SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY
PESHAWAR

CURRICULUM FOR BS-PHYSICS
SESSION (2018 & Onwards)

PHYSICS

SHAHEED BENAZIR BHUTTO WOMEN UNIVERSITY PESHAWAR
DEAPRTMENT OF PHYSICS
LAYOUT FOR BS (4 YEAR) PHYSICS AS APPROVED BY HEC

Compulsory Requirements		**General Education Requirements**		**Foundation Courses in the Major subject**		**Core courses in the major subject Including Research Project/Internship requirements**		**Elective Courses within the Major Subjects**	
9 Courses		7-8 Courses		11-13 Courses		11-13 Courses		04 Courses	
25 Credit Hours		21-24 Credit Hours		36-42 Credit Hours		36-42 Credit Hours		12 Credit Hours	
Subject	Cr. hr	Subject	Cr.hr	Subject	Cr. hr	Subject	Cr. hr	Subject	Cr. Hr
ENGLISH-I	3	GOF-I	3	Mechanics	4	Quantum Mechanics – I	3	Elective-l	3
ENGLISH-II	3	GRF-I	3	Waves and Oscillations	3	Quantum Mechanics – II	3	Elective-II	3
ENGLISH-III	3	Math-III	3	Heat & Thermodynamics	3	Classical Mechanics	3	Elective-III	3
ENGLISH-IV	3	GOF-II	3	Electricity & Magnetism	4	Electronics I	3	Elective–IV	3
PAKISTAN STUDIES	2	GOF-III	3	Modern Physics	3	Electronics II	3		
ISLAMIC STUDIES/ ETHICS	2	GRF-II	3	Optics	3	Mathematical Methods for Physicists–I	3		
		Math-IV	3	Lab-I	1	Mathematical Methods for Physicists–II	3		
				Lab-II	1	Electrodynamics-I	3		
MATH-I	3			Lab-III	1	Electrodynamics-II	3		
MATH-II	3			Lab-IV	1	Statistical Physics	3		
INTRODUCTION TO INFORMATION & COMMUNICATION TECHNOLOGY	3					Nuclear Physics	3		
						Solid State Physics-I	3		
						Solid State Physics-II	3		
						Atomic & Molecular Physics	3		
						Research Project	3		
						Lab-V	2		
						Lab-VI	2		
						Lab-VII	2		
	25		21		24		51		12

Total Credit Hours: 133

RECOMMENDED REVISED SCHEME FOR BS (4 YEAR)

PROGRAMME IN PHYSICS FOR SESSION 2018-and ONWARDS

Semester-I

Course Code	Title	Cr. Hrs.	Remarks
	English-I	3	Comp-1
	Calculus	3	Math-I(Comp-7)
CSC-301	Introduction to Information & communication Technology	3	Comp-9
PHY-311	Mechanics	4	Found-1
	Islamic Studies	2	Comp-6
	Chemistry-I	3	GRF-II(Gen-6)
PHY-312	Lab-I	1	Found-7
Total		16	

Semester-II

Course Cod	Title	Cr. Hrs	Remarks
	English-II	3	Comp-2
	Multivariate Calculus-I	3	Math-II(Comp-8)
	Pakistan Studies	2	Comp-5
	Statistics	3	Comp-4
PHY-313	Electricity & Magnetism	4	Found-4
PHY-314	Lab-II	1	Found-8
Total		16	

Semester-III

Course Code	Title	Cr. Hrs.	Remarks
	English-III	3	Comp-3
	Linear Algebra-I	3	Math-III(Gen-3)
	Basics of Computer Graphics	3	GOF-I(Gen-1)
	Programming Fundamentals	3	GRF-I(Gen-2)
PHY-411	Waves & Oscillations	3	Found-2
PHY-412	Lab-III	1	Found-9
Total		16	

Semester-IV

Course code	Title	Cr. Hrs.	Remarks
	Differential Equations-I	3	Math-IV(Gen-7)
	Logic	3	GOF-II(Gen-4)
	Sociology	3	GOF-III(Gen-5)
PHY-413	Optics	3	Found-6
PHY-414	Heat &Thermodynamics	3	Found-3
PHY-415	Lab-IV	1	Found-10
Total		19	

Semester-V

Course Code	Title	Cr Hr	Remarks
PHY-511	Mathematical Methods of Physics-I	3	Maj-6
PHY-512	Electrodynamics-I	3	Maj-8
PHY-513	Classical Mechanics	3	Maj-3
PHY-514	Statistical Physics	3	Maj-10
PHY-515	Modern Physics	3	Found-5
PHY-516	Lab-V	2	Maj-16
Total		17	

Semester-VI

Course Code	Title	Cr. Hrs.	Remarks
PHY-517	Mathematical Methods of Physics-II	3	Maj-7
PHY-518	Quantum Mechanics-I	3	Maj-1
PHY-519	Electrodynamics-II	3	Maj-9
PHY-520	Electronics-I	3	Maj-4
PHY-521	Atomic & Molecular Physics	3	Maj-14
PHY-522	Lab-VI	2	Maj-17
Total		17	

Semester-VII

Course Code	Title	Cr. Hrs.	Remarks
PHY-621	Quantum Mechanics-II	3	Maj-2
PHY-622	Electronics-II	3	Maj-5
PHY-623	Solid State Physics-I	3	Maj-12
PHY-699	Project/ Thesis/ Elective-I	3	Maj-15/Elective
	Elective-II	3	Maj-11
PHY-624	Lab-VII	2	Maj-18
Total	17		

Total Credit Hours: 133

Semester-VIII

Course Code	Title	Cr. Hrs.	Remarks
	Elective-III	3	Elective
PH-625	Nuclear Physics	3	Maj-11
PHY-699	Project/ Thesis /Elective-IV	3	Maj-15/Elective
PHY-626	Solid State Physics-II	3	Maj-13
	Elective-V	3	Elective
Total		15	

List of Elective Subjects

S.No	Course Codes	Electives	Credit Hours
1.		Introduction to Plasma Physics	3
2.		Introduction to Material Science	3
3.		Environmental Physics	3
4.		Renewable energy Resources	3
5.		Particle Physics	3
6.		Computer Simulations in Physics	3
7.		Computational Physics	3
8.		Methods of Experimental Physics	3
9.		Introduction to Lasers Physics	3
10.		Electronic Materials & Devices	3
11.		Functional Material	3
12.		Introduction to Nanoscience & Nanotechnology	3
13.		Digital Electronics	3
14.		Biophysics	3

BASIC COURSES TO BE TAUGHT IN OTHER DEPARTMENTS

Sr.No	Series of approved courses	Subjects	Course Code	Credit Hours	Program in which it is offered	Semester
1.	01	Mechanics-I	PHY-301	03	BS-Statistics BS-Mathematics BS-Chemistry BS-Health & Physical Education	1st
2.	02	Mechanics-II	PHY-302	03	BS-Statistics	2nd
3.	03	Physics	PHY-303	03	BS-Computer Science	1st
4.	04	Basic Electronics	PHY-304	03	BS-Computer Science	2nd
5.	05	Introductory Electricity & Magnetism	PHY-305	03	BS-Statistics BS-Mathematics BS-Chemistry	2nd

BS-PHYSICS

SEMESTER-I

Course Code	
Course Title	English-I (Functional English)
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	Comp-1
Recommended Books	1. Kaye,E.A.(2002).Maximize your presentation Skills: How to Speak, Look and Act on your Way to the Top.Prima Lifestyle. 2. Hargie,O.(2002).Effective Presentation Skills : Practical Guide Better Speaking. 3. Powell,M.(1996).Presenting in English.Language Teaching Publications. Functional English 1. Grammar a) Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492 b) Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506 2. Writing a) Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41. 3. Reading/Comprehension b) Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2. 4. Speaking
Course Description	
Basics of Grammar ,Parts of speech and use of articles ,Sentence structure, active and passive voice ,Practice in unified sentence ,Analysis of phrase, clause and sentence structure, Transitive and intransitive verbs ,Punctuation and spelling ,**Comprehension** ,Answers to questions on a given text ,**Discussion** ,General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students) ,**Listening** ,To be improved by showing documentaries/films carefully selected by subject teachers,**Translation skills** ,**Urdu to English** ,**Paragraph writing,** Topics to be chosen at the discretion of the teacher ,**Presentation**	

skills ,Introduction Note: Extensive reading is required for vocabulary building

Course Code	
Course Title	Calculus
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	Math-I (Comp-7)
Recommended Books	1. G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", National Book Foundation, 9th ed. 2. G. Strang, "Calculus", Wellesley-Cambridge, 2nd ed., 2010. 3. E. W. Swokowski, M. Olinick, D. Pence, and J. A. Cole, "Calculus"; Pws Pub Co; 6th ed. 1994.
Course Description	
Functions and graphs (shifting and stretching), limits and continuity, differentiation (rates of change, slope of the tangent to a curve, rules for differentiation, chain rule, implicit differentiation, extrema of functions, mean value theorem, simple problems in optimization, use of derivatives in sketching, asymptotic behavior of functions, L'H'opital's rule), integration (indefinite integrals, introduction to the idea of differential equations and their solution – the initial value problem, techniques of integration, Riemann sums and definite integrals, physical interpretation as areas, mean value theorem, areas between curves, finding volumes by slicing, volumes of solids of revolution, arc lengths, areas of surfaces of revolution, centres of mass and higher moments, work), differentiation and integration of transcendental functions (exponential and logarithmic functions and applications to growth and decay problems, trigonometric and inverse trigonometric functions, hyperbolic functions), infinite series (limits of sequences of numbers, series, tests of convergence, power series, Taylor and Maclaurin series).	

