ;Cooperation; Competition; Conflict; Accommodation; Acculturation and diffusion ;Assimilation; Amalgamation; Social Groups ;Definition & Functions; Types of social groups; In and out groups ;Primary and Secondary group ; Reference groups; Informal and Formal groups ;Pressure groups ; Culture ;Definition, aspects and characteristics of Culture ;Material and non-material culture ;Ideal and real culture; Elements of culture; Beliefs; Values; Norms and social sanctions; Organizations of culture; Traits; Complexes; Patterns; Ethos; Theme ; Other related concepts; Cultural Relativism ; Sub Cultures; Ethnocentrism and Xenocentrism; Cultural lag ; Socialization & Personality ; Personality, Factors in Personality Formation ; Socialization, Agencies of Socialization; Role & Status ; Deviance and Social Control; Deviance and its types ; Social control and its need ;Forms of Social control; Methods & Agencies of Social control; Collective Behavior; Collective behavior, its types; Crowd behavior; Public opinion; Propaganda ; Social movements And Leadership

Recommended Books:

1. Anderson, Margaret and Howard F. Taylor. 2001. *Sociology the Essentials*. Australia: Wadsworth.
2. Brown, Ken 2004. *Sociology*. UK: Polity Press
3. Gidden, Anthony 2002. *Introduction to Sociology*. UK: Polity Press.
4. Macionis, John J. 2006. 10th Edition *Sociology* New Jersey: Prentice-Hall
5. Tischler, Henry L. 2002. *Introduction to Sociology* 7th ed. New York: The Harcourt Press.
6. Frank N Magill. 2003. *International Encyclopedia of Sociology*. U.S.A: Fitzroy Dearborn Publishers
7. Macionis, John J. 2005. *Sociology* 10th ed. South Asia: Pearson Education
8. Kerbo, Harold R. 1989. *Sociology: Social Structure and Social Conflict.* New York: Macmillan Publishing Company.
9. Koening Samuel. 1957. *Sociology: An Introduction to the Science of Society*. New York: Barnes and Nobel..
10. Lee, Alfred Mclung and Lee, Elizabeth Briant 1961. *Marriage and The family.*New York: Barnes and Noble, Inc.
11. Leslie, Gerald et al. 1973. *Order and Change: Introductory Sociology*Toronto: Oxford University Press.
12. Lenski, Gevbard and Lenski, Jeam. 1982. *Human Societies*. 4th edition New York: McGraw-Hill Book Company.
13. James M. Henslin. 2004. *Sociology: A Down to Earth Approach*. Toronto: Allen and Bacon.
14. Choices in relationships an introduction to marriage & teh family 8/e (hb) by schacht, 2005
15. Culture and society an introduction to cultural studies (pb) by oswell, 2006
16. Sociology 9/e (hb) by stark, 2004
17. SOCIOLOGY: a down to earth approach (3/E) by HENSLIN, 1997

Course Title: Mathematics II (Introduction to Calculus)
Course No: MATH-310
Credit Hours: 3(3-0)

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

Course Outline: *Preliminaries:* Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities. *Limits and Continuity:* Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

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

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

Recommended Books:

1. Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York
2. Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)
3. Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston
4. Thomas GB, Finney AR, *Calculus* (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

Course Title: Mechanics-II
Course Code: PHY-302
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to acquaint students with rotational dynamics of objects on a macroscopic scale and to develop simple mathematical formalisms to analyze such motions. This is a calculus-based introductory course with maximum emphasis on applying the acquired knowledge to solving problems. Also, a general formalism of Special Theory of Relativity is given.

Course Outline:

Theory:

Rotational Motion: Rotation about a Fixed Axis, Angular Position, Angular Displacement, Angular Velocity and Angular Acceleration, Rotation under Constant Angular Acceleration, relationship between Linear and Angular Variables, Rotational Inertia, Parallel-axis Theorem, Torque and Newton's Law for Rotation, Work and Rotational Kinetic Energy, Power, Rolling Motion, Angular Momentum for a single Particle and a System of Particles, Conservation of Angular Momentum, Precession of a Gyroscope, Static Equilibrium involving Forces and Torques, Determination of moment of inertia of various shapes i.e. for disc, bar and solid sphere

Angular Momentum: Angular Velocity, Conservation of angular momentum, effects of Torque and its relation with angular momentum

Fluid Mechanics: Static fluids and pressure, Archimedes' Principle, Continuity and Bernoulli's Principle.

Special Theory of Relativity: Inertial and non-inertial frame, Postulates of Relativity, The Lorentz Transformation, Derivation, Assumptions on which inverse transformation is derived, Consequences of Lorentz transformation, Relativity of time, Relativity of length, Relativity of mass, Transformation of velocity, variation of mass with velocity, mass energy relation and its importance, relativistic momentum and Relativistic energy, (Lorentz invariants)

Recommended Books:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley & Sons, 9th ed. 2010.
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.

Course Title: Electricity and Magnetism

Course Code: PHY-304
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to understand the Physics of Electromagnetism and to develop simple mathematical formalisms to analyze the electromagnetic fields. This is a calculus-based introductory course with maximum emphasis on applying the acquired knowledge to solving problems.

Course Outline:

Theory:

Electrostatics: Electric Charge, Conductors and Insulators, Coulomb's Law, Electric Fields due to a Point Charge and an Electric Dipole, Electric Field due to a Charge Distribution, Electric Dipole in an Electric Field, Electric Flux, Gauss' Law and its Applications in Planar, Spherical and Cylindrical Symmetry

Electric Potential: Equipotential Surfaces, Potential due to a Point Charge and a Group of Point Charges, Potential due to an Electric Dipole, Potential due to a Charge Distribution, Relation between Electric Field and , Electric Potential Energy

Capacitors and Capacitance: Parallel Plate, Cylindrical and Spherical capacitors, Capacitors in Series and Parallel, Energy Stored in an Electric Field, Dielectrics and Gauss' Law (1 week).

DC Circuits: Electric Current and Current Density, Resistance and Resistivity, Ohm's Law, Power in Electric Circuits, Semiconductors and Superconductors, Work, Energy, and EMF, Resistances in Series and Parallel, Single and Multiloop Circuits, Kirchhoff's Rules, RC Circuits, Charging and Discharging of a Capacitor

Magnetic Field and Magnetic Force: Crossed Electric and Magnetic Fields and their Applications, Hall Effect, Magnetic Force on a Current Carrying Wire, Torque on a Current Loop, Magnetic Dipole Moment, Magnetic Field Due to a Current, Force between two Parallel Currents, Ampere's Law, Biot-Savart Law: Magnetic Field due to a Current, Long Straight Wire carrying Current, Solenoids and Toroids, A current-carrying Coil as a Magnetic Dipole, Inductance, Faraday's Law of Induction, Lenz's Law, Induction and Energy Transfers, Induced Electric Fields, Inductors and Inductances, Self- Inductance, RL Circuits, Energy Stored in a Magnetic Field, Energy Density, Mutual Induction **Alternating Fields and Currents:** LC Oscillations, Damped Oscillations in an RLC circuit, Alternating Currents, Forced Oscillations, Resistive, Capacitive, and Inductive Loads, RLC series Circuit, Power in AC Circuits, Transformers, Gauss' Law for Magnetism, Induced Magnetic Fields, Displacement Current, Spin & Orbital Magnetic Dipole Moment, Diamagnetism, Paramagnetism, Ferromagnetism, Hysteresis.

Recommended Books:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley & Sons, 9th ed. 2010.
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
5. ed. 1992.
6. D. C. Giancoli, "Physics for Scientists and Engineers, with Modern Physics", Addison-Wesley, 4th ed. 2008.

Course Title: English-III (Technical Writing and Presentation Skills)
Course Code: ENG-409
Credit Hours: 3(3-0)

Course Objectives
The course aims to:
- Enhance language skills
- Develop critical thinking

Course Contents:
Presentation skills:
Essay writing: Descriptive, narrative, discursive, argumentative
Academic writing: How to write a proposal for research paper/term paper How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
Technical Report writing:
Progress report writing:
Note: Extensive reading is required for vocabulary building
Books Recommended:
1. Langan, J. 2004. College Writing Skills McGraw-Hill Higher Education.
2. Kirszner. L.G., Mandell, S. R. Patterns of College Writing. 4th Ed. by St. Martin's Press.
3. White, R. 1992. Writing.Advanced.Oxford Supplementary Skills.Third Impression (particularly suitable for discursive, descriptive, argumentative and report writing).
4. Neulib, J., Cain, K. S., Ruffus, S., Scharton, M. (Editors). Reading. The Mercury Reader.A Custom Publication.Compiled by norther Illinois University. (A reader that will give students exposure to the best of twentieth century literature

Course Title: Mathematics III (Introduction to Geometry)
Course Code: MATH-407
Credit Hours: 3 (3-0)

Course Objectives: To prepare the students, not majoring in mathematics, with the essential tools of geometry to apply the concepts and the techniques in their respective disciplines.
Course Outline: *Geometry in Two Dimensions:* Cartesian-coordinate mesh, slope of a line, equation of a line, parallel and perpendicular lines, various forms of equation of a line, intersection of two lines, angle between two lines, distance between two points, distance between a point and a line.
Circle: Equation of a circle, circles determined by various conditions, intersection of lines and circles, locus of a point in various conditions.
Conic Sections: Parabola, ellipse, hyperbola, the general-second-degree equation
Recommended Books:
1. Abraham S, Analytic Geometry, Scott, Freshman and Company, 1969
2. Kaufmann JE, College *Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
3. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

Course Title: Basic Statistical Inference
Course Code: STAT-401
Credit Hours: 3 (3-0)

Course Objectives:
- To understanding of basic techniques of sampling and estimation, their properties and application.
- To select a sample from a given population and use it to make inferences about the population and its parameter.
- To test, deduce and infer the validity of different types of hypotheses and models built on the basis of the raw data collected in diverse problem-situations.

Course Outline:
Sampling and sampling distribution of sample mean, proportion, difference between means and difference between proportions; Point and interval estimate properties of good point estimator; Testing of hypothesis for population mean, difference between population means and population proportion

and difference between two population proportions, difference between means for paired data; Single population variance, ratio of two variances; Non-parametric methods: The sign test, Wilcoxon's signed rank test, Mann-Whitney U test, Median test, Run test, Kolmogorov-Smirnov test, Kruskal-Wallis test, Median test for k-samples, Friedman test.

Recommended Books:

1. Ross, S. (2017). A first course in Probability. 9th edition. Pearson Education Limited.
2. DeGroot, M. Schervish, M. (2017). Probability and Statistics. 4th edition. Pearson Education Limited.
3. Srivastava, M.K., Khan, A.H. and Srivastava, N. (2014). Statistical Inference: Theory of Estimation. Prentice-Hall of India Pvt. Ltd
4. Clark, G.M. and Cooke, D. (1998). A Basic Course in Statistics. 4th ed, Arnold, London.
5. Mclave, J.T., Benson P.G. and Sincich, T. (2014). Statistics for Business and Economics. 12th Edition. Pearson Education Ltd, U.K.
6. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2015). Probability and Statistics. 3rd edition. Schaums Outlines Series. McGraw-Hill. NY.

Course Title: Introduction to Education

Course Code: EDU-301
Credit Hours: 3(3-0)

Course Contents:

- **Concept of Education**
  - Definitions
  - Aims of education
  - Fundamentals of education
- **Curriculum**
  - Old and new concepts
  - Curriculum designs
  - Principles of curriculum construction
  - Curriculum development in Pakistan
- **School**
  - Components and principles of school organization
  - Co-curricular activities in school
  - School community and school
  - Value clarification and school
- **Teaching**
  - Characteristics of good teaching
  - Teaching strategies for Pakistan school
  - Models of teaching
  - Innovations in teaching
- **Teacher**
  - Qualities of a good teacher
  - Professional ethics for a Pakistan teacher
  - The Holy Prophet (PBUH) as a teacher
- **Student**
  - *Aadaab* for a student
  - Teacher-student relationship
  - Individual difference among student
  - Guidance services for students
- **Learning:**
  - Definitions
  - Laws of learning
  - Factors influencing learning

- **Classroom Environment**
  - Roles of teacher in classroom
  - Discipline-concept, types and motivation factors

Recommended Readings:

1. Steve Bartlett Diana Burton. 2016. Introduction to Education Studies. Fourth Edition. SAGE Publications Ltd. ISBN: 9781473919006.
2. Ann Gravells 2017Principles and Practices of Teaching and Training: A guide for teachers and trainers in the FE and skills sector. Learning Matters. ISBN-13: 978-1473997134
3. Bhatia, K.K. (1989); Principles and Practice of Education, New Delhi: Kalyani Publishers.
4. Dasj, B.N., (2000); Foundation of Educational Thought and Practice, New Delhi: S.Chand and company Ltd.
5. Hussain, Sajid, (1994); Taleem-o-Nisab Am Tareeq-e-Tadrees, Karachi; Rehbar Publishers.
6. Farrant, JS., (1986); Principles and Practice of Education, Singapore: Longman.
7. McNergney, Herbert, (1998) Foundations of Education, London: Allyn and Bacon.
8. Moore, T.W. (1986); Philosophy of Education, London: Routledge and Kegan Paul.
9. Nath, Prem (1990); The Bases of? Education, New Delhi: S. Chand & Company Ltd.
10. Shahid, S.M. (1990); Taleem Ki Bunyadin, Lahore: Majeed Book Depot.