Course Code	CSC-301
Course Title	Introduction to Information & Communication Technology
Credit Hours	3

Prerequisite /Co requisite	None
Remarks	Comp-9
Recommended Books	1. Norton, P.(7th ed.). Introduction to Computers .McGraw Hill . 2. Williams, S.(6th ed.). Using Information Technology: A Practic Introduction to Computer & Communications .McGraw Hill. 3. Sarah ,E., Hutchinson., Stacey, C., Sawyer.(6th ed.).Computer Communications & information: A user's introduction. 4. Leon,A., Leon.M. Fundamentals of Information Technology. Le press

Course Description

- Introducing Computer Systems, Types of computer and history of computer
- Basic Definitions & Concepts,
- **Hardware:** Computer Systems & Components. Interacting with the Computer, input and output devices
- Storage Devices, Number Systems
- **Software**: Operating Systems, Programming and Application Software, Introduction to Programming, Databases and Information Systems, Database, Introduction to RDBMS, Uses of Databases, Management information systems
- Computer Programmes, hardware software interaction, compilers and interpreters, Input-Processing-Output charts, algorithms, flowcharts, generations of language
- Networks, uses of networks, Types of networks, network topologies and protocols
- 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, threats, identity theft, online spying tools, threats to hardware hacking
- Taking protective measures
- Project Week, Review Week

Course Code	PHY-311
Course Title	Mechanics
Credit Hours	4
Prerequisite /Co requisite	None
Remarks	Found-1

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 Description

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 Acceleratio Motion under Constant Acceleration, Projectile Motion, Uniform Circular Motion, Relative Velocit 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 force 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 Frictio 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.

Rotational Motion: Rotation about a Fixed Axis, Angular Position, Angular Displacement, Angula 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. **Simple Harmonic Motion (SHM):** Amplitude, Phase, Angular Frequency, Velocity and Acceleration in SHM, Linear and Angular Simple Harmonic Oscillators, Energy in SHM, Simple Pendulum, Physical Pendulum, SHM and Uniform Circular Motion, Damped Harmonic Oscillator. **Special Theory of Relativity:** Inertial and non-inertial frame, Postulates of Relativity, The Lorentz Transformation, Derivation, Assumptions on which inverse transformation is derived, Consequence 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 importanc relativistic momentum and Relativistic energy, (Lorentz invariants) $E^2=p^2c^2+m_\circ{}^2c^4$.

Course Code	
Course Title	Islamic studies
Credit Hours	2
Prerequisite /Co requisite	None
Remarks	Comp-6
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 Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)

	8. H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989) 9. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

Course Description

Introduction to Quranic Studies

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

Study of Selected Text of Holy 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 Holy 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)

Seats 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. Quranic & Science

Islamic Economic System

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

Political System of Islam

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

Islamic History

1. Period of Khlaft-E-Rashida
2. Period of Ummayyads
3. Period of Abbasids

Social System of Islam

1. Basic Concepts Of Social System Of Islam
2. Elements Of Family

Ethical Values Of Islam

Course Code	
Course Title	Chemistry-I
Credit Hours	2+1
Prerequisite	None / None

/Co requisite	
Remarks	GRF-II(Gen-6)
Recommended Books	1. Cotton, F.A., Wikinson,G. and Gaus, P.L., "Basic Inorgan Chemistry", 3rd Ed., Wily, New York 1995. 2. Huheey, J. E., Kieter, E.A. and Kieter, R.L., "Inorganic Chemistr Principles of Structure and Reactivity", 4th Ed., Harper and Ro New York, 2001. 3. Clyde Day, M. & Selbin, J., "Theoretical Inorganic Chemistry 2nd Ed., Van Nustrand Rienhold, 1969. 4. Lee, J.D., "Concise Inorganic Chemistry ", Chapmann and Ha 5th Ed., 1996. 5. Shriver, D.F., Atkins P.W. and Langford, C. H., " Inorgan Chemistry", Oxford University Press, 2nd Ed., 1994. 6. Bassette, J., Denny, G.H. and Mendham, J., "Vogal's Textbook Quantitative Inorganic Analysis Including Elementry Instrument Analysis " English Language Book Society, 4th Ed., 1981.
Course Description	
The Periodic Law and Periodicity: Development of Periodic Table, Classification of elements based on s,p,d,f orbitals, group trends and periodic properties in s, p, d and f block elements, i.e. atomic radii, ionic radii, ionization potential, electron affinities electronagetivities and redox potential. **Principles of Chemical Bonding:** Types of chemical bonding**,** Lewis structures and prediction shapes using VSEPR model the localized bond approach, VB theory, hybridization and resinance, the delocalized approach to bonding, molecular orbital theory as applied to diatomic and polyatomic molecules, three center bonds, bonding theory of metals and intermetallic compounds, conductors, insulators and semi-conductors, bonding in electron deficie compounds, hydrogen bonding. **Acids and Bases:** Concepts of acids and bases including SHAB concept, relative strength of aci and bases, significance of pH, pKa, pKb, and buffer solutions. Theory of indicators, solubilit solubility product, common ion effect and their industrial applications. **Chemistry of p-block Elements:** Chemistry and structure of p-block elements, main emphasis on the chemistry and structure of noble gases and their compounds chemistry and structure of interhalogens, pseudohalgens and poly halides.	

Course Code	PHY-312
Course Title	LAB-I (Mechanics & Fluids)

Credit Hours	1
Prerequisite /Co requisite	Mechanics / None
Remarks	Found-7
Course Description	
Mechanics and Fluids: **List of Experiments:** 1. Modulus of Rigidity by Static & Dynamic method (Maxwell‟s needle, Barton‟s Apparatus). 2. To study the damping features of an oscillating system using simple pendulum of variable mass. 3. Measurement of viscosity of liquid by Stoke‟s / Poiseulli‟s method. 4. Surface tension of water by capillary tube method. 5. To determine the value of “g” by compound pendulum / Kater‟s Pendulum. 6. To study the dependence of Centripetal force on mass, radius, and angular velocity of a body circular motion. 7. Investigation of phase change with position in traveling wave and measurement of the velocity sound by C.R.O. 8. Determination of moment of inertia of a solid/hollow cylinder and a sphere etc. 9. To study the conservation of energy (Hook‟s law).	

Course Code	PHY-301
Course Title	Mechanics-I
Credit Hours	2+1
Prerequisite /Co requisite	None
Remarks	Found-1
Recommended Books	1. D. Halliday, R. Resnick and J. Walker, “Fundamentals of Physics”, John Wiley & Sons, 9th ed. 2010. 2. 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.

Course Description
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 Acceleratio Motion under Constant Acceleration, Projectile Motion, Uniform Circular Motion. **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, Power, Conservative and Non-conservative Forces, Work and Potential 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. **Rotational Motion:** Rotation about a Fixed Axis, Angular Position, Angular Displacement, Angular Velocity and Angular Acceleration, Rotational Inertia, Parallel-axis Theorem, Torque and Newton's Law for Rotation, Conservation of Angular Momentum. **Angular Momentum:** Angular Velocity, Conservation of angular momentum, effects of Torque and its relation with angular momentum. **Simple Harmonic Motion (SHM):** Amplitude, Phase, Angular Frequency, Velocity and Acceleration in SHM, Linear and Angular Simple Harmonic Oscillators, Energy in SHM, Simple Pendulum, SHM and Uniform Circular Motion, Damped Harmonic Oscillator.

BS-PHYSICS

SEMESTER-II

Course Code	
Course Title	English-II(Communication Skills)
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	Comp-2
Recommended Books	1. Kaye,E.A.(2002).Maximize your presentation Skills: How to Speak, Look and Act on your Way to the Top.Prima Lifestyle. 2. Hargie,O.(2002).Effective Presentation Skills : Practical Guide Better Speaking. 3. Powell,M.(1996).Presenting in English.Language Teaching Publications. <u>Communication Skills</u> **a.** Grammar 1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6. **b.** Writing 1. Writing. Intermediate by Marie-Chrisitine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking). 2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing). **c.** Reading 1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0. 2. Reading and Study Skills by John.
Course Description	
Paragraph writing: , Essay writing , CV and job application, Translation skills- Urdu to English ,Study skills, Academic skills, Presentation skills ,Personality development (emphasis on content, style and pronunciation) Note: documentaries to be shown for discussion and review.	

Course Code	

Course Title	Multivariate Calculus-I
Credit Hours	3
Prerequisite /Co requisite	Calculus /None
Remarks	Math-II (Comp-8)
Recommended Books	1. G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", National Book Foundation, 9th ed. 2. G. Strang, "Calculus", Wellesley-Cambridge, 2nd ed., 2010. 3. E. W. Swokowski, M. Olinick, D. Pence, and J. A. Cole, "Calculus"; Pws Pub Co; 6th ed. 1994.
Course Description	
Motivation and geometric background (conic sections, parametrized curves, polar coordinates, vectors and analytic geometry in space, examples of vector fields in space relevant to physics), partial derivatives (limits and continuity, partial derivatives, chain rule, role of constraints, directional derivatives – gradient vectors and tangent planes, extrema and saddle points, Lagrange multipliers, Taylor's expansion of a multi-variable function), multiple integrals (double and triple integrals, centres of mass and higher moments, areas and volumes, integration in spherical and cylindrical coordinate systems), calculus of vector fields with emphasis on physical interpretation (line integrals and work, circulation and curl, conservative fields and gradients, surface and volume integrals, divergence of a vector field, Green's theorem in a plane, Stoke's theorem, divergence theorem).	

Course Code	
Course Title	Pakistan Studies
Credit Hours	2
Prerequisite /Co requisite	None
Remarks	Comp-5
Recommended Books	

Course Description
Historical Perspective, Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.Factors leading to Muslim separatism, People and Land , Indus Civilization , Muslim advent, Location and geo-physical features. **Government and Politics in Pakistan** Political and constitutional phases,1947-58, 1958-71, 1971-77 ,1977-88 ,1988-99 ,1999 onward, **Contemporary Pakistan** , Economic institutions and issues , Society and social structure, Ethnicity , Foreign policy of Pakistan and challenges, Futuristic outlook of Pakistan.

Course Code	
Course Title	Statistics
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	Comp-4
Recommended Books	
Course Description	

Course Code	PHY-313
Course Title	Electricity & Magnetism
Credit Hours	4
Prerequisite /Co requisite	Mechanics, Calculus / Multivariate Calculus
Remarks	Foundation-4
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 Description

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 Multi-loop 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, BiotSavart 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.

Course Code	PHY-314
Course Title	LAB-II (Electricity & Magnetism)
Credit Hours	1
Prerequisite /Co requisite	Electricity & Magnetism /None
Remarks	Found-8
Course Description	

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, Theveinin, Norton).
15. To study the application of Lorentz force by CRO.

Course Code	PHY-305
Course Title	Introductory Electricity & Magnetism
Credit Hours	2+1
Prerequisite /Co requisite	None
Recommended Books	1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley & Sons, 9th ed. 2010. 2. 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.

Course Description

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.

DC Circuits: Electric Current and Current Density, Resistance and Resistivity, Ohm's Law, Power in Electric Circuits, Work, Energy, and EMF, Resistances in Series and Parallel,

Magnetic Field and Magnetic Force: Crossed Electric and Magnetic Fields and their Applications 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, BiotSavart Law: Magnetic Field due to a Current, Long Straight Wire carrying Current, 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.

BS-PHYSICS

SEMESTER-III

Course Code	
Course Title	English-III (Technical Writing & Presentation Skills)
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	Comp-3
Recommended Books	Technical Writing and Presentation Skills a) Essay Writing and Academic Writing 1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing). 2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004. 3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press. b) Presentation Skills c) Reading 1. The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editiors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).
Course Description	
Essay writing ,Academic writing Technical Report writing ,Progress report writing Note: Extensive reading is required for vocabulary building	

Course Code	
Course Title	Linear Algebra-I
Credit Hours	3
Prerequisite /Co requisite	Multivariate Calculus-I /None
Remarks	Math-III (Gen-3)
Recommended Books	1. K. F. Riley, M. P. Hobson and S. J. Bence, "Mathematical Methods for Physicists", Cambridge University Press 2006 2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th ed. CL Engineering, 2011.

Course Description

Review of vectors in 3 dimensions[(arrows) with a view of abstraction into properties of vector spaces in N dimensions (closure, associativity and commutativity of addition, existence of identity and inverse, distributivity of scalar multiplication), idea of vector norm in 3 dimensions, orthogonality, expansion in a basis, multiplication of vectors in 3 dimensions, applications of vector algebra to geometry and physics], vector spaces in N dimensions (definition, basis, inner product), linear operators, matrices (matrix algebra, functions of matrices, transpose, complex and Hermitian conjugates, trace, determinant, inverse, rank, special types of matrices diagonal, triangular, symmetric and antisymmetric, orthogonal, Hermitian and anti-Hermitian, unitary, normal, eigenvalue problem, similarity transformations and change of basis, diagonalisation, simultaneous linear equations), normal modes (oscillatory systems, elementary use of symmetries to guess normal modes, Rayleigh-Ritz method), Fourier series as an application of the ideas of linear algebra to the space of periodic functions (identification of the space of periodic functions of a certain period as a linear vector space, identification of sinusoidal functions as basis vectors in this infinite dimensional vector space, properties of Fourier series, Parseval's theorem, handling of non-Periodic functions via extending the domain of definition of function), sets of functions, problem in the context of differential operators, adjoint an Hermitian operators, properties of Hermitian operators (reality of eigenvalues orthogonality of eigenfunctions, completeness of eigenfunctions eigenbasis), Sturm-Lioville equations (Hermitian nature of Sturm-Liovill operator, transforming an equation into Sturm-Lioville form, Fourier-Legendre and Fourier-Bessel series).

Course Code	
Course Title	Basics of Computer Graphics
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	GOF-I, Gen-1
Recommended Books	
Course Description	

Course Code	CSC-402
Course Title	Programming Fundamentals
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	GRF-I Gen-2
Recommended Books	1. Hanley & Kauffman.(Latest Edition). Problem Solving and Program Design in C. Addison-Wesley . 2. Deital,H.M., & Dietal,P.J. (Latest Edition). C How to Program. Prentice Hall 3. IT series. Object oriented Programming using C++.
Course Description	
- Overview of computers and programming. - Types of programming languages(Low level, assembly language and High level Languages) - Overview of language for e.g. C++ language. - Language processors(compiler, Interpreter, Assembler) - Basics of structured and Modular programming. - Basic Algorithms and problem solving, - Development of basic algorithms, analyzing problem, designing solution, testing designed solution. - Fundamental programming constructs, - Translation of algorithms to programmes, - Data types - Variables and constants	

- Operators (Arithmetic, assignment operator, increment and decrement, operator precedence.
- Comments(Single line and multiple line)
- Control structures(If structure, if-else structure, multiple if else structure, nested if structure, compound conditions witch structure)
- Go to statement.
- Looping structure(for loop, while loop, do-While), break, continue
- Functions(Use defined and built in)
- Arrays(Sequential search, binary search, Selection sort, bubble sort, two dimensional arrays and multi dimensional arrays), Structures(Nested structures) ,Union, Enumerations, Pointers,Testing programmes.

Course Code	PHY-411
Course Title	Waves & Oscillations
Credit Hours	3
Prerequisite /Co requisite	Mechanics, Multivariate Calculus-I /None
Remarks	Found-2
Recommended Books	1. J. Pain, "The Physics of Vibrations and Waves", John Wiley, 6th ed. 2005. 2. P. French, "Vibrations and Waves", CBS Publishers (2003). 3. F. S. Crawford, Jr., "Waves and Oscillations", Berkeley Physics Course, Vol. 3, McGraw-Hill, 1968. 4. A. Hirose, and K. E. Lonngren, "Introduction to Wave Phenomena", Krieger Publications, 2003.

Course Description

Simple and Damped Simple 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, Electromagnetic Waves.

Wave Pulses: Fourier Series and Fourier Transforms, Bandwidth, Heisenberg's Uncertainty Principle.

Multi-Dimensional Waves: Plane Waves, Three-Dimensional Wave Equation, Laws of Geometric Optics, Waveguides, Cylindrical Waves. **Interference and Diffraction of Waves:** Double-Slit Interference, Single-Slit Diffraction.