Course Title: Waves and Oscillations
Course Code: PHY-401
Credit Hours: 3(3-0)

Course Objectives: To develop a unified mathematical theory of oscillations and waves in physical systems.
Course Outline:

Theory:

Simple and Damped Harmonic Oscillation: Mass-Spring System, Simple Harmonic Oscillator Equation, Complex Number Notation, LC Circuit, Simple Pendulum, Quality Factor, LCR Circuit.
Forced Damped Harmonic Oscillation: Steady-State Behavior, Driven LCR Circuit, Transient Oscillator Response, Resonance
Coupled Oscillations: Two Spring-Coupled Masses, Two Coupled LC Circuits, Three Spring Coupled Masses, Normal Modes, Atomic and Lattice Vibrations
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, Transmission Lines, Reflection and Transmission at Boundaries.
Wave Pulses: Fourier Series and Fourier Transforms, Bandwidth.
Multi-Dimensional Waves: Plane Waves, Three-Dimensional Wave Equation, Electromagnetic waves, Laws of Geometric Optics, Waveguides, Cylindrical Waves
Interference and Diffraction of Waves: Double-Slit Interference, Single-Slit Diffraction, Double-slit diffraction.
Recommended Books:

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

Course Title: Foreign Language (Arabic)

Course Code: FLA-301
Credit Hours: 3 (3-0**)**

Course Objectives:

To learn Arabic grammar and language as learning foreign languages is important to communicate with our neighbor countries far various political and socio economic issues

COURSE OUTLINES:

Alphabet; make up words and phrases; reading and writing; with special emphasis on unfamiliar sounds; Greetings and introductions; Forms of titles and address in the feminine and masculine; Talking about oneself and one's family; Expressing thanks and making requests; Learning numerical; the time and counting; Etiquette in private and public places; Daily routines: work, shopping, leisure; Basics of grammar; Key vocabulary; Reading; writing and speaking; Practical drills to learn reading and writing; Listening comprehension; Drills of unfamiliar alphabet; Insight into cultural differences between regions where the language is spoken.

Course Title: Ordinary Differential Equations
Course Code: MATH-507
Credit Hours: 3 (3-0)

Objectives:

To introduce students to the formulation, classification of differential equations and existence and uniqueness of solutions. To provide skill in solving initial value and boundary value problems. To develop understanding and skill in solving first and second order linear homogeneous and nonhomogeneous differential equations and solving differential equations using power series methods

Theory:

Introduction and formulation, classification of differential equations, existence and uniqueness of solutions, introduction of initial value and boundary value problems First order ordinary differential equations: Basic concepts, formation and solution of differential equations. Separable variables, Exact Equations, Homogeneous Equations, Linear equations. Some nonlinear first order equations with known solution, differential equations of Bernoulli and Ricaati type, Clairaut equation, modeling with first-order ODEs, Basic theory of systems of first order linear equations, Homogeneous linear system with constant coefficients, Non homogeneous linear system. Second and higher order linear differential equations: Initial value and boundary value problems, Homogeneous and non-homogeneous equations, Superposition principle, homogeneous equations with constant coefficients, Linear independence and Wronskian, Nonhomogeneous equations, undetermined coefficients method, variation of parameters, Cauchy-Euler equation, Modeling. Sturm-Liouville problems: Introduction to eigen value problem, adjoint and self-adjoint operators, self-adjoint differential equations, eigen values and eigen functions, Sturm-Liouville (S-L) boundary value problems, regular and singular S-L problems, properties of regular S-L problems. Series Solutions: Power series, ordinary and singular points, Existence of power series solutions, power series solutions, types of singular points, Frobenius theorem, Existence of Frobenius series solutions, solutions about singular points, The Bessel, modified Bessel Legendre and Hermite equations and their solutions.

Recommended Books:

1. Zill D. G. and Michael R., Differential equations with boundary-value problem, 5th edition, Cullin Brooks/Cole, 1997.
2. Boyce W. E. and Diprima R. C., Elementary differential equations and boundary value problems, 7th edition, John Wiley & Sons, Inc.
3. Arnold V. I., Ordinary Differential Equations, Springer, 1991.
4. Apostol T., Multi Variable Calculus and Linear Algebra, 2nd edition, John Wiley and sons, 1997.
5. Richard B., Gabriel C., Differential Equations, 4th Edition (Schaum's Outlines) 4th Edition, McGraw-Hill Education; 2014.

Course Title: HUMAN RESOURCE MANAGEMENT

Course Code: BA-507
Credit Hr. 3(3-0)

COURSE DESCRIPTION

This course is basically designed to provide students the basic understanding of key HRM functions, which include HR planning, recruitment & selection, compensation, performance evaluation, and training & development. Since human resource provides a competitive advantage that ultimately has a vital role in success and effectiveness of any organization, this course emphasizes on the understanding of the basic concepts of managing human resource and their applications in today's organizations. The course is designed to help the students understand if western human resource management theories and practices have any relevance to the local settings. The students will also be encouraged to compare and contrast the human resource practices suggested in their text books and the practices critical for achieving success from indigenous perspective.

RECOMMENDED BOOKS

- By Luis R. Gomez Mejia, David B. Balkin, Robert L. Cardy **Managing Human** Resources. (Fourth ed.)
- Human Resource Management by Gary Dessler.
- Personnel-managing people at work by Dale s beach.

Course Title:Heat & Thermodynamics
Course Code: PHY-402
Credit Hours: 3(3-0)

Course Objectives: To understand the fundamentals of heat and thermodynamics. Explain the key concepts of thermal physics and their consequences, in particular kinetic theory and the 1st and 2nd laws of thermodynamics. Apply the key concepts of thermal physics to a variety of thermodynamic systems such as engines, refrigerators and the atmosphere.

Course Outline:

Theory:

Basic Concepts: Thermodynamic systems, Surrounding and Boundaries. Type of systems. Macroscopic and microscopic description of system. 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, 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 potentials, Maxwell's relations, TdS equations. Energy equations and their applications, Intrinsic and mutual stabilities of single component system, Conditions of stabilities, The Le Chatelier-Braun Principle, Phase transitions (latent heat), First order Phase transition, Discontinuities of Volume and Entropy, Second Order Phase Transition, Low Temperature Physics, Joule-Thomson effect and its equations. Thermoelectricity: Thermocouple, Seabeck's effect, Peltier's effect, Thomson effect.

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, Qualitative description. Diffusion, Conduction and viscosity.

Recommended Books:

1. D. Halliday, R. Resnick and K. Krane, "Physics", John Wiley, 5th ed. 2002.
2. M. W. Zemansky, "Heat and Thermodynamics", Mc Graw Hill, 7th ed. 1997.
3. M. Sprackling, "Thermal Physics" McMillan 1991.
4. B. N. Roy, "Principle of Modern Thermodynamics", Institute of Physics, London 1995.

Course Title:Modern Physics
Course Code: PHY-404
Credit Hours: 3(3-0)

Course Objectives: To understand the non-classical aspects of Physics, The emphasis is on the applications of Quantum Physics in microscopic-scale Physics, atomic and molecular structure and processes.
Course Outline:

Theory:

Quantization of Charge, Black Body Radiation, Photoelectric Effect, X-rays and Compton Effect, Atomic Spectra, Rutherford's Nuclear Model, The Bohr Model of Hydrogen Atom and X-rays Spectra, Pauli's Exclusion Principle, The Frank Hertz Experiment, Angular Momenta and Magnetic Dipole Moments, The De-Broglie Hypothesis, Wave Packets, The Uncertainty Principle, Properties of Nuclei, Mass Deficit and Packing Fraction, Binding Energy, Nuclear Forces and Models, Radioactivity, Radioactive Dating, Nuclear Fission and Fusion, Nuclear Reactors, Thermonuclear Reactions, The Stern-Gerlach Experiment, Magnetic Resonance.
Recommended Books:

1. Arthur Beiser, "Concepts of Modern Physics", McGraw-Hill, 6th ed. 2002.
2. Kenneth S. Krane, "Modern Physics", 3rd Edition, 2012
3. Paul A. Tipler and Ralph A. Llewellyn, "Modern Physics", W H Freeman and Company 6th ed. 2012.
4. R.A. Serway, C.J. Moses and C.A. Moyer, "Modern Physics", Brooks Cole, 3rded. 2004.
5. R. M. Eisberg and R. Resnick, "Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles", John Wiley, 2nded. 2002

Course Title:Optics
Course Code: PHY-508
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to understand different motions of objects on a macroscopic scale and to develop simple mathematical formalisms to analyze such motions. This is a calculus-based introductory course with maximum emphasis on applying the acquired knowledge to solving problems.
Course Outline:

Theory:

Propagation of Light & Image Formation: Huygens' Principle, Fermat's Principle, Laws of Reflection and Refraction, Refraction at a Spherical Surface, Thin Lenses, Newtonian Equation for a Thin Lens
Matrix Methods in Paraxial Optics: Ray Transfer Matrices, Thick Lens
Superposition & Interference: Standing Waves, Beats, Phase and Group Velocities, Thin Dielectric Films, Michelson and Fabry-Perot Interferometers, Resolving Power, Free-Spectral Range
Polarization: Linear, circular and elliptical polarization
Fraunhofer Diffraction: from a Single Slit, Rectangular and Circular Apertures, Double Slit, Many Slits
Coherence & Holography: Temporal Coherence, Spatial Coherence, Holography of a Point object and an Extended Object
Laser Basics: Stimulated Emission, Population Inversion, Resonators, Threshold and Gain

Recommended Books:

1. F. Pedrotti, L. S. Pedrotti and L. M. Pedrotti, "Introduction to Optics", Pearson Prentice Hall, 3rd ed. 2007.
2. E. Hecht and A. Ganesan, "Optics", Dorling Kindersley, 4th ed. 2008.
3. M. V. Klein and T. E. Furtak, "Optics", John Wiley, 2nd ed. 1986.
4. K. K Sharam, "Optics: Principles and Applications", Academic Press, 2006.
5. C. A. Bennett, "Principles of Physical Optics", John Wiley, 2008.

Course Title: Mathematical Methods of Physics-I
Course Code: PHY-501
Credit Hours: 3(3-0)

Course Objectives: To give the understanding of Differential equations and their uses in Physics, Introduction to special functions, Fourier Series, Fourier Transforms, Solution of Boundary value problems and their uses.
Course Outline:

Theory:

Special Functions: Bessel Functions, Neumann Functions, Hankel Functions, Spherical Bessel Functions, Legendre Functions, Associated Legendre Functions, Spherical Harmonics, Hermite Polynomials.
Partial Differential Equations: Introduction to important PDEs in Physics (wave equation, diffusion equation, Poisson's equation, Schrodinger's equation), general form of solution, general and particular solutions (first order, inhomogeneous, second order), characteristics and existence of solutions, uniqueness of solutions, separation of variables in Cartesian coordinates, superposition of separated solutions, separation of variables in curvilinear coordinates, special functions, integral transform methods, Green's functions
Complex Analysis: Review (polar form of complex numbers and de Moivre's theorem, complex logarithms and powers), functions of a complex variable, Cauchy-Riemann conditions, power series in a complex variable and analytic continuation with examples, multi-valued functions and branch cuts, singularities and zeroes of complex functions, complex integration, Cauchy's theorem, Cauchy's integral formula, Laurent series and residues, residue integration theorem, definite integrals using contour integration.