Course Code	PHY-412
Course Title	LAB-III (Waves & Oscillations)
Credit Hours	1
Prerequisite /Co requisite	Waves & Oscillations
Remarks	Found-9
Course Description	
List of Experiments: 1. To determine thermal Emf and plot temperature diagram. 2. Determination of temperature coefficient of resistance of a given wire. 3. Determination of "J" by Callender – Barnis method. 4. The determination of Stefan‟s constant. 5. Calibration of thermocouple by potentiometer. 6. To determine frequency of AC supply by CRO. 7. To determine Horizontal/Vertical distance by Sextant. 8. The determination of wavelength of Sodium –D lines by Newton‟s Ring. 9. The determination of wavelength of light/laser by Diffraction grating. 10. Determination of wavelength of sodium light by Fresnel‟s bi-prism. 11. The determination of resolving power of a diffraction grating. 12. The measurement of specific rotation of sugar by Polarimeter and determination of sugar concentration in a given solution. 13. To study the combinations of harmonic motion (Lissajous figures). 14. To study the parameters of waves (Beats phenomenon). 15. To determine the Thermal conductivity of good and bad conductors using Lee‟s and Searl‟s apparatus. 16. To study the laws of vibration of stretched string using sonometer. 17. To determine the stopping potential by photo cell.	

BS-PHYSICS

SEMESTER-IV

Course Code	
Course Title	Differential Equations-I
Credit Hours	3
Prerequisite /Co requisite	Linear Algebra-I
Remarks	Math-IV (Gen-7)
Recommended Books	1. D. G. Zill and M. R. Cullen, "Differential Equations with Boundary Value Problems", 3rd ed. National Book Foundation. 2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley, 8th ed. 1999. 3. K. F. Riley, M. P. Hobson and S. J. Bence, "Mathematical Methods for Physicists", Cambridge University Press 2006.
Course Description	
Introduction to ODEs (physical motivation), First order ODEs (separable variables, homogeneous equations, exact equations, linear equations, Bernoulli equation and other examples), applications of first order ODEs linear and non-linear, linear differential equations of higher order (initial value and boundary value problems, linear dependence and independence, solutions of linear equations, constructing a second solution from a known solution, homogeneous linear equations with constant coefficients, undetermined coefficients, variation of parameters), applications of second order ODEs (simple harmonic motion, damped and forced oscillators, electrical circuits and springs), differential equations with variable coefficients (Cauchy-Euler equation, power series solution of differential equations – solutions about ordinary and singular points-Legendre's and Bessel's equations as examples), Laplace transform (Laplace transform and its inverse and properties, use in solving differential equations, Dirac delta function).	

Course Code	
Course Title	Logic
Credit Hours	3
Prerequisite	None

/Co requisite	
Remarks	GOF-II (Gen-4)
Recommended Books	
Course Description	

Course Code	
Course Title	Sociology
Credit Hours	3
Prerequisite /Co requisite	None
Remarks	GOF-III (Gen-5)
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.
Course Description	

Course Code	PHY-413
Course Title	Optics
Credit Hours	3
Prerequisite / Co requisite	Waves & Oscillations /None
Remarks	Found-6

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 Description	
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, Significance of System Matrix Elements, Cardinal Points of an Optical System with examples, Optical Instruments including Simple Magnifiers, Telescopes and Microscopes, Chromatic and Monochromatic Aberrations, Spherical Aberrations, Coma, Distortion, Stops, Pupils, Windows. **Superposition & Interference:** Standing Waves, Beats, Phase and Group Velocities, Two-Beam and Multiple-Beam Interference, Thin Dielectric Films, Michelson and Fabry-Perot Interferometers, Resolving Power, Free-Spectral Range. **Polarization:** Jones Matrices, Production of Polarized Light, Dichroism, Brewster's Law, Birefringence, Double Refraction. **Fraunhofer Diffraction:** from a Single Slit, Rectangular and Circular Apertures, Double Slit, Many Slits, Diffraction Grating, Dispersion, Resolving Power Blazed Gratings. **Fresnel Diffraction:** Zone Plates, Rectangular Apertures, Cornu's Spiral **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, Multi-layered Dielectric Films	

Course Code	PHY-414
Course Title	Heat & Thermodynamics
Credit Hours	3

Prerequisite / Co requisite	Mechanics / Multivariate Calculus-I
Remarks	Found-3
Recommended Books	1. D. Halliday, R. Resnick and K. Krane, "Physics", John Wiley, 6th ed. 2002. 2. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", John Wiley, 9th ed. 2010 3. M. W. Zemansky, "Heat and Thermodynamics", Mc Graw Hill, 7th ed. 1997. 4. M. Sprackling, "Thermal Physics" McMillan 1991. 5. B. N. Roy, "Principle of Modern Thermodynamics", Institute of Physics, London 1995.

Course Description

Basic Concepts and Definitions in Thermodynamics: Thermodynamic system, 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, Review of previous concepts. Internal energy of an ideal gas: Equipartition of Energy, Intermolecular forces, Qualitative discussion, The Virial expansion, The Van der Waals equation of state.

Thermodynamics: First law of thermodynamics and its applications to adiabatic, isothermal, cyclic and free expansion. Reversible and irreversible processes. Second law of thermodynamics, Carnot theorem and Carnot engine. Heat engine, Refrigerators. Calculation of efficiency of heat engines. Thermodynamic temperature scale: Absolute zero, Entropy, Entropy in reversible process, Entropy in irreversible process. Entropy and Second law of thermodynamics, Entropy and Probability. Thermodynamic Functions:

Thermodynamic functions (Internal energy, Enthalpy, Gibb's functions, Entropy, Helmholtz functions), Maxwell's relations, TdS equations, Energy equations and their applications. Low Temperature Physics, Joule-Thomson effect and its equations. Thermoelectricity: Thermocouple,

Seabeck's effect, Peltier's effect, Thomson effect.

Introduction to Statistical Mechanics: Statistical distribution and mean values, Mean free path and microscopic calculations of mean free path. Distribution of Molecular Speeds, Distribution of Energies, Maxwell distribution, Maxwell Boltzmann energy distribution, Internal energy of an ideal gas, Brownian Motion Legvaian equation, Qualitative description.

Course Code	PHY-415
Course Title	LAB-IV (Optics)
Credit Hours	1
Prerequisite / Co requisite	None / Optics
Remarks	Found-10

Course Description

List of Experiments:

1. Determination of e/m of an electron.
2. Determination of ionization potential of mercury.
3. Characteristics of a semiconductor diode (Compare Si with Ge diode
4. Setting up of half & full wave rectifier & study of following factors
5. Smoothing effect of a capacitor
6. Ripple factor & its variation with load.
7. Study of regulation of output voltage with load.
8. To set up a single stage amplifier & measure its voltage gain and band width.
9. To set up transistor oscillator circuit and measure its frequency by an oscilloscope.
10. To set up and study various logic gates (AND, OR, NAND etc.) using diode and to develop their truth table.
11. To set up an electronic switching circuit using transistor LDR and demonstrate its use as a NOT Gate.
12. Characteristics of a transistor.
13. To study the characteristic curves of a G. M. counter and use it to determine the absorption co-efficient of β-particle in Aluminum.
14. Determination of range of α-particles.
15. Mass absorption coefficient of lead for γ-rays using G.M counter.

16. Use of computer in the learning of knowledge of GATE and other experiments.

BS-PHYSICS

SEMESTER-V

Course Code	PHY-511
Course Title	Mathematical Methods of Physics-I
Credit Hours	3
Prerequisite / Co requisite	Mechanics, Differential Equations-I, Linear Algebra-I /None
Remarks	Maj-6
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, 8th ed. 1999.
Course Description	
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, integral transform methods, Green's functions **Complex Analysis:** Review of 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.	

Course Code	PHY-512
Course Title	Electrodynamics-I
Credit Hours	3
Prerequisite / Co requisite	Electricity & Magnetism, Multivariate Calculus-I / None
Remarks	Maj-8

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 Description

The Dirac Delta Function: Review of vector calculus using example of Dirac Delta function, the divergence of r/r2, the one-dimensional and the threedimensional 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.

Multi-pole Expansion: Approximate potential at large, the monopole and dipole terms, origin of coordinates in multi-pole, 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, multi-pole 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.

Course Code	PHY-513
Course Title	Classical Mechanics
Credit Hours	3
Prerequisite / Co requisite	Mechanics / None
Remarks	Maj-3
Recommended Books	1. T. L. Chow, "Classical Mechanics", John Wiley, 1995. 2. T. Kibble and F. Berkshire, "Classical Mechanics", World Scientific, 5th ed. 2004.

Course Description

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

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

Poisson brackets, phase space and Liouville's theorem.