Recommended Books:

1. G. Arfken, H. J. Weber, and F. E. Harris, "Mathematical Methods for Physicists", Academic Press, 7th ed. 2012.
2. K. F. Riley, M. P. Hobson, S. J. Bence, "Mathematical Methods for Physicists", Cambridge University Press, 2006
3. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley, 8thed1999

Course Title:Electromagnetic Theory-I
Course Code: PHY-503
Credit Hours: 3(3-0)

Course Objectives: On completion of the course the student shall be able: to formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media, and also solve such problems in simple geometries using separation of variables and the method of images
Course Outline:

Theory:

Review of Vector Calculus: vector algebra and calculus, Cartesian coordinates spherical coordinates, differential operators (grad, div, curl).
The Dirac Delta Function: Review of vector calculus using example of Dirac Delta function, the divergence of r/r^2, the one-dimensional and the three-dimensional Dirac delta functions. The theory of vector fields: the Helmoholtz theorem, potentials
Electrostatics: The electric field: introduction, Coulomb's law, the electric field, continuous charge distributions. Divergence and curl of electrostatic fields: field lines, flux and Gauss's law, the divergence of E, applications of Gauss's law, the curl of E. Electric potential: introduction to potential, comments on potential, Poisson's equation

and Laplace's equation, the potential of a localized charge distribution, summary, electrostatics boundary conditions, Work and energy in electrostatics: the work done to move a charge, the energy of a point charge distribution, the energy of a continuous charge distribution, comments on electrostatic energy. Conductors: basic properties, induced charges, surface charge and the force on a conductor, capacitors

Special Techniques: Laplace's equation: introduction, Laplace's equation in one, two and three dimensions, boundary conditions and uniqueness theorems, conductors and second uniqueness theorems

The Method of Images: The classic image problem, induced surface charge, force and energy, other image problems

Multipole Expansion: Approximate potential at large, the monopole and dipole terms, origin of coordinates in multipole, expansions, the electric field of a dipole

Electric Fields in Matter-Polarization: dielectrics, induced dipoles, alignment of polar molecules, polarization. The field of a polarized object: bound charges, physical interpretation of bound charges, and the field inside a dielectric. The electric displacement: Gauss's law in the presence of dielectrics, a deceptive parallel, boundary conditions. Linear Dielectrics: susceptibility, permittivity, dielectric constant, boundary value problems with linear dielectrics, energy in dielectric systems, forces on dielectrics

Magnetostatics: The Lorentz Force law: magnetic fields, magnetic forces, currents. The Biot-Savart Law: steady currents, the magnetic field of a steady current. The divergence and curl of B: straight-line currents, the divergence and curl of B, applications of Ampere's law, comparison of magnetostatics and electrostatics. Magnetic Vector Potential: the vector potential, summary, magnetic boundary conditions, multipole expansion of the vector potential.

Magnetic Fields in Matter: Magnetization, diamagnets, paramagnets, ferromagnets, torques and forces on magnetic dipoles, effect of a magnetic field on atomic orbits, magnetization. The Field of a Magnetized Object: bound currents, physical interpretation of bound currents, and the magnetic field inside matter. The auxiliary field H: Ampere's law in magnetized materials, a deceptive parallel, boundary conditions. Linear and nonlinear media: magnetic susceptibility and permeability, ferromagnetism.

Recommended Books:

1. D. J. Griffiths, "Introduction to Electrodynamics", Prentice Hall, 3rd ed. 1999.
2. M. N. O. Sadiku, "Elements of Electromagnetics", . Oxford University Press, 5th ed.2009.
3. F. Melia, "Electrodynamics", University of Chicago Press, 2001.
4. Hearld J and W. Muller-Kristen, "Electrodynamics", World Scientific Publishing, 2nd ed. 2011.

Course Title:Classical Mechanics
Course Code: PHY-505
Credit Hours: 3(3-0)

Course Objectives: To understand the optical phenomena and their uses in physical systems. The foundations of physics, as evidenced through solving problems in elementary mechanics and electricity and magnetism.

Course Outline:

Theory:

Introduction: Space and Time, Newton's Laws, The Concepts of Mass and Force, External Forces.

Linear Motion: Conservative Forces; Conservation of Energy, Motion near Equilibrium; the Harmonic Oscillator, Complex Representation, The Law of Conservation of Energy, The Damped Oscillator, Oscillator under Simple Periodic Force, General Periodic Force, Impulsive Forces; the Green's Function Method, Collision Problems.

Energy and Angular Momentum: Energy; Conservative Forces, Projectiles, Moments; Angular Momentum, Central Forces; Conservation of Angular Momentum, Polar Co-ordinates, The Calculus of Variations, Hamilton's Principle; Lagrange's Equations**.**

Central Conservative Forces: The Isotropic Harmonic Oscillator, The Conservation Laws, The Inverse Square Law, Orbits, Scattering Cross-sections, Mean Free Path, Rutherford Scattering**.**

Rotating Frames: Angular Velocity; Rate of Change of a Vector, Particle in a Uniform Magnetic Field, Acceleration; Apparent Gravity, Coriolis Force, Larmor Effect, Angular Momentum and the Larmor Effect**.**

Potential Theory: Gravitational and Electrostatic Potentials, The Dipole and Quadrupole, Spherical Charge Distributions, Expansion of Potential at Large Distances, The Shape of the Earth, The Tides, The Field Equations.

The Two-Body Problem: Centre-of-mass and Relative Co-ordinates, The Centre-of-mass Frame, Elastic Collisions, CM and Lab Cross-sections.
Many-Body Systems: Momentum; Centre-of-mass Motion, Angular Momentum; Central Internal Forces, The Earth–Moon System, Energy; Conservative Forces, Lagrange's Equations**.**
Rigid Bodies: Basic Principles, Rotation about an Axis, Perpendicular Components of Angular Momentum, Principal Axes of Inertia, Calculation of Moments of Inertia, Effect of a Small Force on the Axis, Instantaneous Angular Velocity, Rotation about a Principal Axis, Euler's Angles.
Lagrangian Mechanics: Generalized Co-ordinates; Holonomic Systems, Lagrange's Equations, Precession of a Symmetric Top, Pendulum Constrained to Rotate about an Axis, Charged Particle in an Electromagnetic Field, The Stretched String, Small Oscillations and Normal Modes, Orthogonal Co-ordinates, Equations of Motion for Small Oscillations, Normal Modes, Coupled Oscillators, Oscillations of Particles on a String, Normal Modes of a Stretched String.
Hamiltonian Mechanics: Hamilton's Equations, Conservation of Energy, Ignorable Co-ordinates, General Motion of the Symmetric Top, Liouville's Theorem, Symmetries and Conservation Laws, Galilean Transformations
Recommended Books:

1. T. Kibble and F. Berkshire, "Classical Mechanics", World Scientific, 5th ed. 2004.
2. T. L. Chow, "Classical Mechanics", John Wiley, 1995.
3. S.T. Thornton, J.B. Marion, "Classical Dynamics of Particles and Systems", Brooks Cole; 5th ed. 2003.

Course Title:Computational Physics
Course Code: PHY-507
Credit Hours: 3(3-0)

Course Objectives: The objective of this course is to provide an introduction to computational methods in solving problems in physics.

Course Outline:

Theory:

Scientific Computing Languages: Introduction to FORTRAN or C+ and programming techniques in practical applications to basic Physics problems.
Numerical Methods: Euler-Newton method for solving differential equations, The trapezoidal rule for numerical quadrature and simple applications of random number, Solution of integral equations, Solution of nonlinear equations, Linear algebra, solution of linear algebraic equations, Ordinary differential equations.
Computer Graphics: Use of computation and computer graphics to simulate the behavior of complex physical systems, Computational techniques in investigating and visualizing fundamental physics.
Scientific Packages: Introduction to MATHEMATICA and MATLAB and their use in Physics.
Recommended Books:

1. "The Art of Scientific Computing" by W. H. Numerical recipes, Brian P. Flannery, Saul A. Teukolsky and William T. Vetterling, Cambridge University Press, (1988)
2. "Numerical Analysis with C++ " by Prof. Dr. S. A. Bhatti, 4th Edition (2002).
3. "Introduction to Matlab 6 For Engineers" by J. Palm III, J. William, McGraw-Hill International Edition, (2012)

Course Title:ELECTRONICS-I
Course Code: PHY-509
Credit Hours: 3(3-0)

Course Objectives: The goals of this course are to give the student an understanding of the elements of semiconductor physics and principles of semiconductor devices that constitute the foundation of the operation and limitations of the primary electronic devices like p-n junctions, bipolar transistors, and field effect transistor. The students will find current knowledge of new developments in semiconductor devices and circuits.
Course Outline:

Theory:

Introduction: Band Theory of Solids, Materials Used in Electronics, Current in Semiconductors, *N*-Type and *P*-Type Semiconductors, The *PN* Junction.
Diodes Applications: Diode Operation, Voltage-Current (*V-I*) Characteristics, Diode Models, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers.
Special Purpose diode: The Zener Diode, Zener Diode Applications, The Varactor Diode, Optical Diodes.
Bipolar Junction Transistor: Bipolar Junction Transistor (BJT) Structure,Basic BJT Operation, BJT Characteristics and Parameters, The BJT as an Amplifier, The BJT as a Switch and LED driver.
Transistor Bias Circuit: The DC Operating Point, Voltage-Divider Bias, Other Bias Methods.
BJT Amplifiers: Amplifier Operation, Transistor AC Models, The Common-Emitter Amplifier, The Common-Collector Amplifier, The Common-Base Amplifier, Multistage Amplifiers, The Differential Amplifier
Recommended Books:

1. "Electronics Devices (Conventional Current Version)" by Thomas L. Floyd, Prentice Hall, 8th edition, (2009).
2. J.D. Ryder, "Electronic Circuits and Systems", Prentice Hall 1976.
3. Theodore F. Bogart, "Electronic Circuits", McGraw Hill,
4. B. Grob, "Basic Electronics", MacGraw Hill, Tch ed. 1997.
5. A. P. Malvino, "Electronic Principles", McGraw Hill, 7th ed. 2006.
6. James J. Brophy "Basic electronics for scientists" McGraw Hill, 5th ed. 1990.

Course Title:Mathematical Methods of Physics-II
Course Code: PHY-502
Credit Hours: 3(3-0)

Course Objectives: To give the understanding of Differential equations and their uses in Physics, Introduction to special functions, Fourier Series, Fourier Transforms, Solution of Boundary value problems and their uses.
Course Outline:

Theory:

Fourier Series and Integral Transforms: Definition and general properties, Fourier Series of Various Physical Functions, Uses and Applications of Fourier Series, Fourier Transforms, Convolution Theorems, Laplace transforms and applications.
Tensor Analysis: Vector calculus (differentiation, integration, space curves, multi-variable vectors, surfaces, scalar and vector fields, gradient, divergence and curl, cylindrical and spherical coordinates, general curvilinear coordinates), change of basis, Cartesian tensor as a geometrical object, order/rank of a tensor, tensor algebra, quotient law, pseudo-tensors, Kronecker delta and Levi-cevita, dual tensors, physical applications, integral theorems for tensors, non-Cartesian tensors, general coordinate transformations and tensors.
Group Theory and Representations for finite groups: Transformations, groups – definitions and examples, subgroups and Cayley's theorem, cosets and Lagrange's theorem, conjugate classes, invariant subgroups, factor groups, homomorphism, direct products, mappings, linear operators, matrix representations, similarity transformation and equivalent matrix representations, group representations, equivalent representations and characters, construction of representations and addition of representations, invariance of functions and operators, unitary spaces and Hermitian matrices, operators: adjoint, self-adjoint, unitary, Hilbert space, reducibility of representations, Schur's lemmas, orthogonality relations, group algebra, expansion of functions in basis of irreducible representations, Kronecker product, symmetrized and anti-symmetrized representations, adjoint and complex-conjugate representations, real representations

Recommended Books:

1. G. Arfken, H. J. Weber, and F. E. Harris, "Mathematical Methods for Physicists", Academic Press, 7th ed. 2012.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley, 8th ed. 1999.
3. M. Hamermesh, "Group Theory and its Applications to Physical Problems", Dover Publications 1989.

Course Title:Quantum Mechanics-I
Course Code: PHY-504
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to acquire working knowledge of the Quantum Mechanics postulates on physical systems. The students will learn to pinpoint the historical aspects of quantum mechanics and shall understand the differences between classical and quantum mechanics by using the ideas of wave functions, uncertainty relations, solution of Schrodinger's wave equation etc.
Course Outline:

Theory:

Historical Review: Blackbody radiation, The photoelectric effect, A quantum theory of atomic states, Waves versus particles, The de Broglie Hypothesis and the Davisson-Germer Experiment, Uncertainty as a Cornerstone of natural Law, Probability waves.
The wave function: The Schrödinger equation, Statistical interpretation, Probability, Normalization, Momentum, The uncertainty relation.
The time independent Schrodinger equation: Stationary states, The infinite square well, The harmonic oscillator, The free particle, The delta-function potential, The finite square well, The scattering matrix.
Quantum mechanics formulism: Linear Algebra, Function spaces, The generalized statistical interpretation, The uncertainty principle.
Quantum mechanics in three dimensions: Schrodinger equation in spherical coordinates, The hydrogen atom, Angular momentum, Spin.
Identical Particles: Two-particle systems, Atoms, Solids, Quantum statistical mechanics.
Recommended Books:

1. "Introduction to Quantum Mechanics" by David J. Griffith, 2nd Edition, Cambridge University Press, (2016).
2. "Introductory Quantum Mechanics" R. L. Lieboff, Holden-Day San Francisco (1980).
3. "Qunatum Mechanics" by C.Cohen-Tannoudji, B. Diu, F. Laloe, Vol I,II, Wiley (1977).
4. "Quantum Mechanics" by Sokoev, Ternou, Holt, Rinehart & Winston Publishers (1996).
5. "Introduction to Quantum Mechanics" Dicke, Wittke, Addison-Wesley (1974).
6. "Quantum Physics" by S. Gasiorowicz, Wiley Publishers (1996).
7. "Qunatum Mechanics" by C.Cohen-Tannoudji, Vol I,II by, Wiley Sons (1977).

Course Title:Electromagnetic Theory-II
Course Code: PHY-506
Credit Hours: 3(3-0)

Course Objectives: Students will learn scientific, mathematical and engineering principles that enable them to understand forces, fields, and waves; know how devices work that use those principles and phenomena; and be familiar with the historical context in which development of knowledge and devices occurred.
Course Outline:

Theory:

This course is the second part of the core level undergraduate course on Electromagnetic Theory and a previous knowledge of Electromagnetic Theory I is expected.

Electrodynamics: Electromotive force: Ohm's law, electromotive force, motional emf, electromagnetic induction: Faraday's law, the induced electric field, inductance, energy in magnetic fields, Maxwell's equations: electrodynamics before Maxwell, how Maxwell fixed Ampere's law, Maxwell's equations, magnetic charges, Maxwell's equations in matter, boundary conditions
Conservation Laws: Charge and energy: the continuity equation, Poynting's theorem, momentum: Newton's third law in electrodynamics, Maxwell's stress tensor, conservation of momentum, angular momentum
Electromagnetic Waves: Waves in one dimension: the wave equation, sinusoidal waves, boundary conditions, reflection and transmission, polarization, electromagnetic waves in vacuum: the wave equation for E and B, monochromatic plane waves, energy and momentum in electromagnetic waves, electromagnetic waves in matter: propagation in linear media, reflection and transmission at normal incidence, reflection and transmission at oblique incidence, absorption and dispersion: electromagnetic waves in conductors, reflection at a conducting surface, the frequency dependence of permittivity, guided waves: wave guides, the waves in a rectangular wave guide, the coaxial transmission line
Potentials and Fields: The potential formulation: scalar and vector potentials, gauge transformations, Coulomb gauge and Lorentz gauge, continuous distributions: retarded potentials, Jefimenko's equations, point charges: Lienard-Wiechert potentials, the field of a moving point charge
Radiation, Dipole Radiation: What is radiation, electric dipole radiation, magnetic dipole radiation, radiation from an arbitrary source, point charges: power radiated by a point charge, radiation reaction, the physical basis of the radiation reaction
Electrodynamics and Relativity: The special theory of relativity: Einstein's postulates, the geometry of relativity, the Lorentz transformations, the structure of space-time, relativistic mechanics: proper time and proper velocity, relativistic energy and momentum, relativistic kinematics, relativistic dynamics, relativistic electrodynamics: magnetism as a relativistic phenomenon, how the field transform, the field tensor, electrodynamics in tensor notation, relativistic potentials.
Recommended Books:

1. D. J. Griffiths, "Introduction to Electrodynamics", ed. Prentice Hall, 3rd ed. 1999.
2. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 5th ed. ed. 2009.
3. F. Melia, "Electrodynamics", University of Chicago Press, 1st ed. 2001.
4. Hearld J and W. Muller-Kristen, "Electrodynamics", World Scientific Publishing, 2nd ed. 2011.

Course Title: ELECTRONICS-II
Course Code: PHY-510
Credit Hours: 3(3-0)

Course Objectives: The goals of this course are to give the student an understanding of the elements of semiconductor physics and principles of semiconductor devices that constitute the foundation of the operation and limitations of the primary electronic devices like p-n junctions, bipolar transistors, and field effect transistor. The students will find current knowledge of new developments in semiconductor devices and circuits.
Course Outline:

Theory:

Field Effect Transistors: The JFET, JFET Characteristics and Parameters, JFET Biasing, The Ohmic Region, The MOSFET, MOSFET Characteristics and Parameters,MOSFET Biasing.
Power Amplifiers: The Class A Power Amplifier, The Class B Push-Pull Amplifiers, Class C Amplifiers.
The Operational Amplifier: Introduction to Operational Amplifiers, Op-Amp Input Modes and Parameters, Negative Feedback, Op-Amps with Negative Feedback, Effects of Negative Feedback on Op-Amp, Impedances,Bias Current and Offset Voltage,Open-Loop Frequency and Phase Responses, Closed-Loop Frequency Response.
Basic op-amp circuits: Comparators, Summing Amplifiers,Integrators and Differentiators.
Amplifier frequency Response: Basic Concepts, The Decibel, Low-Frequency Amplifier Response, High-Frequency Amplifier Response, Total Amplifier Frequency Response, Frequency Response of Multistage Amplifiers, Frequency Response Measurements.
Oscillator: The Oscillator, Feedback Oscillators, Oscillators with *RC* Feedback Circuits, Oscillators with *LC* Feedback Circuits, Relaxation Oscillators, The 555 Timer as an Oscillator.

Recommended Books:

1. "Electronics Devices (Conventional Current Version)" by Thomas L. Floyd, Prentice Hall, 8th edition, (2009).
2. J.D. Ryder, "Electronic Circuits and Systems", Prentice Hall 1976.
3. Theodore F. Bogart, "Electronic Circuits", McGraw Hill,
4. B. Grob, "Basic Electronics", MacGraw Hill, Tch ed. 1997.
5. A. P. Malvino, "Electronic Principles", McGraw Hill, 7th ed. 2006.
6. James J. Brophy "Basic electronics for scientists" McGraw Hill, 5th ed. 1990.
7. Electronic Device and Circuit Theory by Robert Boylestad and LiousNashelsky Prentice hall, USA.

Course Title: Quantum Mechanics-II
Course Code: PHY-601
Credit Hours: 3(3-0)

Course Objectives: Principles of quantum mechanics. Schroedinger wave mechanics: history and philosophical implications. Basic properties of wave mechanics and applications (potential barriers). Eigenvalues and eigenfunctions of quantum mechanical operators (energy, momentum, orbital momentum). Quantum harmonical oscillator. Hydrogen atom. Electron spin. Electron in magnetic field (electron magnetic moment and nuclear magnetic resonance.

Course Outline:

Theory:

Addition of Angular Momenta: Total angular momentum in classical mechanics, total angular momentum in quantum mechanics, addition of two spin ½ angular momenta, addition of two arbitrary angular momenta, Clebsch-Gordon coefficients, sddition of spherical harmonics, vector operators, Wigner-Eckart theorem, electric Multipole moments, Evolution of two angular momenta J_1 and J_2 coupled by an interaction $aJ_1 . J_2$.

Stationary Perturbation Theory: Description of the method, perturbation of a non-degenerate level, perturbation of a degenerate level, one-dimensional harmonic oscillator subjected to a perturbing potential, interaction between the magnetic dipoles of two spin ½ particles, Van der waals forces, volume effect and The influence of the spatial extension of the nucleus on the atomic levels, variational method, energy bands of electrons in solids, a simple example of the chemical bond: The H_2^+ ion 516

Applications of Perturbation Theory to Atomic Systems: fine and hyperfine structure of atomic levels in hydrogen, Calculation of the mean values of the spin-orbit coupling in the 1*s*, 2*s* and 2*p* levels, hyperfine structure And the Zeeman effect for muonium and positronium, Stark effect

Approximation Methods for Time-Dependent Problems: Statement of the problem, approximate solution of the Schrodinger equation, An important special case: Sinusoidal or constant perturbation, Interaction of an atom with electromagnetic waves, linear and non-linear response of a two-level system subjected to a sinusoidal perturbation, Ooscillations of a system between two discrete states under the effect of a resonant perturbation, Rabi flopping, decay of discrete state resonantly coupled to a continuum of final states, Fermi's golden rule

Systems of Identical Particles: Identical particles, Permutation operators, The symmetrization postulate, difference between bosons and fermions, Pauli's exclusion principle, many-electrons atom and their electronic configurations, energy levels of the helium atom, configurations, terms, multiplets, spin isomers of hydrogen (ortho and parahydrogen)

Scattering by a Potential: Importance of collision phenomena, Stationary scattering states, scattering cross section, scattering by a central potential, method of partial waves, phenomenological description of collisions with absorption.

Recommended Books:

1. D.J. Griffiths, "Introduction to Quantum Mechanics", Addison-Wesley, 2nd ed. 2004.
2. R. Liboff, "Introductory Quantum Mechanics", Addison-Wesley, 4th ed. 2002.
3. N. Zettili, "Quantum Mechanics: Concepts and Applications", John Wiley, 2nd ed. 2009.

Course Title:Nuclear Physics
Course Code: PHY-603
Credit Hours: 3(3-0)

Course Objectives: The main objective of this course is to understand the nuclear structure using different nuclear models. To understand the nature of nuclear forces. To give understanding of radioactivity and nuclear reactions.

Course Outline:

Theory:

Basic concept: History and overview, some introductory terminology, units and dimensions. **Nuclear properties:** The nuclear radius, mass and abundance of nuclides, nuclear binding energy, nuclear angular momentum and parity, nuclear electromagnetic moments, nuclear excited states.
The forces between nucleons: The nucleon-nucleon scattering, proton-proton and neutron-neutron interactions, properties of the nuclear forces, the exchange force model.
Nuclear models: The shell model, the liquid drop model, more realistic nuclear models. **Radioactive decay:** The radioactive decay law, production and decay of radioactivity, growth of daughter activities, types of decays, natural radioactivity.
Nuclear reactions: Types of reactions and conservation laws, energetics of nuclear reactions, reaction cross sections.
Nuclear fission: Why nuclei fission, characteristics of fission, energy in fission, controlled fission reactions, fission reactors.
Nuclear fusion: Basic fusion processes, characteristics of fusion, solar fusion, controlled fusion reactors, thermonuclear weapons.
Accelerators: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding-beam accelerators

Recommended Books:

1. "Introductory Nuclear Physics"by K. S Krane.. John Wiley & Sons (1988).
2. "Introductory Nuclear Physics" by S. M Samuel Wong, 2nd ed. Wiley-VCH (1999).
3. "Atomic and Nuclear Physics" S. N. Ghoshal. S Chand & Co Ltd. (2010).
4. "Cosmic Rays and Particle Physics" by TK Gaisser.Cambridge University Press (1991) .
5. "Nuclear Physics" by Irving Kaplan, 2nd ed. Addison-Wesley Publishing Company, Inc. (1964).
6. "Concepts of Nuclear Physics" by BL. Cohen, 1st ed. McGraw-Hill Inc., (1971).
7. "Techniques for Nuclear & Particle Physics Experiments Basic Concepts of Physics" WR Leo Beiser, 2nd ed. Addison-Wesley Publishing Company (1972).

Course Title:Solid State Physics- I
Course Code: PHY-605
Credit Hours: 3(3-0)

Course Objectives: This course will deepen your understanding of the electronic properties of solids already gained through Introduction to Condensed Matter, and use this under- standing to elucidate the electrical, optical and magnetic properties of crystalline solids. It will also give you an introduction to density functional theory. The course will be complemented by the presentation of examples of current solid-state research.

Course Outline:

Theory:

Crystal Structure: Lattices and basis, Symmetry operations, Fundamental Types of Lattice, Position and Orientation of Planes in Crystals, Simple crystal structures
Crystal Diffraction and Reciprocal Lattice: Diffraction of X-rays, Neutrons and electrons from crystals; Bragg's law; Reciprocal lattice, Ewald construction and Brillouin zone, Fourier Analysis of the Basis
Phonons and Lattice: Quantization of Lattice Vibrations, Phonon momentum, inelastic scattering by phonons, Lattice Vibrations for Mono-atomic and diatomic basis, Optical Properties in the Infrared Region

Thermal Properties of Solids: Lattice heat Capacity, Classical model, Einstein Model, Enumeration of normal modes, Density of state in one, two or three dimensions, Debye model of heat capacity, Comparison with experimental results, thermal conductivity and resistivity, Umklapp processes
Electrical Properties of Metals: Classical free electron theory of metals, energy levels and density of orbital's in one dimension, effect of temperature on the Fermi–Dirac distribution function, properties of the free electron gas, electrical conductivity and Ohm's Law, thermal and electrical conductivities of metals and their ratio, motion of free electrons in magnetic fields, cyclotron frequency, static magneto conductivity and Hall Effect along with applications.
Recommended Books:

1. C. Kittle, "Introduction to Solid State Physics", John Wiley, 8th ed. 2005.
2. N. W. Ashcroft and N. D. Mermin, "Solid State Physics", Rinehart & Winston, 1976.
3. J.S. Blakemore,
4. S. R. Elliott, "The Physics and Chemistry of Solids", John Wiley, 1998
5. M. A. Omar, "Elementary and Solid State Physics", Pearson Education, 2000.
6. H. M. Rosenberg, "The Solid State", Oxford Science Publication, 3rd ed. 1988.
7. M. A. Wahab, "Solid State Physics", Narosa Publishing House, 1999.