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

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

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

Course Code	PHY-514
Course Title	Statistical Physics
Credit Hours	3
Prerequisite / Co requisite	Heat & Thermodynamics, Calculus-II, Statistics /None
Remarks	Maj-10
Recommended Books	1. F. Reif, "Fundamentals of Statistical and Thermal Physics", Waveland Pr Inc, 2008. 2. W. Brewer, F. Schwabl, "Statistical Mechanics", Springer, 2nd ed. 2006. 3. T. L. Hill, "Statistical Mechanics", World Scientific Publishing Company, (2004). 4. K. Huang, "Statistical Mechanics", John Wiley, 2nd ed. 1987.

Course Description

Review of Classical Thermodynamics: States, macroscopic vs. microscopic, "heat" and "work", energy, entropy, equilibrium, laws of thermodynamics, Equations of state, thermodynamic potentials, temperature, pressure, chemical potential, thermodynamic processes (engines, refrigerators), Maxwell relations, phase equilibria.

Foundation of Statistical Mechanics: Phase Space, Trajectories in Phase Space, Conserved Quantities and Accessible Phase Space, Macroscopic Measurements and Time Averages, Ensembles and Averages over Phase Space, Liouville's Theorem, The Ergodic Hypothesis, Equal a priori Probabilities. Specification of the state of a system, concept of ensembles, elementary

probability calculations, distribution functions, statistical interpretation of entropy (Boltzmann theorem).

Statistical Ensembles: Microcanonical ensemble, canonical ensemble and examples (e.g., paramagnet), calculation of mean values, calculation of partition function and its relation with thermodynamic quantities, the grand canonical ensemble and examples (e.g. adsorption), calculation of partition function and thermodynamic quantities.

Simple Applications of Ensemble Theory: Monoatomic ideal gas in classical and quantum limit, Gibb's paradox and quantum mechanical enumeration of states, equipartition theorem and examples (ideal gas, harmonic oscillator), specific heat of solids, quantum mechanical calculation of para-magnetism.

Quantum Statistics: Indistinguishability and symmetry requirements, Maxwell-Boltzmann statistics, Bose-Einstein and photon statistics, FermiDirac statistics (distribution functions, partition functions). Examples: polyatomic ideal gas (MB), black body radiation (photon statistics), conduction electrons in metals (FD), Bose condensation (BE).

Systems of Interacting Particles: Lattice vibrations in solids, van der Waals gas, mean field calculation, ferromagnets in mean field approximation.

Course Code	PHY-515
Course Title	Modern Physics
Credit Hours	3
Prerequisite / Co requisite	Mechanics, Electricity & Magnetism /None
Remarks	Found-5
Recommended Books	1. R.A. Serway, C.J. Moses and C.A. Moyer, "Modern Physics", Brooks Cole, 3rd ed. 2004. 2. Paul A. Tipler and Ralph A. Llewellyn, "Modern Physics", W H Freeman and Company 6th ed. 2012. 3. Arthur Beiser, "Concepts of Modern Physics", McGraw-Hill, 6th ed. 2002. 4. R. M. Eisberg and R. Resnick, "Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles", John Wiley, 2nd ed. 2002.

Course Description
Motivation for Non--Classical Physics: Quantum interference, blackbody radiation and ultraviolet catastrophe, Planck's quantization. **Wace-Particle Duality:** Photoelectric effect, Compton effect, production and properties of X-rays, diffraction of X-rays, concept of matter waves, de Broglie relationship, electrons are waves, electron diffraction, particulate nature of matter, contributions of Faraday (atoms exist), Thomson (electron exists), Rutherford (nucleus exists) and Bohr (quantization of energies inside an atom), wave packets and wave groups, dispersion, Heisenberg uncertainty principle, direct confirmation of quantization through Franck-Hertz experiment and spectroscopy, working of electron microscopes. **Quantum Mechanics in One Dimension:** The concept of a wavefunction, time independent Schrodinger equation and interpretation of the equation, solving the Schrodinger equation for a free particle, for a particle inside an infinite box, relationship between confinement and quantization, working of a CCD camera. **Quantum Mechanical Tunneling:** Concept of tunneling, reflection and transmission of wave functions from barriers, applications: radioactivity, scanning tunneling microscope, decay of black holes. **Quantum Mechanics in Three Dimensions:** The Hydrogen atom, orbitals, angular momentum and its quantization, orbital magnetism, Zeeman effect, concept of spin, Pauli's exclusion principle, Building of the periodic table, magnetic resonance and MRI, why is iron magnetic? White dwarfs, and neutron stars. **From Atoms to Molecules and Solids:** Ionic bonds, covalent bonds, hydrogen bonds, molecular orbitals, how crystals are different from amorphous solids? Why and how do metals conduct electricity? Bands in solids, semiconductors, introduction to LED's and lasers, introducing grapheme. **Nuclear Structure:** Size and structure of nucleus, nuclear forces, radioactivity and nuclear reactions, radiocarbon dating.

Course Code	PHY-516
Course Title	LAB-V (Electronics)
Credit Hours	2
Prerequisite	Electronics-I
Remarks	Maj-16

Course Description
Electronics: List of Experiments 1. Determination of e/m of an electron. 2. Determination of ionization potential of mercury. 3. Characteristics of a semiconductor diode (Compare Si with Ge diode) 4. Setting up of half & full wave rectifier & study of following factors 5. Smoothing effect of a capacitor 6. Ripple factor & its variation with load. 7. Study of regulation of output voltage with load. 8. To set up a single stage amplifier & measure its voltage gain and band width. 9. To set up transistor oscillator circuit and measure its frequency by an oscilloscope. 10. To set up and study various logic gates (AND, OR, NAND etc.) using diode and to develop their truth table. 11. To set up an electronic switching circuit using transistor LDR and demonstrate its use as a NOT Gate. 12. Characteristics of a transistor. 13. To study the characteristic curves of a G. M. counter and use it to determine the absorption co-efficient of β-particle in Aluminum. 14. Determination of range of α-particles. 15. Mass absorption coefficient of lead for γ-rays using G.M counter. 16. Use of computer in the learning of knowledge of GATE and other experiments.

BS-PHYSICS

SEMESTER-VI

Course Code	PHY-517
Course Title	Mathematical Methods of Physics-II
Credit Hours	3
Prerequisite / Co requisite	Mathematical Methods of Physics-I/None
Remarks	Maj-7
Recommended Books	1. M.L. Boas, 'Mathematical Methods in Physical Sciences', John Wiley & Sons, New York (1989). 2. C. Wa Wong, 'Introduction to Mathematical Physics', Oxford University Press, New York (1991). 3. Hassani, 'Foundations of Mathematical Physics', Prentice Hall International Inc" Singapore. 4. Chattopadhyay, 'Mathematical Physical', Wiley Eastern Limited, New Delhi, (1990). 5. H, Cohen, 'Mathematics for Scientists & Engineers' Prentice Hall International Inc., New Jersey (1992).
Course Description	
Group Theory: Introduction to groups, group representation, invariant subgroups and factor groups, discrete groups Dihedral groups, continuous groups-O groups, SU(2) groups, Lie groups**.** **Integral Transforms:** The integral transforms, Fourier transform, Convolution theorem, Parseval's theorem, elementary Laplace transform and its applications. **Boundary Value Problems and Green's Functions:** Boundary value problems in Physics, Non-homogeneous boundary value problems and Green's functions, Green's functions for one-dimensional problems, Eigen function expansion of Green's function, construction of Green's functions in higher dimensions.	

Course Code	PHY-518
Course Title	Quantum Mechanics-I
Credit Hours	3
Prerequisite / Co requisite	Modern Physics /None
Remarks	Maj-1
Recommended Books	1. D.J. Griffiths, "Introduction to Quantum Mechanics", Addison-

	Wesley, 2nd ed. 2004.R. 2. Liboff, "Introductory Quantum Mechanics", Addison-Wesley, 4 ed. 2002. 3. N. Zettili, "Quantum Mechanics: Concepts and Applications", John Wiley, 2nd ed. 2009.
Course Description	
Waves and Particles: Introduction to the fundamental ideas of quantum mechanics: Electromagnetic waves and photon, material particles and matter waves, quantum description of a particle, wave packets, particle in a time-independent scalar potential, order of magnitude of the wavelength associated with material particles, constraints imposed by uncertainty relations, one-dimensional Gaussian wave packet: Spreading of the wave packet, stationary states of a particle in one-dimensional square potential, behavior of a wave packet at a potential step **The Mathematical Tools of Quantum Mechanics:** One-particle wave function space, state space, Dirac notation, representations in the state space, observable, representations, review of some useful properties of linear operators, unitary operators, study of the and representations, some general properties of two observable, Q and P, whose commutator is equal to $i\hbar$, the two-dimensional infinite well. **The Postulates of Quantum Mechanics:** Statement of the postulates and their physical interpretation, the physical implications of the Schrodinger equation, the superposition principle, particle in an infinite potential well, study of the probability current in some special case, root-mean-square deviations of two conjugate observables, the density and evolution operators, Schrodinger and Heisenberg pictures, Gauge invariance, bound states of a particle in a potential well of arbitrary shape, unbound states of a particle in the presence of a potential well or barrier of arbitrary shape, quantum properties of a particle in a one-dimensional periodic structure. **Application of The Postulates to Simple Cases: Spin ½ And Two-Level Quantum Systems:** Spin ½ particles, quantization of the angular momentum, illustration of the postulates in the case of a spin ½, general study of two level systems, Pauli matrices, diagonalization of a 2×2 hermitian matrix, System of two spin ½ particles, Spin ½ density matrix, Spin ½ particle in a static magnetic field and a rotating field, Magnetic resonance **The One-Dimensional Harmonic Oscillator:** Importance of the harmonic oscillator in physics, eigenvalues and eigenstates of the Hamiltonian, mean value and root-mean-square deviations of X and P in state , Some examples of harmonic oscillators, study of the stationary states in the	

representation, Hermite polynomials, solving the Eigenvalues of the harmonic oscillators by the polynomial method, study of the stationary states in the representation, isotropic three-dimensional harmonic oscillator, charged harmonic oscillator placed in a uniform electric field, coherent states, Normal vibrational modes of coupled harmonic oscillators, vibrational modes of an infinite linear chain of coupled harmonic oscillators, phonons, onedimensional harmonic oscillator in thermodynamics equilibrium at a temperature T

General Properties of Angular Momentum in Quantum Mechanics:
concept of angular momentum in quantum mechanics, commutation relations, application to orbital angular momentum, spherical harmonics, rotation operators, rotation of diatomic molecules, angular momentum of stationary states of a two-dimensional harmonic oscillator, charged particle in a magnetic field and Landau levels

Particle in a Central Potential: The Hydrogen atom, Stationary states of a particle in a central potential, motion of the center of mass and relative motion for a system of two interacting particles, Hydrogen atom, Hydrogenlike systems, A solvable example of a central potential: the isotropic threedimensional harmonic oscillator, probability currents associated with the stationary states of the hydrogen atom, The hydrogen atom placed in a uniform magnetic field, para-magnetism and diamagnetism, Zeeman effect, study of some atomic orbitals, vibrational-rotational levels of diatomic molecules.

Course Code	PHY-519
Course Title	Electrodynamics-II
Credit Hours	3
Prerequisite / Co requisite	Electrodynamics-I / None
Remarks	Maj-9
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 Description	

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.

Course Code	PHY-520
Course Title	Electronics-I
Credit Hours	3
Prerequisite / Co requisite	Modern Physics /None
Remarks	Maj-4
Recommended Books	1. Thomas L. Floyd, "Electronics Fundamentals: Circuits, Devices and Applications", Prentice Hall, 8th ed., 2009. 2. B. Grob, "Basic Electronics", McGraw-Hill, Tch ed. 1997. 3. B. Streetman and S. Banerjee "Solid State Electronics Devices", Prentice Hall, 6th ed. 2005. 4. A. Bar-lev, "Semiconductor and Electronics Devices", Prentice Hall, 3rd ed. 1993. 5. D. H. Navon and B. Hilbert, "Semiconductor Micro-devices and Materials", CBS College Publishing, 1986. 6. A. P. Malvino, "Electronic Principles", McGraw-Hill, 7th ed. 2006. 7. R. T. Paynter, "Introductory Electric Circuits", Prentice Hall, 1998.

Course Description

The Semiconductor Diode: Metals, insulators and semiconductors, Conduction in Silicon and Germanium, The forbidden energy gap, n and p type semiconductors, the junction diode, diode voltage-current equation, Zener diodes, light emitting diodes, photodiodes, capacitance effects in the pn junction.

The Diode as Rectifier and Switch: The ideal diode model, the half wave rectifier, the full wave rectifier, the bridge rectifier, measurement of ripple factor in the rectifier circuit, the capacitor filter, the ∏ filter, the ∏-R filter, the voltage doubling rectifier circuit, rectifying AC voltmeters, diode wave clippers, diode clampers.

Circuit Theory and Analysis: Superposition theorem, Thevenin's Theorem, Norton's Theorem, Model for circuit, one port and two-port network, Hybrid parameter equivalent circuit, Power in decibels.

The Junction Transistor as an Amplifier: Transistor voltage and current designations, the

junction transistors, the volt-ampere curve of a transistor, the current amplification factors, the load line and Q point, the basic transistor amplifiers, the common emitter amplifier, the trans-conductance gm, performance of a CE amplifier, relation between Ai and Av, the CB amplifier, the CC amplifier, comparison of amplifier performance. **DC Bias for the Transistor:** Choice of Q point, variation of Q point, fixed transistor bias, the four resistor bias circuit, design of a voltage feedback bias circuit, Common emitter, common collector, common base biasing. **Field Effect Transistor:** What is /field effect transistor, JFET: Static characteristics of JFET, Metal oxide semiconductor Field Effect Transistor (MOSFET of IGFET): enhancement and depletion mode, FET biasing techniques, Common drain, common source and common gate, fixed bias and self-bias configurations, Universal JFET bias curve, Darlington pair. **Operational Amplifiers:** The integrated amplifier, the differential amplifier, common mode rejection ratio, the operational amplifier, summing operation, integration operation, comparator, milli-voltmeter.

Course Code	PHY-521
Course Title	Atomic & Molecular Physics
Credit Hours	3
Prerequisite / Co requisite	Quantum Mechanics-I
Remarks	Maj-14
Recommended Books	1. C. J. Foot, “Atomic Physics”, Oxford University Press, 2005. 2. B. H. Bransden and C. J. Joachain, “Physics of Atoms and Molecules”, Pearson Education, 2nd ed. 2008. 3. W. Demtroder, “Atoms, Molecules and Photons”, y, Springer, 2nd ed. 2010. 4. C. N. Banwell and E. M. McCash, “Fundamentals of Molecular Spectroscopy”, McGraw-Hill, 4th ed. 1994. 5.J. M. Hollas, “Basic Atomic & Molecular Spectroscopy”, John Wiley, 2002.

Course Description
One Electron Atoms: Review of Bohr Model of Hydrogen Atom, Reduced Mass, Atomic Units and Wavenumbers, Energy Levels and Spectra, Schrodinger Equation for One-Electron Atoms, Quantum Angular Momentum and Spherical Harmonics, Electron Spin, Spin-Orbit interaction. Levels and Spectroscopic Notation, Lamb Shift, Hyperfine Structure and Isotopic Shifts. Rydberg Atoms. **Interaction of One-Electron Atoms with Electromagnetic Radiation:** Radiative Transition Rates, Dipole Approximation, Einstein Coefficients, Selection Rules, Dipole Allowed and Forbidden Transitions. Metastable Levels, Line Intensities and Lifetimes of Excited States, Shape and Width of Spectral Lines, Scattering of Radiation by Atomic Systems, Zeeman Effect, Linear and Quadratic Stark Effect. **Many-Electron Atoms:** Schrodinger Equation for Two-Electron Atoms, Para and Ortho States, Pauli's Principle and Periodic Table, Coupling of Angular Momenta, L-S and J-J Coupling. Ground State and Excited States of MultiElectron Atoms, Configurations and Terms. **Molecular Structure and Spectra:** Structure of Molecules, Covalent and Ionic Bonds, Electronic Structure of Diatomic Molecules, Rotation and Vibration of Diatomic Molecules, Born-Oppenheimer Approximation. Electronic Spectra, Transition Probabilities and Selection Rules, FrankCondon Principle, H2+ and H2. Effects of Symmetry and Exchange. Bonding and Anti-bonding Orbitals. Electronic Spin and Hund's Cases, Nuclear Motion: Rotation and Vibrational Spectra (Rigid Rotation, Harmonic Vibrations). Selection Rules. Spectra of Triatomic and Polyatomic Molecules, Raman Spectroscopy, Mossbauer Spectroscopy.

Course Code	PHY-522
Course Title	LAB-VI (Modern Physics)
Credit Hours	2
Prerequisite / Co requisite	Modern Physics
Remarks	Maj-17
Course Description	
Modern Physic : **List of Experiments:**	

1. To study the characteristics of a Geiger-Muller counter and to examine the attenuations of beta particles in Al-and Pb foils.
2. Measurement of the half-life of a radio nuclide. To study the pulse-height as a function of the H.H.T. in a scintillation counter.
3. Measurement of the spectrum of gamma rays from a radioisotope. Shielding and attenuation of gamma rays.
4. To study the characteristics of a solid-state detector and use it to measure the spectra of alpha and beta particles.
5. Use of a Lithium-drifted Ge-counter for gamma spectroscopy and to compare its performance with that of a NA l-detector.
6. AC circuits and dielectric constants of water and ice.
7. Radio frequency measurement. Skin-effect, etc.
8. Experiments with transmission lines.
9. Measurement of characteristic impedance. Velocity. Standing wave ratio, etc.