Course Title:Atomic and Molecular Physics
Course Code: PHY-607
Credit Hours: 3(3-0)

Course Objectives: To provide an introduction to the structure and spectra of atoms and molecules and to prepare students for more advanced courses on Physics of Atoms, Molecules and Photons
Course Outline:

Theory:

Structure of Atoms: Review of Bohr's theory, Sommerfeld model, Frank Hertz experiment and approximation methods.
One Electron System: Review of Schrodinger equation for hydrogen atom, Fermi Golden rule, Quantum numbers, Atoms in radiation field, Radiative transitions, Einstein coefficients, Selection rules, normal Zeeman effect, Stark effect, Hyperfine structure.
Many body Systems: Pauli exclusion principle, Periodic system of the elemments, Stern Gerlach experiment, Spin orbit coupling, Central field approximation, Hartree Fock methods and self consistent field, Thomas Fermi potential, LS coupling, jj coupling and other type of coupling, X-ray spectra.
Interaction with field: Many electron atoms in an electromagnetic field, Anomalous Zeeman effect, Paschen back effect, Stark effect.
Molecules: Ionic and covalent bonding, Diatomic molecules-rotational, vibrational, and electronic spectra; Born Oppenhimer approximation, Transition probabilities of diatomic molecules, electron spin and Hund's cases, Polyatomic molecules (brief introduction), Raman effect, Hydrogen Molecular ion (LCAO approximation), Hydrogen molecule (Heitler London and molecular orbital theories)
Recommended Books:

1. B. H. Bransden and C. J. Joachain, "Physics of Atoms and Molecules",Pearson Education, 2nd ed. 2008.
2. C. J. Foot, "Atomic Physics", Oxford University Press, 2005.
3. Anne P. Thorne, Spectrophysics, Chapman and Hall, 2nd edition, 1988.
4. W. Demtroder, "Atoms, Molecules and Photons", y, Springer, 2nd ed. 2010.
5. C. N. Banwell and E. M. McCash, "Fundamentals of Molecular Spectroscopy", McGraw-Hill, 4th ed. 1994.
6. J. M. Hollas, "Basic Atomic & Molecular Spectroscopy", John Wiley, 2002.

Course Title:Statistical Physics
Course Code: PHY-609

Credit Hours: 3(3-0)

Course Objectives: The aim of this course is to develop concepts in classical laws of thermodynamics and their application, postulates of statistical mechanics, statistical interpretation of thermodynamics, microcanonical, canonical and grant canonical ensembles. The students will learn the methods of statistical mechanics used to develop the statistics for Bose-Einstein, Fermi-Dirac statistics.

Course Outline:

Theory:

Basics of thermodynamics: Temperature, Work, Energy, thermal equilibrium, Kinetic theory and general gas law, Macroscopic and Microscopic variables, Extensive and intensive state variable, Defining systems, Describing systems and their behavior, Specific volume and pressure, measuring temperature.

Laws of thermodynamics: Reviewing mechanical concepts of energy, Broading our understanding of work, Broading our understanding of energy, energy transfer by heat, Energy as a state function, Quasistatic work, reversible and irreversible work, path dependent work, Defining the Kelvin temperature scale, Maximum performance measures for cycles operating between two reservoirs, carnot cycle.

Using entropy: Introducing entropy, Defining entropy change, Entropy change in internally reversible Processes, Entropy balance for closed systems, Entropy rate balance for control volumes, Isentropic processes,

Introduction to statistical methods: Elementary statistical concepts and examples, The simple random walk problem in one dimension, General discussion of mean values, Calculation of mean values for the random walk problem, probability distribution for large N, Gaussian probability distributions, Probability distribution for large N.

Statistical formulation of the mechanical problem: Specification of the state of a system, Statistical ensemble, Statistical ensemble, canonical ensemble, Microcanonical Ensemble, grand canonical ensemble, chemical potential Basic postulates, Probability calculations, Behavior of the density of states, Thermal interaction, mechanical interaction, Boltzmann equations.

Recommended Books:

1. "Introductory Statistical Mechanics" by R. Bowley, M. Sanches, 2nd Edition, Clarendon Press, (1999).
2. "Introduction to Statistical Physics" by K. Huang, Taylor & Francis Publishers, (2001).
3. "Fundamentals of Engineering Thermodynamics" by M. J. Moran and Howard N. Shapiro, John Wiley & Sons, (1996)
4. "Fundamentals of Statistical and Thermal Physics" by R. Reif, Waveland Press, (2009).
5. "Elementary Statistical Physics" by C. Kittle, Cambridge University Press, (2012).

Course Title: Solid State Physics – II
Course Code: PHY-602
Credit Hours: 3(3-0)

Course Objectives: This course will deepen your understanding of the electronic properties of solids already gained through Introduction to Condensed Matter, and use this under- standing to elucidate the electrical, optical and magnetic properties of crystalline solids. It will also give you an introduction to density functional theory. The course will be complemented by the presentation of examples of current solid-state research.

Course Outline:

Theory:

Dielectric Properties of Solids: Polarization, Depolarization, Local and Maxwell field, Lorentz field, Clausius-Mossotti relation, Dielectric Constant and Polarizability, Masurement of dielectric constant, ferro electricity and ferroelectric crystals, Phase Transitions, First and 2nd order phase transitions, Applications

Semiconductors: General properties of semiconductors, intrinsic and extrinsic semiconductors, their band structure, carrier statistics in thermal equilibrium, band level treatment of conduction in semiconductors and junction diodes, diffusion and drift currents, collisions and recombination times

Optical Properties: Interaction of light with solids, Optical Properties of Metals and Non-Metals, Kramers-Kronnig Relation, Excitons, Raman Effect in crystals, optical spectroscopy of solids

Magnetic Properties of Materials: Magnetic dipole moment and susceptibility, different kinds of magnetic materials, Langevin diamagnetic equation, Paramagnetic equation and Curie law, Classical and quantum approaches to paramagnetic materials. Ferro-magnetic and anti – ferromagnetic order, Curie point and exchange integral, Effect of temperature on different kinds of magnetic materials and applications

Superconductivity: Introduction to superconductivity, Zero-Resistance and Meissner Effect , Type I and Type II superconductors, Thermodynamic fields,Tow fluid model, London equations , BCS and Ginzburg – Landau Theory, Vortex Behaviour, Critical Current Density, Josephson effect and applications.

Recommended Books:

1. C. Kittle, "Introduction to Solid State Physics", John Wiley, 8th ed. 2005.
1. N. W. Ashcroft and N. D. Mermin, "Solid State Physics", Rinehart & Winston, 1976.
2. G. Burns, "High Temperature Superconductivity - An Introduction", Academic Press, 1992.
3. M. Fox, "Optical Properties of Solids", Oxford University Press, 2nd ed. 2010.
4. N. A. Spaldin, "Magnetic Materials: Fundamentals and Device Applications", Cambridge University Press, 2nd ed. 2010.
5. M. A. Omar, "Elementary and Solid State Physics", Pearson Education, 2000.
6. H. M. Rosenberg, "The Solid State", Oxford Science Publication, 3rd ed. 1988.
7. M. A. Wahab, "Solid State Physics", Narosa Publishing House, 1999.

Course Title: Introduction to Materials Science
Course Code: PHY-608
Credit Hours: 3(3-0)

Course Objectives: To understand the important aspects of materials moving towards microstructures.
Course Outline:

Theory:

Atomic Structure of Materials: The packing of atoms in 2-D and 3-D, unit cells of the hexagonal close packing (hcp) and cubic closed packing (ccp) structures, interstitial structures, density computation, lattices and symmetry elements, indexing lattice directions and lattice planes, interplanar spacing, lattices and crystal systems in 3-D, symmetry, crystallographic point groups and space groups, Bragg's law and the intensities of Bragg reflections
Imperfections in Solids: Vacancies, impurities, dislocations, interfacial defects, bulk or volume defects, atomic vibrations
Microstructure: Microstructure and microscopy, pressure vs. temperature phase diagrams, temperature vs. composition phase diagrams, equilibrium, thermodynamic functions, variation of Gibbs energy with temperature and composition, general features of equilibrium phase diagrams, solidification, diffusion mechanisms, nucleation of a new phase, phase diagrams of Fe-C system and other important alloys, materials fabrication
Mechanical Behavior of Materials: Normal stress and normal strain, shear stress and shear strain, elastic deformation, plastic deformation, Young's modulus, shear modulus, Poisson's ratio, elastic strain energy, thermal expansion, estimate of the yield stress, dislocations and motion of dislocations, slip systems, dislocations and strengthening mechanisms, fracture mechanics, ductile fracture, brittle fracture, Griffith criterion, ductile fracture, toughness of engineering materials, the ductile-brittle transition temperature, cyclic stresses and fatigue, creep
Polymers: Polymer basics, polymer identification, polymer molecules, additional polymerization, step growth polymerization, measurement of molecular weight, thermosetting polymers and gels, rubbers and rubber elasticity, configuration and conformation of polymers, the glassy state and glass transition, determination of Tg, effect of temperature and time, mechanical properties of polymers, case studies in polymer selection and processing
Biomaterials: Introduction to biomaterials, materials selection, biopolymers, structural polysaccharides, hard materials, biomedical materials.
Recommended Books:

1. W. D. Callister, "Materials Science and Engineering: An Introduction", Wiley, 7th ed. 2006.
2. W. D. Callister and D. G. Rethwisch "Fundamentals of Materials Science and Engineering: An Integrated

Approach",Wiley, 4th ed. 2012.
3. J. F. Shackelford, "Introduction to Materials Science for Engineers", Prentice Hall, 7th ed. 2008.

Course Title: Introduction to Nanoscience and Nanotechnologies
Course Code: PHY-610
Credit Hours: 3(3-0)

Course Objectives: Introduce the concept and applications of nano sciences and nanotechnologies Nano structures and nano technologies.

Course Outline:

Theory:

Introduction: Feynman talks on small structures, Nano scale dimension, Course goals and objectives
Quantum Effects: Wave particle duality, Energy quanta, Uncertainty principle, De Broglie relation, Quantum Dots, Moore's law, tunneling
Surfaces and Interfaces: Interfaces, Surface chemistry and physics, Surface modification and characterization, Thin Films, Sputtering, Self-assembled films
Material Properties: Subatomic physics to chemical systems, types of chemical bonds, solid state physics / Material properties
Fabricating Nano Structures: Sol gel, Lithography (photo and electron beam), MBE, Self-assembly, FIB, Stamp technology, Nano junctions
Electrons in Nano Structures: Variation in electronic properties, free electron model, Bloch's theorem, Band structure, Single electron transistor, Resonant tunneling
Molecular Electronics: Lewis structures, Approach to calculate Molecular orbitals, Donor Acceptor properties, Electron transfer between molecules, Charge transport in weakly interacting molecular solids, Single molecule electronics
Nano Materials: Quantum dots, nano wires, nano photonics, magnetic nano structures, nano thermal devices, Nano fluidic devices, biomimetic materials
Nano Biotechnology: DNA micro-arrays, Protein and DNA Assembly, Digital cells, genetic circuits, DNA computing
Characterization Techniques: Electron Microscopy (STM, AFM,SEM and TEM), Fluorescence methods,Synchrotron Radiation, XRD.
Nanotechnology the Road Ahead: Nanostructure innovation, Quantum Informatics, Energy solutions.

Recommended Books:

1. S. Lindsay, "Introduction to Nanoscience", Oxford University Press, 2009.
2. C. Binns, "Introduction to Nanoscience and Nanotechnology (Wiley Survival Guides in Engineering and Science)", Wiley, 2010.

Course Title: Particle Physics
Course Code: PHY-612
Credit Hours: 3(3-0)

Course Objectives: The main objectives of this course will be the students become familiar with the principal concepts and building blocks of elementary particle physics and see how they are inter related. The course is intended to provide a broader that will allow the students to continue their knowledge in postgraduate studies.

Course Outline:

Theory:

A Review of Particle Physics: Fundamental forces, Quarks and color, Weak interactions, Natural units.
Symmetries: Symmetries and conservation laws, Noether's theorem Parity, Charge conjugation, CP violation. Symmetries and groups, Group SU(2), Isospin, Group SU(3), Strangeness, Mesons, Baryons, Magnetic moments, Heavy quarks, Charm and beyond, Hadron masses, Color factors.
Relativistic Kinematics: Lorentz transformations, Four-vectors, Energy and momentum, Mandelstam variables.