BS-PHYSICS

SEMESTER-VII

Course Code	PHY-621
Course Title	Quantum Mechanics-II
Credit Hours	3
Prerequisite / Co requisite	Quantum Mechanics-I /None
Remarks	Maj-2
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 Description

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 Multi-pole moments, Evolution of two angular momenta J1 and J2 coupled by an interaction aJ1 . J2.

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 H2+ ion

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 1s, 2s and 2p 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 symmetrizati

postulate, difference between bosons and fermions, Pauli's exclusion principle, many-electrons ato and their electronic configurations, energy levels of the helium atom, configurations, term multiplets, spin isomers of hydrogen (ortho and parahydrogen).

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

Course Code	PHY-622
Course Title	Electronics-II
Credit Hours	3
Prerequisite / Co requisite	Electronic-I/None
Remarks	Maj-5
Recommended Books	1. Thomas L. Floyd, "Electronics Fundamentals: Circuits, Devices and Applications", Prentice Hall, 8th ed. 2009. 2. B. Grob, "Basic Electronics", McGraw-Hill, Tch ed. 1997. 3. B. Streetman and S. Banerjee "Solid State Electronics Devices", Prentice Hall, 6th ed. 2005. 4. A. Bar-lev, "Semiconductor and Electronics Devices", Prentice Hall, 3rd ed. 1993. 5. D. H. Navon and B. Hilbert, "Semiconductor Micro-devices and Materials", CBS College Publishing, 1986. 6. A. P. Malvino, "Electronic Principles", McGraw-Hill, 7th ed. 2006. 7. R. T. Paynter, "Introductory Electric Circuits", Prentice Hall, 1998.
Course Description	
Amplifiers and their Frequency Response: Cascade amplifier, The Amplifier pass band, The frequency plot, Low frequency plot, Low frequency limit, The un-bypassed emitter resistor, high frequency equivalent circuit, The Miller Effect, high frequency limit of transistor, bandwidth of a cascade amplifier. **Feedback:** Positive and Negative feedback, Principle of feedback amplifier, stabilization of gain by negative feedback, Bandwidth improvement with negative feedback,	

Reduction of nonlinear distortion, control of amplifier output and input resistance, current series feedback circuit, voltage shunt feedback circuit.

Oscillators: Introduction, Classification of oscillators, Damped and undamped oscillators, the oscillatory circuit, frequency stability of an oscillator, essentials of a feedback LC oscillator, tuned base oscillator, Hartley oscillator, Colpitis oscillator, crystal oscillator.

Power Amplifiers: Introduction, Power relation in class-A amplifiers, effect of thermal environment, determination of the output distortion, class-B amplifier, efficiency of class-A and class-B amplifiers.

Modulation and Demodulation: Introduction, carrier wave modulation, Need for modulation, radio Broadcasting, Methods of modulation, amplitude modulation, Forms of amplitude modulation, single side band system of modulation, Diode for linear detector for amplitude modulation, High power level amplitude modulation, automatic volume control, Frequency modulation.

Multivibrators: Multivibrators, Basic types of Multivibrators, uses of Multivibrators, Astable Multivibrators, Mono-stable Multivibrators, Bi-stable Multivibrators, Schmitt Trigger Circuit.

Integrated Circuits: Introduction, Integrated circuit advantages and drawbacks, scale of integration, classification of integrated circuit by structure, Classification of integrated circuit by function, comparison between different integrated circuit. Integrated circuit terminology, Integrated circuit fabrication, Basic processing steps. Silicon device processes Silicon wafer preparation, diffusion, Oxidation photolithography, Chemical vapour deposition, Metallization, Circuit probing, Scribing and separating into chips, Mounting and packing applications of integrated circuit.

Digital Circuits: Decimal, Binary, Octal, hexadecimal number systems, conversion of decimal numbers to any other number system and vice-versa, Binary codes, OR, AND, NOT, NAND, NOR logic gates, Boolean Algebra. Boolean expressions, simplification of Boolean expression using Boolean Algebra.

Course Code	PHY-623
Course Title	Solid State Physics-I
Credit Hours	3
Prerequisite / Co requisite	Quantum Mechanics-I, Statistical Physics / None
Remarks	Maj-12

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. S. R. Elliott, "The Physics and Chemistry of Solids", John Wiley, 1998 4. M. A. Omar, "Elementary and Solid State Physics", Pearson Education, 2000. 5. H. M. Rosenberg, "The Solid State", Oxford Science Publication, 3rd ed. 1988. 6. M. A. Wahab, "Solid State Physics", Narosa Publishing House, 1999
Course Description	
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 Monoatomic 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.	

Course Code	PHY-624
Course Title	LAB-VII

Credit Hours	2
Prerequisite /Co requisite	Modern Physics / Nuclear Physics
Remarks	Maj-18

Course Description

Advanced Experiments:

List of Experiments:

1. Measurement of the total neutron cross-section

2. To prove the Rutherford law of scattering of charged particles.

3. Measurement of the spectrum of gamma rays from a radioisotope (e.g.Cs) and study of their photoelectric and Compton absorption.

4. Source strength of C060 by gamma coincidence methods.

5. Determination of the constituents of substance by activation analysis.

6. To examine the characteristics of a Solid-State detector and to use it for alpha and beta Spectroscopy and compare the results with those obtained by a scintillation counter.

7. . The use of an analogue computer for solving differential equations.

8. To examine the stopping-power of various substances for thermal neutrons.

9. Determination of Planck's constant (h) by using the photoelectric effect.

10. Determination of the charge on an electron (e) by Millikan's method.

11. The Frank-hertz experiment (Measurement of excitation potential of Hg).

12. Determination of the Rydberg constant from the spectrum of hydrogen.

13. Fabry-Perot interferometer used as a gas refractometer.

14. To study the Zeeman effect for a line in the spectrum of helium.

15. Experiments with microwaves. Study of their optical properties.

16. Electron spin resonance (E.S.R.) by microwave absorption.

17. Nuclear magnetic resonance (N.M.R.) of protons in water.

18. The study of the Mossba uer effect.

19. The measurement of Hall effect in germanium and silicon.

20. To build a medium or short-wave transmitter.

21. Measurement of the conductivity of Si and Ge as a functions of temperature.

22. To determine the energy gap in silicon and Germanium.

23. Drift mobility. (Shockley-Haynes experiments for Germanium, demonstrating transistor action).

24. Simple diode manufacture and point-contact transistor.

BS-PHYSICS

SEMESTER-VIII

Course Code	PHY- 625
Course Title	Nuclear Physics
Credit Hours	3
Prerequisite / Co requisite	Modern Physics / None
Remarks	Maj-11
Recommended Books	1. E. Segre, "Nuclei and Particles", Bejamin-Cummings, 2nd ed. 1977. 2. Kaplan, "Nuclear Physics", Addison-Wisely, 1980. 3. Green, "Nuclear Physics", McGraw-Hill, 1995. 4. K. S. Krane, "Introducing Nuclear Physics", John Wiley, 3rd ed. 1988. 5. B. Povh, K. Rith, C. Scholtz, F. Zetsche, "Particle and Nuclei", 1999.

Course Description

History: Starting from Bacqurel's discovery of radioactivity to Chedwick's neutron.

Basic Properties of Nucleus: Nuclear size, mass, binding energy, nuclear spin, magnetic dipole and electric quadrupole moment, parity and statistics.

Nuclear Forces: Yukawa's theory of nuclear forces. Nucleon scattering, charge independence and spin dependence of nuclear force, isotopic spin.

Nuclear Models: Liquid drop model, Fermi gas model, Shell model, Collective model.

Theories of Radioactive Decay: Theory of Alpha decay and explanation of observed phenomena, measurement of Beta ray energies, the magnetic lens spectrometer, Fermi theory of Beta decay, Neutrino hypothesis, theory of Gamma decay, multipolarity of Gamma rays, Nuclear isomerism.

Nuclear Reactions: Conservation laws of nuclear reactions, Q-value and threshold energy of nuclear reaction, energy level and level width, cross sections for nuclear reactions, compound nucleolus theory of nuclear reaction and its limitations, direct reaction, resonance reactions, Breit-Wigner one level formula including the effect of angular momentum.