Introduction to QED: The Klein-Gordon equation, Dirac's interpretation of negative energy solutions, Feynman-Stuckelberg interpretation of negative energy solutions, The Dirac equation, Covariant form of Dirac equation, Continuity equation for Dirac equation, Free-Particle solution of Dirac equation, Normalization of spinors and the completeness relations, Trace theorems and properties of γ matrices.
Gauge Symmetries: U(1), SU(2) and SU(3) gauge transformations, Transformation law for A_μ, Lagrangian density of a free particle, Invariance of a theory under global gauge transformations, Lagrangian density and local U(1) gauge transformations, Lagrangian density and non-abelian continuous group of local gauge transformations.

Recommended Books:

1. "Introduction of elementary Particles" by D. J. Griffiths, John Wiley and Sons, (1987).
2. "Nuclear and Particle Physics" by E. E. Jobes, Burcham, Longman Scientific & Technical Publishers, (1995)
3. "Introduction to Nuclear and Particle Physics" by Das, A. and Ferbel, Johan Wiley and Sons, (1994).
4. "Nuclear and Particle Physics" by W.S.C. Williams, Oxford University Press, (1995)
5. "Concepts of Particle Physics" by K. and F Weisskopt, Vol-1, Oxford University Press, (1986).

Course Title:Plasma Physics
Course Code: PHY-614
Credit Hours: 3(3-0)

Course Objectives: The main purpose of this course is to provide the basic understandings of plasma physics, both in low temperature and high temperature, so that in future if some students are interested in research in the field of plasma physics the course will be too much helpful from applications and development point of view. The students will get basic knowledge of plasma physics, plasma chemistry and their applications. After studying this course students can work in both fields theoretical and experimental for low temperature as well as high temperature plasmas.
Course Outline:

Theory:

Basics of Plasmas: Plasma as state of matter, Debye Length, Plasma frequency, Collisions, DC conductivity, A.C conductivity.
Plasma Production and Measurement: DC discharge, RF discharge, Photo Ionization, Tunnel Ionization, Avalanche Breakdown, Laser Produced Plasmas, Langmuir Probe.
Waves and Instabilities: Electromagnetic waves, Langmuir wave, Ion acoustic wave, Surface Plasma wave, Ionosphere Propagation, Two stream Instability, Weibel Instability.
Plasma Confinement: Single Particle motion in a magnetic field, Motion in magnetic and electric fields, Motion in inhomogeneous and curved magnetic fields, Magnetic moment Invariance, Mirror confinement, Tokamak Confinement.
Applications: Medium and short wave communication, Plasma Processing of Materials, Laser Ablation, Laser Driven Fusion, Magnetic Fusion.

Recommended Books:

1. “Introduction to plasma Physics and controlled fusion”, Francis F. Chen.
2. “Plasma Discharge in liquid, water treatment and applications”, Yong Yang, Yong I. Cho, Alexander Fridman.

Course Title:Laser Physics

Course Code: PHY-616
Credit Hours: 3(3-0)

Course Objectives: The aim of the course is that the student shall have acquired a thorough understanding of the theory of modern laser physics and they would be able to describe in detail the inherent behavior and functionality of the many different types of modern lasers.

Course Outline:

Theory:

Introductory Concepts: Spontaneous Emission, Absorption, Stimulated Emission, Pumping Schemes, Absorption and Stimulated Emission Rates, Absorption and Gain Coefficients, Resonance Energy Transfers, Properties of Laser Beam; Mono chromaticity, Coherence, Directionality, Brightness.

Spectroscopy of Molecule and Semiconductors: Electronic Energy Levels, Molecular Energy Levels, Level Occupation at Thermal Equilibrium, Stimulated Transition, Selection Rules, Radiative and Nonradiative Decay, Semiconductor,

Optical Resonators: Plane Parallel (Fabry-Perot) Resonator, Concentric (Spherical) Resonator, Confocal, Resonator, Generalized Spherical Resonator, Ring Resonator, Stable Resonators, Unstable Resonators.

Pumping Processes: Optical pumping: Flash lamp and Laser, Electrical Pumping: Longitudinal Configuration and Transverse Configuration, Gas Dynamics Pumping, Chemical Pumping.

Continuous Wave (CW) and Pulsed Lasers: Rate Equations, Threshold Condition and Output Power, Optimum Output Coupling, Laser Tuning, Oscillation and Pulsations in Lasers, Q-Switching and Mode-Locking Methods, Phase Velocity, Group Velocity, and Group-Delay Dispersion, Line broadening.

Lasers Systems: Solid State Lasers, Nd, YAG Lasers and Semiconductor Lasers, Gas lasers.

Laser Applications: Material Processing, Surface Hardening, Cutting, Drilling, Welding etc

Recommended Books:

1. "Laser Physics" by J. Eberly and P. Milonni, Wiley sons, New York, (2010)
2. "Principles of Lasers" O. Svelto, Plenum Press New York & London (1992).
3. "Quantum Optics" by Scully and Zubairy, Cambridge University Press (1997).
4. "Lasers" by A.E. Siegman, University, Science Books Mill Valley, (1986)
5. "Laser Theory" by H. Haken, Springer, Berlin (1984).

Course Title: Introduction to Photonics
Course Code: PHY-618
Credit Hours: 3(3-0)

Course Objectives: To study the application of light, studying the photonic devices including detectors.

Course Outline:

Theory:

Guided Wave Optics: Planar slab waveguides, Rectangular channel waveguides, Single and multi-mode optical fibers, waveguide modes and field distributions, waveguide dispersion, pulse propagation

Gaussian Beam Propagation: ABCD matrices for transformation of Gaussian beams, applications to simple resonators

Electromagnetic Propagation in Anisotropic Media: Reflection and transmission at anisotropic interfaces, Jones Calculus, retardation plates, polarizers

Electro-optics and Acousto-optics: Linear electro-optic effect, Longitudinal and transverse modulators, amplitude and phase modulation, Mach-Zehnder modulators, Coupled mode theory, Optical coupling between waveguides, Directional couplers, Photoelastic effect, Acousto-optic interaction and Bragg diffraction, Acousto-optic modulators, deflectors and scanners

Optoelectronics: p-n junctions, semiconductor devices: laser amplifiers, injection lasers, photoconductors, photodiodes, photodetector noise

Recommended Books:

1. B. E. A. Saleh and M. C. Teich, “Fundamentals of Photonics”, John Wiley, 2nd ed. 2007.
2. J-M. Liu, “Photonic Devices”, Cambridge University Press, 2009.

3. A. Yariv and P. Yeh, "Photonics: Optical Electronics in Modern Communications", Oxford University Press, 2006.

Course Title:Environmental Physics
Course Code: PHY-620
Credit Hours: 3(3-0)

Course Objectives: The main objectives of this course will be familiarize with the essentials of environment and Global climate. To learn to use spectroscopy for environments.
Course Outline:

Theory:

Introduction: The human environment, Laws of thermodynamics, energy transfer, the greenhouse effect and climate change.
Basic Environmental Spectroscopy: Electromagnetic spectrum, radiation from black body, Lambert -Beer's Law, Radiative flux in the atmosphere, scattering and absorption of light by small particles, Rayleigh scattering, Mie scattering, Geometric scattering.
Greenhouse gases and Global Climate change on Earth: Energy balance, Anthropogenic CO_2 and other greenhouse gases, evidence for increase in the atmosphere. Aerosols and their properties, dynamics of aerosol population, climate change due to aerosols.
Transport of Pollutants: Diffusion and diffusion equation, dispersion of pollutant in rivers, ground water flow, Gaussian plumes in air, continental transport of pollutant.
Sound and Noise: Basic acoustics, measuring sound, propagation of sound over distance, human perceptions of sound and noise, noise level, controlling noise, active control of sound.
Atmosphere and Radiation: General laws of radiation, natural Radiation, solar and terrestrial radiation, energy balance for Earth and Atmosphere, solar variability, absorption of radiation by atmospheric gases.
Atmosphere and Climate: Structure of the atmospheres, vertical profiles in the lower layers of the atmospheres, lateral movements in the atmosphere, atmospheric circulation, cloud and fog formation, cloud types.
Climatology and Measurements of Climate Factor: Data collection and organization, statistical analysis of climatic data, general characteristics of measuring equipments, measurement of temperature, air humidity, surface wind velocity, radiation balance, precipitation, atmospheric pressure, automatic weather stations
Recommended Books:

1. Egbert, B. and Rienk, V, G, B; 1999: Environmental Physics 2nd edition. John Wiley and Sons.
2. Guyot Praxis Publication, 1998: Physics of Environmental and Climate.
3. John H. Seinfeld & Spyros N. Pandis, 1998: Atmospheric Chemistry and Physics: From Air Pollution to Climate Change. John Wiley and Sons.
4. Clare Smith, 2001. Environmental Physics. Environment and Politics.

Course Title:Quantum Information Theory
Course Code: PHY-622
Credit Hours: 3(3-0)

Course Objectives: To understand the fundamental concepts of quantum information, communication, computation, and physical protocols for quantum computation.
Course Outline:

Theory:

Review of Quantum Mechanics and overview of Quantum information: Postulates of quantum mechanics, quantum states and observables, Dirac notation, projective measurements, density operator, pure and mixed states, entanglement, tensor products,no-cloning theorem, mixed states from pure states in a larger Hilbert space, Schmidt decomposition, generalized measurements, (CP maps, POVMs), qualitative overview of Quantum Information
Quantum Communication: Dense coding, teleportation, entanglement swapping, instantaneous transfer of information, quantum key distribution

Entanglement and its Quantification: Inseparability of EPR pairs, Bell inequality for pure and mixed states, entanglement witnesses, Peres-Horodecki criterion, properties of entanglement measures, pure and mixed state entanglement, relative entropy as entanglement measure, entanglement and thermodynamics, measuring entanglement

Quantum Information: Classical information theory (data compression, Shannon entropy, von Neumann entropy), fidelity, Helstrom's measurement and discrimination, quantum data compression, entropy and information, relative entropy and its statistical interpretation, conditional entropy, Holevo bound, capacity of a quantum channel, relative entropy and thermodynamics, entropy and erasure, Landauer's erasure

Quantum Computation: Classical computation (Turing machines, circuits, complexity theory), quantum algorithms (Deutsch's algorithm, Oracles, Grover's algorithm, factorization and quantum Fourier transform), role of entanglement in algorithms (search algorithm), modeling quantum measurements, Bekenstein bound, quantum error correction (general conditions, stabilizer codes, 3-qubit codes, relationship with Maxwell's demon), fault tolerant quantum computation (overview)

Physical Protocols for Quantum Information and Computation: Ion trap, optical lattices, NMR, quantum optics, cavity QED.

Recommended Books:

1. V. Vedral, "Introduction to Quantum Information Science", Oxford University Press, 2007.
2. M. Nielsen and I. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Anv. ed. 2010.
3. W. Steeb and Y. Hardy, "Problems and Solutions in Quantum Computing and Quantum Information", World Scientific Publishing, 3rd ed. 2011.
4. Book on general quantum mechanics: A. Peres, Quantum Theory: Concepts and Methods, Kluwer Academic Publishers (2002).
5. Seth Lloyd's notes on quantum information available online at: web.mit.edu/2.111/www/notes09/spring.pdf

Course Title:Surface Physics
Course Code: PHY-624
Credit Hours: 3(3-0)

Course Objectives: The objective of this course is to provide an introduction to computational methods in solving problems in physics.

Course Outline:

Theory:

Introduction to surface processes: Thermodynamic ideas of surfaces; Surface energy and the Wulff theorem; The Terrace-Ledge-Kink Model; Introduction to surface reconstructions and surface electronics. Examination of Surfaces: Structure; Chemical analysis and microscopy; Diffraction techniques for structure; Inelastic scattering techniques for analysis; microscopic examination of surfaces Including UHV-based electron and scanned probe microscopy; AFM/STM, Synchrotron radiation (EXAFS).Atomic processes in adsorption: Surface processes in physic- and chemi-sorption; Phase diagrams and phase transitions in mono and multilayers; Chemisorptions and chemical reactions. Equilibrium forms and crystal growth mechanisms: Equilibrium evaporation and growth forms; Surface steps and crystal growth; Surface diffusion; Phase transitions and faceting.

Recommended Books:

1. "A. Zangwill, Physics at Surfaces, Cambridge University Press, 1st edition, 1998.
2. A. J. R., The Structure and Chemistry of Solid Surfaces, Wiley, New York, 1st edition.
3. T. M. Methods of Surface Analysis, Elsevier, Amsterdam, 1st edition, 1984.

Course Title:Digital Electronics
Course Code: PHY-626

Credit Hours: 3(3-0)

Course Objectives: To learn the basics of digital electronics such a as Boolean Algebra,To develop logic circuit using the Boolean Algebra, To understand the computer interface and micro-controller along with the embedded systems.

Course Outline:

Theory:

Review of Number Systems: Binary, Octal and Hexadecimal number system, their inter-conversion, concepts of logic, truth table, basic logic gates

Boolean Algebra: De Morgan's theorem, simplification of Boolean expression by Boolean Postulates and theorem, K-maps and their uses. Don't care condition, Different codes. (BCD, ASCII, Gray etc.). Parity in Codes

IC Logic Families: Basic characteristics of a logic family. (Fan in/out, Propagation delay time, dissipation, noise margins etc. Different logic based IC families (DTL, RTL, ECL, TTL, CMOS)

Combinational Logic Circuit: Logic circuits based on AND – OR, OR-AND, NAND, NOR Logic, gate design, addition, subtraction (2's compliments, half adder, full adder, half subtractor, full subtractor encoder, decoder, PLA. Exclusive OR gate

Sequential Logic Circuit: Flip-flops clocked RS-FF, D-FF, T-FF, JK-FF, Shift Register, Counters (Ring, Ripple, up-down, Synchronous) A/D and D/A Converters

Memory Devices: ROM, PROM, EAPROM, EE PROM, RAM, (Static and dynamic) Memory mapping techniques

Micro-controller/ Embedded System: Introduction to Embedded and microcontroller based systems, The Microprocessor and microcontroller applications and environment, microcontroller characteristics, features of a general purpose microcontroller, Microchip Inc and PIC microcontroller, Typical Microcontroller examples:, Philips 80C51 & 80C552 and Motorola 68Hc05/08, Interfacing with peripherals.

Recommended Books:

1. M. M. Mano, "Digital Logic and Computer Design", Prentice Hall, 1995.
2. R. Tokheim, "Digital Electronics", McGraw Hill, 7th ed. 2007.
3. B. B. Brey, "The Intel Microprocessors: Architecture, Programming and Interfacing", Merril, 2nd ed. 1991.
4. Thomas L. Floyd, "Electronics Fundamentals: Circuits, Devices and Applications", Prentice Hall, 8th ed. 2009.
5. T. Wilmshurst, "The Design of Small-Scale Embedded Systems", Palgrave, 2001.
6.

Course Title:Nanomaterials and Applications
Course Code: PHY-628
Credit Hours: 3(3-0)

Course Objectives: A graduate level introductory course to "nanotechnology". The course will cover several key aspects of applied nanomaterials, namely their synthesis, characterization, processing, and applications.

Course Outline:

Theory:

Structure of atoms, Types of bonds and bonding in metals, Ionic Bond, Covalent Bond, Metallic bond, Crystal structure And crystal Geometry, Imperfections in Crystals, Grain boundaries, Dislocations, stacking faults, Frenkel and schottky disorder, Annealing, nanomaterials and nanostructures, Properties of nanomaterials, Electronic, Magnetic, optical and mechanical, Synthesis of nanomaterials, Mechanical grinding, Gas phase synthesis, Sputtering, Saser ablation, Properties of nanomaterials, Applications areas of nanomaterials, Environmental applications, Biological applications nanostructured gas sensors, Environmental sensors and monitoring, Soil remediation, Water treatment, Air purification..

Recommended Books:

1. Solid State Physics H. Ibach , H. Luth, , Springer-Verlag
2. Principles of Materials Science and Engineering Smith, W.F., McGraw Hill, 1996
3. Nanostructures and nanomaterials, synthesis, properties and applications, Cao, Guozhong, Imperial College Press, 2004
4. Nanostructured materials, processing, properties and potential applications, Carl C. Koch, Noyes publications, William Andrew publishing, NY, USA, 2002
5. Environmental application of nanomaterials, Glen E Fryxell, Cao, Guozhong, , Imperial College Press, 2007.

Course Title:Physics at Nanoscale
Course Code: PHY-630
Credit Hours: 3(3-0)

Course Objectives: The course will cover several key aspects of applied nanomaterials, namely their synthesis, characterization, processing, and applications.

Course Outline:

Theory:

Introduction and basic theory. Origins and nature of nanotechnology, Nanotechnology in society, current issues, the wave-like nature of electrons. Standing waves and electron energy levels. Travelling waves, reflection and tunneling. Solving simple quantum problems. Electrons in metals. Electron emission phenomena. Field electron emission and cold cathodes. Nanomaterials: Length scales, top down and bottom up approaches. Common growth methods, Properties of selected nanomaterials, including carbon nanotubes and other carbon based materials, metallic nano clusters. Introduction 'of scanning tunneling microscopy, atomic and molecular manipulation and atomic force microscopy. Tools of Nanotechnology: Electron and Ion based methods, The Muller nano tip as an electron and ion source, Field-ion microscope. Atom-probe instruments. Focused Ion Beam machines. High-resolution electron microscopes.

Recommended Books:

1. C.S.Barrett, Structure of Metals (McGraw-Hill). A.V. Tobolsky, Properties and Structure of Polymers (John-Wiley and Sons).
2. F.C.Phillips, An Introduction to Crystallography (John-Wiley and Sons).
3. A.H.Cottrell, Theory of Dislocations in Crystals (Gordon and Breach) \Maser. R. (ed) Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices (Wiley-VCH, Weinheim, 2003).

Course Title: Methods of Experimental Physics
Course Code: PHY-632
Credit Hours: 3(3-0)

Course Objectives: To learn about the vacuum techniques to learn the detection techniques about radiation, temperature. To learn about the measuring techniques along with data analysis.

Course Outline:

Theory:

Vacuum Techniques: Gas Transport: Throughout, Pumping Speed, Pump down Time Ultimate pressure. Fore-Vacuum Pumps: Rotary Oil pumps, sorption pumps. Diffusion pumps, sorption pumps (High Vacuum). Production of ultrahigh vacuum, Fundamental concepts, guttering pumps, Ion pumps, Cryogenic pumps, Turbo molecular pumps. Measurement of total pressure in Vacuums Systems, Units pressure ranges, Manometers, Perini gauges, The McLoad gauges, Mass spectrometer for partial measurement of pressure. Design of high Vacuum system, Surface to Volume ratio, Pump Choice, pumping system design. Vacuum Components, Vacuum valves, vacuum Flanges, Liquid Nitrogen trap, Mechanical feed throughs & Electrical feed throughs Leak detection: Basic consideration, leak detection equipment, Special Techniques and problems, Repair Techniques

Sensor Technology: Sensors for temperature, pressure displacement, rotation, flow, level, speed, position, phase, current voltage, power magnetic field, tilt, metal, explosive and heat.

Introduction to Computer Interfacing: GPIB Interface, RS 232, DA/AD conversion, Visual c/visual Basic
Data Analysis: Evaluation of measurement: Systematic Errors, Accuracy, Accidental Errors, Precision, Statistical Methods, Mean Value and Variance, Statistical Control of Measurements, Errors of Direct measurements, Rejection of data, Significance of results, Propagation of errors, preliminary Estimation, Errors of Computation. Least squares fit to a polynomial. Nonlinear functions. Data manipulation, smoothing, interpolation and extrapolation, linear and parabolic interpolation

Recommended Books:

1. F. James, "Statistical Methods in Experimental Physics", World Scientific Company, 2nd ed. 2006.
2. M. H. Hablanian, "High-Vacuum Technology", Marcel Dekker, 2nd ed. 1997.
3. P. Bevington and D. K. Robinson, "Data Reduction and Error Analysis for Physical Science", McGraw Hill, 3rd ed. 2002.
4. S. Tavernier, "Experimental Techniques in Nuclear and Particle Physics", Springer, 2010.
5. J. B. Topping, "Errors of Observations and Their Treatment", Springer, 4th ed. 1972.

Course Title: Applied Physics
Course Code: PHY-634
Credit Hours: 3(3-0)

Pre-requisites:
Course Objectives: This freshmen level course has been designed to provide an introduction to the ideas and concepts of Physics that would serve as a foundation for subsequent electronic engineering courses. The primary objective is to endow the knowledge of a wide variety of electric and magnetic phenomena along with their scientific applications, specifically, in the field of electronic engineering. The course initiates with a short review of relevant mathematics, immediately followed by the basics of electricity at the atomic level. A majority of the course is then dedicated for electric and magnetic fields, forces, elements and their applications. Additionally, it also aims to provide introductory knowledge of wave theory and semi-conductor theory in conjunction with their applications.

Course Outline:

Vectors and Scalars
- Introduction to vectors and scalars
- Addition of vectors
- Components of vectors
- Vectors and laws of physics
- Multiplying vectors

Electric Charge
- Introduction to electric charge
- Conductors and Insulators
- Coulomb's Law
- Charge is quantized
- Charge is conserved

Electric Fields
- Introduction to Electric Field
- Electric field lines
- The electric field due to point charge
- The electric field due to electric dipole
- The electric field due to line of charge
- The electric field due to a charged disk
- A point charge in electric field
- A dipole in electric field

Gauss' Law
- Introduction to Gauss' law
- Flux
- Flux of an electric field

- Gauss' Law and its applications
- Gauss' law and Coulombs' Law
- Applying Gauss' law to Cylindrical Symmetry
- Applying Gauss' law to Planner Symmetry
- Applying Gauss' law to Spherical Symmetry

Electric Potential

- Introduction to electric potential
- Electric potential energy
- Electric potential
- Calculating the potential from the field
- Potential due to a point charge
- Potential due to group of charges
- Potential due to an electric dipole
- Potential due to continuous charge distribution

Capacitance

- Introduction to capacitance
- Calculating the capacitance
- Capacitors in parallel and series
- Energy stored in an electric field
- Capacitors with dielectric
- Dielectric and Gauss' Law

Current and Resistance

- Introduction to electric current
- Current density
- Resistance and Resistivity
- Ohm's Law
- Power in electric circuits
- Semiconductors and super conductors

Circuits

- Introduction to electric circuits
- Pumping charges
- Work, energy and EMF
- Calculating the current in single loop circuit
- Multi loop circuits
- The RC Circuits
- The ammeter and voltmeter

Magnetic Fields

- Introduction to magnetic fields
- What produce magnetic field
- The Hall effect
- A circulating charge particle
- Magnetic force on a current carrying wire
- Torque on a current loop

Motion in 1-D, 2-D and 3-D

- Position, velocity and acceleration
- Projectile motion

Newton's Law and its applications

- Newton's Law
- Applying Newton's law
- Friction
- Drag Force and terminal velocity

Recommended Books:

1. Fundamentals Of Physics, 9th Edition by Halliday, Resnick & Walker
2. University Physics, 12th Edition by Sears and Zemansky's
3. Fundamentals Of Electromagnetic Phenomenon, D. Corson & Lorrain, W. H. Freeman & Co.
4. Physics, Volume 1, Halliday, Resnich and Krane, Fourth Edition, John Wiley & Sons, Inc.

Lab Title: Lab-I: Mechanics Lab

Course Code: PHY-303

Credit Hours: 1(0-1)

Objectives: The main objectives of this lab course are to introduce the students with the theory and working of the various experiments related to mechanics. To equip the student with enough information to be able to interpret the motion of the objects.

List of Experiments:

1. Modulus of Rigidity by Static & Dynamic method (Maxwell's needle, Barton's Apparatus).
2. Measurement of viscosity of liquid by Stoke's / Poisseulli's method.
3. Surface tension of water by capillary tube method.
4. To determine the value of "g" by compound pendulum / Kater's Pendulum.
5. To study the dependence of Centripetal force on mass, radius, and angular velocity of a body in circular motion.
6. Determination of moment of inertia of a solid/hollow cylinder and a sphere etc.
7. To study the conservation of energy (Hook's law)
8. To determine the Young's Modulus by bending beam method.

Lab Title: Lab-II: Electricity and Magnetism

Course Code: PHY-306

Credit Hours: 1(0-1)

Objectives: The main objectives of this lab course are to introduce the students with the theory and working of the various experiments related to electricity and magnetism.

List of Experiments:

1. Measurement of resistance using a Neon flash bulb and condenser
2. Conversion of a galvanometer into Voltmeter & an Ammeter
3. To study the characteristics of Photo emission and determination of Plank's constant using a Photo cell.
4. Calibration of an Ammeter and a Voltmeter by potentiometer
5. Charge sensitivity of a ballistic galvanometer
6. Comparison of capacities by ballistic galvanometer.
7. To study the B.H. curve & measure the magnetic parameters.
8. Measurement of low resistance coil by a Carey Foster Bridge.
9. Resonance frequency of an acceptor circuit
10. Resonance frequency of a Rejecter Circuit.
11. Study of the parameter of wave i.e. amplitude, phase and time period of a complex signal by CRO.
12. Measurement of self/mutual inductance.
13. Study of electric circuits by black box.
14. To study the network theorems (Superposition, Thevinin, Norton).

Lab Title: Lab-III: Waves and Oscillations

Course Code: PHY-403

Credit Hours: 1(0-1)

Objectives: The main objectives of this lab course are to introduce the students with the theory and working of the various experiments related to waves and Oscillations.

List of Experiments:

1. To study the damping features of an oscillating system using simple pendulum of variable mass.
2. To determine Horizontal/Vertical distance by Sextant.
3. The determination of wavelength of Sodium –D lines by Newton's Ring.
4. The determination of wavelength of light/laser by Diffraction grating.
5. Determination of wavelength of sodium light by Fresnel's biprism.
6. The determination of resolving power of a diffraction grating.
7. The measurement of specific rotation of sugar by Polarimeter and determination of sugar concentration in a given solution.
8. Investigation of phase change with position in traveling wave and measurement of the velocity of sound by C.R.O.
9. To study the combinations of harmonic motion (Lissajous figures).
10. To study the parameters of waves (Beats phenomenon).
11. To study the laws of vibration of stretched string using sono meter.

Lab Title: Lab-IV: Modern Physics Lab

Course Code: PHY-406

Credit Hours: 1(0-1)

Pre-requisites:

Objectives: Enhance classroom learning of modern physics by performing some milestone physics experiments, and learn basic skill and technique in data acquisition and analysis, as well as in writing lab reports.

List of Experiments:

1. To measure Planck's constant by studying photoelectric effect.
2. To measure work function of a metal and verification of Richardson's equation.
3. Determination of dielectric constant of liquid and solid.
4. To determine the characteristic of G. M. tube and measure the range and maximum Energy of particles.
5. Measurement of half-life of a radioactive source.
6. Characteristics of G.M. counter and study of fluctuations in random process.
7. To determine charge of an electron by Millikan's oil drop method.

Lab Title: Lab-V: Electronics Lab

Course Code: PHY-511

Credit Hours: 2(0-2)

Pre-requisites:

Objectives:

The main goals of this laboratory course are to make students familiar with practical knowledge and skills for the use of basic electrical equipment's, components and devices.

List of Experiments:

1. Showing relation of two physical quantities by means of Graphs.
2. Study of CRO and Frequency generator.
3. Characteristics of semiconductor diode.
4. Characteristics of Zener diode.
5. Single phase Half wave rectifiers with inductive and capacitive filters.
6. Single phase Full wave rectifiers with inductive and capacitive filters.
7. Use of diode as Logic gates.
8. Characteristics of transistor under CE
9. Characteristics of transistor under CB
10. Characteristics of transistor under CC
11. To construct an RC coupled Single stage amplifier) Using transistor as an amplifier.
12. Using transistor as Multi vibrator.(A stable, Bi stable and Mono Stable Multi vibrator)
13. To construct RC oscillator using Transistor.
14. Characterization of op-amp.

Lab Title: Lab-VI: Optics Lab

Course Code: PHY-512

Credit Hours: 2(0-2)

Objectives: The main objectives of this lab course are to introduce the students with the theory and working of the various experiments related to optics.

List of Experiments:

1. Experiments demonstrating optical phenomena such as interference, diffraction, linear motion, reflection, refraction, dispersion
2. Michelson interferometry
3. Measurement of refractive index using interferometry.
4. Measurement of the speed of light, diffraction gratings and multiple-slit interference
5. Thin film interference and Newton's rings, use of digital cameras for optics experiments
6. Lambert-Beer's law
7. Optical polarization
8. Magneto-optical Faraday rotation.

Lab Title: Lab-VII: Spectroscopy Lab

SEMESTER BREAK UP SCHEME OF STUDIES
BS PHYSICS (MORNING/EVENING)
Applicable for session 2021-2025 and onward in Main Department and Affiliated Colleges

(Approved in 4th Academic Council Meeting)
Department of Physics, Ghazi University, D.G.Khan

Course Code: PHY-611

Credit Hours: 2(0-2)

Objectives: The main objectives of this lab course are to introduce the students with the theory and working of the various experiments related to spectra of atoms and molecules. To equip the student with enough information to be able to interpret the output signals from spectroscopic instruments.

List of Experiments:

1. Measurement of wavelengths of sodium light, difference of wave lengths and thickness of thin film e.g. mica using Michelson interferometer.
2. The study of spectra using Fabry-Perot interferometers.
3. The determination of Cauchy's constants using spectrometer.
4. To study some aspects of Ferromagnetism by drawing B. H. curve.
5. Measurement of speed of light using laser source rotating mirror method.
6. To study Zeeman Effect.
7. To determine e/m of an electron using a fine beam tube.
8. To study Hall effect in an n-type/p-type semiconductor or a metal.
9. To measure the critical potential of mercury by Frank-Hertz method.

Title: Project
Course Code: PHY-699
Credit Hours: 30-3)

- Maximum limit of students in one project is 05.

Course Title: Translation of Quran-I
Course code: IS-301
1(1-0) Non Credit

کورس کا تفصیلی خاکہ

ہفتہ نمبر	بنیادی عنوان	تفصیل
.1	تدریسی کورس کا تعارف	کورس کا تعارف، اہمیت، مقاصد، اہداف اور ترتیب
.2	سورۃ البقرہ	آیات 1-16 کا مطالعہ
.3	سورۃ البقرہ	آیات 74-83 کا مطالعہ
.4	سورۃ البقرہ	آیات 104-113 کا مطالعہ
.5	سورۃ البقرہ	آیات 130-141 کا مطالعہ
.6	سورۃ البقرہ	کا مطالعہ188آیات 153-167 اور آیت نمبر
.7	سورۃ البقرہ	تک کا مطالعہ232 نیز 226-216-215 اور 201-200آیات

SEMESTER BREAK UP SCHEME OF STUDIES
BS PHYSICS (MORNING/EVENING)
Applicable for session 2021-2025 and onward in Main Department and Affiliated Colleges

(Approved in 4th Academic Council Meeting)
Department of Physics, Ghazi University, D.G.Khan

.8	سورۃ البقرہ	کا مطالعہ 255-254آیات233- 242 اور
.9	**وسطی امتحان**	
.10	سورۃ آل عمران	اور 96-110 کا مطالعہ34-26آیات
.11	سورۃ آل عمران	130-144 آیات کا مطالعہ
.12	سورۃ آل عمران	آیات 169-180 کا مطالعہ
.13	سورۃ آل عمران	آیات181-194 کا مطالعہ
.14	سورۃ النساء	آیات 4-14کا مطالعہ
.15	سورۃ النساء	آیات 19-25کا مطالعہ
.16	سورۃ النساء	آیات 34-43کا مطالعہ
.17	سورۃ النساء	آیات 58-70کا مطالعہ
.18	سورۃ النساء	کا مطالعہ 137-127 اور 93، 92-87-85آیات

مجوزہ فہرست تراجم القرآن

۱۔	موضح القرآن	شاہ عبدالقادر دہلوی
۲۔	فتح القرآن	مولانا فتح محمد جالندھری
۳۔	ترجمہ قرآن مجید	حافظ نذر احمد
۴۔	آسان ترجمہ قرآن	سید شبیر احمد
۵۔	احسن البیان	مولانا محمد جوناگڑھی
۶۔	ترجمہ ضیاء القرآن	پیر کرم شاہ الازہری
۷۔	آسان ترجمہ قرآن	مولانا محمد تقی عثمانی
۸۔	ترجمہ قرآن	مولانا اشرف علی تھانوی
۹۔	کشف الرحمٰن	مولانا احمد سعید دہلوی
۱۰۔	ترجمہ تبیان القرآن	مولانا غلام رسول سعیدی
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۱۳۔	ترجمہ قرآن	سید ابوالاعلیٰ مودودی
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Course Title: Translation of Quran-II

Course code: IS-401

1(1-0) Non Credit

ہفتہ نمبر	بنیادی عنوان	تفصیل
.1	تدریسی کورس کا تعارف	کورس کا تعارف، اہمیت، مقاصد، اہداف اور ترتیب
.2	سورۃ المائدہ	کا مطالعہ1-11 آیات
.3	سورۃ المائدہ	کا مطالعہ32-40 آیات
.4	سورۃ المائدہ	کا مطالعہ44-56 آیات
.5	سورۃ المائدہ	کا مطالعہ87-100 آیات
.6	سورۃ الانعام	کا مطالعہ34-50 آیات
.7	سورۃ الانعام	کا مطالعہ 56-70 آیات
.8	سورۃ الانعام	کا مطالعہ74-90آیات
.9	**وسطی امتحان**	
.10	سورۃ الانعام	کا مطالعہ93-104 آیات
.11	سورۃ الانعام	کا مطالعہ136-145 آیات
.12	سورۃ التوبہ	کا مطالعہ12,17-29آیات
.13	سورۃ التوبہ	کا مطالعہ71-80آیات
.14	سورۃ یونس	کا مطالعہ46-60 آیات
.15	سورۃ یوسف	کا مطالعہ 101-111آیات
.16	سورۃ ابراہیم	کامطالعہ 22-34آیات
.17	سورۃ الحجر	کا مطالعہ51-77 آیات
.18	سورۃ النحل	کا مطالعہ97-110آیات

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۲۔	فتح القرآن	مولانا فتح محمد جالندھری
۳۔	ترجمہ قرآن مجید	حافظ نذر احمد
۴۔	آسان ترجمہ قرآن	سید شبیر احمد
۵۔	احسن البیان	مولانا محمد جوناگڑھی
۶۔	ترجمہ ضیاء القرآن	پیر کرم شاہ الازہری
۷۔	آسان ترجمہ قرآن	مولانا محمد تقی عثمانی
۸۔	ترجمہ قرآن	مولانا اشرف علی تھانوی
۹۔	کشف الرحمٰن	مولانا احمد سعید دہلوی
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۱۶۔	Quran Translation English	Dr. Mohammad Mahmoud Ghali
۱۷۔	Quran Translation English	Muhammad Asad

Course Title: Translation of Quran-III
Course code: IS-501
1(1-0) Non Credit

ہفتہ نمبر	بنیادی عنوان	تفصیل
.1	تدریسی کورس کا تعارف	کورس کا تعارف، اہمیت، مقاصد، اہداف اور ترتیب
.2	سورۃ بنی اسرائیل	آیات 23-38 کا مطالعہ
.3	سورۃ بنی اسرائیل	آیات 45-57 کا مطالعہ
.4	سورۃ الکھف	آیات 1-17 کا مطالعہ
.5	سورۃ الکھف	آیات 94-110کا مطالعہ
.6	سورۃ مریم	آیات16-36 کا مطالعہ
.7	سورۃ طٰہٰ	آیات 124-135 کا مطالعہ
.8	سورۃ الانبیاء	آیات1-20کا مطالعہ

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.9	**وسطی امتحان**	
.10	سورۃ الحج	آیات 1-13 کا مطالعہ
.11	سورۃ الحج	آیات 68-78 کا مطالعہ
.12	سورۃ المومنون	آیات 1-22 کا مطالعہ
.13	سورۃ المومنون	آیات51-71 کا مطالعہ
.14	سورۃ النور	آیات1-10کا مطالعہ
.15	سورۃ النور	آیات 27-34 کا مطالعہ
.16	سورۃ النمل	آیات 76-93 کا مطالعہ
.17	سورۃ لقمان	آیات 1-21 کا مطالعہ
.18	سورۃ السجدہ	آیات 10-22 کا مطالعہ

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Course Title: Translation of Quran-IV

Course code: IS-601

1(1-0) Non Credit

ہفتہ نمبر	بنیادی عنوان	تفصیل
.1	تدریسی کورس کا تعارف	
.2	سورۃ الفاطر	آیات8-30 کا مطالعہ
.3	سورۃ یٰسین	آیات 22-42 کا مطالعہ
.4	سورۃ یٰسین	آیات 51-67کا مطالعہ
.5	سورۃ الصافات	آیات 22-62 کا مطالعہ
.6	سورۃ الزمر	آیات1-20 کا مطالعہ
.7	سورۃ الزمر	آیات 53-70 کا مطالعہ
.8	سورۃ المؤمن	آیات 51-68 کا مطالعہ
.9	**وسطی امتحان**	
.10	سورۃ حٰم السجدہ	آیات 26-42 کا مطالعہ
.11	سورۃ الشوریٰ	آیات 37-53 کا مطالعہ
.12	سورۃ الزخرف	آیات 26-40 کا مطالعہ
.13	سورۃ محمد	آیات 20-38 کا مطالعہ
.14	سورۃ الرحمٰن	پہلے دو رکوعات کا مطالعہ
.15	سورۃ الواقعۃ	پہلے دو رکوعات کا مطالعہ
.16	سورۃ الحدید	آیات 16-29 کا مطالعہ
.17	سورۃ الحشر سورۃ الطلاق	آیات18-24 کا مطالعہ آیات 1-12 کا مطالعہ (مکمل سورت)
.18	سورۃ الانفطار سورۃ الاعلیٰ	مکمل سورت کا مطالعہ مکمل سورت کا مطالعہ

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