Course Code	PHY- 626
Course Title	Solid State Physics-II
Credit Hours	3

Prerequisite	Solid State Physics-I
Remarks	Maj-13
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. G. Burns, "High Temperature Superconductivity: An Introduction", Academic Press, 1992. 4. M. Fox, "Optical Properties of Solids", Oxford University Press, 2nd ed. 2010. 5. N. A. Spaldin, "Magnetic Materials: Fundamentals and Device Applications", Cambridge University Press, 2nd ed. 2010.

Course Description

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.

BS-PHYSICS

ELECTIVE COURSES

Course Code	
Course Title	Introduction to Plasma Physics
Credit Hours	03
Remarks	Elective
Recommended Books	1. F. F. Chen, "Introduction to Plasma Physics", 2nd ed. Plenum, 1995. 2. D. A. Gurnett and A. Bhattacharjee, "Introduction to Plasma Physics: with space and laboratory application", Cambridge University Press, 2005. 3. T. J. M. Boyd and J. J. Sanderson, "The Physics of Plasmas", Cambridge University Press, 2003.
Course Description	
Introduction: Occurrence of plasma, Concept of temperature, Debye shielding, the plasma parameter, Criteria for plasma.	

Course Code	
Course Title	Introduction to Material Science
Credit Hours	03
Remarks	Elective
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. 4. http://www.msm.cam.ac.uk/teaching/index.php, 5. http://www.doitpoms.ac.uk/
Course Description	
Atomic Structure of Materials, Imperfections in Solids, Microstructure, Mechanical Behavior of Materials, Polymers.	

Course Code	
Course Title	Environmental Physics
Credit Hours	03
Remarks	Elective
Recommended Books	1. E.t Booker and R. Van Grondelle, "Environmental Physics", John Wiley, 3rd ed. 2011. 2. G. Guyot, "Physics of Environment and Climate", John Wiley, 1998.

Course Description

Introduction to the Essentials of Environmental Physics: The economic system, living in green house, enjoying the sun, Transport of matter, Energy and momentum, the social and political context.

Basic Environmental Spectroscopy: Black body radiation, The emission spectrum of sun, The transition electric dipole moment, The Einstein Coefficients, Lambert – Beer's law, The spectroscopy of bi-molecules, Solar UV and life, The ozone filter.

The Global Climate: The energy Balance, (Zero-dimensional Greenhouse Model), elements of weather and climate, climate variations and modeling.

Transport of Pollutants: Diffusion, flow in reverse, ground water. Flow equations of fluid Dynamics, Turbulence, Turbulence Diffusion, Gaussian plumes in air, Turbulent jets and planes.

Noise: Basic Acoustics, Human Perceptions and noise criteria, reducing the transmission of sound, active control of sound.

Radiation: General laws of Radiation, Natural radiation, interaction of electromagnetic radiation and plants, utilization of photo synthetically active radiation.

Atmosphere and Climate: Structure of the atmosphere, vertical profiles in the lower layers of the atmosphere, Lateral movement in the atmosphere, Atmospheric Circulation, cloud and Precipitation, The atmospheric greenhouse effect.

Topo Climates and Micro Climates: Effects of surface elements in flat and widely unduling areas, Dynamic action of seliq. Thermal action of selief.

Climatology and Measurements of Climate Factor: Data collection and organization, statistical analysis of climatic data, climatic indices, General characteristics of measuring equipment. Measurement of temperature, air humidity, surface wind velocity, Radiation balance,

precipitation, Atmospheric Pressure, automatic weather stations.

Course Code	
Course Title	Renewable energy Recourses
Credit Hours	03
Remarks	Elective
Recommended Books	1. J. W. Twidell and A. D. Weir; Renewable Energy Resources; E & F.N. Spon. Ltd. London. (1986). 3. M. Iqbal; An Introduction to Solar Radiation: Academic Press, Canada. (1983). 4. S. Roberts, A Practical Guide to Solar Electricity, Prentice Hall Inc. USA, (1991). 5. M. A. Green; Solar Cells, Operating Principles, Technology, and system Application: Prentice Hall, Inc. US (1982). 6. T. J. Jansen, Solar Engineering Technology; Prentice Hall Inc. USA, (1985). 7. V. D. Hunt, Wind Power, A Book on Wind Energy Conversion System; Litton Educational Publishing Inc. (1981). 8. E. C. Price, P. N. Cheremisinoff; Biogas, Production and Utilization; Ann Arbor Science, USA, (1981). 9. I. Campbell, Biomass, Catalysts and liquid fuels; Technonic Publishing Co. Inc. USA, (1983).
Course Description	
Energy Scenarios: Importance of energy, world primary energy sources, energy demand, supplie reserves, growth in demand, life estimates, and consumption pattern of conventional energy source oil, gas, coal, hydro, nuclear etc. **Energy & Environment**: Emission of pollutants from fossil fuels and their damaging effects, a economics impact; Renewable energy and its sustainability. Renewable Scenarios: Defini renewable, promising renewable energy sources, their potential, availability, present status, existi technologies and availability.	

Solar Energy: Sun-Earth relationship, geometry, sun path and solar irradiance, solar spectrum, sol constant, atmospheric effects, global distribution, daily and seasonal variations, effects of till angl resource estimation, extraterrestrial, global, direct, diffused radiation, sun shine hours, air mas hourly, monthly and annual mean, radiation on tilt surface, measuring instruments.

Solar Thermal: Flat plate collectors, their designs, heat transfer, transmission through glas absorption transmission of sun energy, selective surfaces, performance, and efficiency; lo temperature applications: water heating, cooking, drying, desalination, their designs a performance; concentrators, their designs, power generation, performance and problems.

Photovoltaics: PV effect, materials, solar cell working, efficiencies, different types of solar cel characteristics, (dark, under illumination), efficiency limiting factors, power, spectral response, fi factor, temperature effect; PV systems, components, packing fraction, modules, arrays, controller inverters, storage, PV system sizing, designing, performance and applications.

Wind: Global distribution, resource assessment, wind speed, height and topographic effects, pow extraction for wind energy conversion, wind mills, their types, capacity, properties, wind mills f water lifting and power generation, environmental effect.

Hydropower: Global resources, and their assessment, classification, micro, mini, small and lar resources, principles of energy conversion; turbines, types, their working and efficiency for micro small power systems; environmental impact.

Biogas: Biomass sources; residue, farms, forest. Solid wastes: agricultural, industrial and municip wastes etc; applications, traditional and non-traditional uses: utilization process, gasificatio digester, types, energy forming, Environment issues. Resources availability; digester, their type sizes, and working, gas production, efficiency; environmental effects;

Geothermal: Temperature variation in the earth, sites, potentials, availability, extraction technique applications; water and space heating, power generations, problems, environmental effects.

Waves and Tides: Wave motion, energy, potentials, sites, power extraction, and transmissio generation of tides, their power, global sites, power generation, resource assessment, problem current status and future prospects.

Hydrogen Fuel: Importance of H_2 as energy carrier, Properties of H_2, production, hydrolysis, fu cells, types, applications, current status and future prospects.

Nuclear: Global generations of reserves through reprocessing and breeder reactors, growth rat prospects of nuclear fusion, safety and hazards issue.

Energy Storage: Importance of energy storage, storage systems, mechanical, chemical, biologica electrical, fuel cells etc.

Course Code	
Course Title	Computer Simulations in Physics
Credit Hours	3
Remarks	Elective
Recommended Books	1. T. Pang, "An Introduction to Computational Physics", Cambridge University Press, 2008. 2. R. Landau, M. Paez, C. Bordeianu, "A Survey of Computational Physics", Princeton University Press, 2008
Course Description	
Programming for Scientific Computation: unix/linux basics, the editingcoding- compiling-debugging-optimizing-visualizing-documenting production chain, Fortran95. **Numerical Programming:** Functions: approximation and fitting, Numerical calculus. Ordinary differential equations, Matrices, Spectral analysis, Partial differential equations. **Modeling and Simulation:** Molecular dynamics simulations, modeling continuous media Monte Carlo simulations. **Project:** A project will be chosen by the student in consultation with the instructor. Selection of the project should be done soon after the module on modelling and simulation starts and continue over the course of the rest of the semester. The final part of the course is reserved for presentation of preliminary and final results.	

Course Code	
Course Title	Computational Physics
Credit Hours	3
Remarks	Elective
Recommended Books	1. M. L. De Jong, "Introduction to Computational Physics", Addison Wesley, 1991. 2. S. T. Koonini, "Computational Physics", the Benjamin-Cummings, 1985 3. H. Gould, J. Tobochnik and W. Christian, "An Introduction to Computer Simulation Methods", Addison Wesley, 3rd ed. 2006.

	4. S. C. Chapra and R. P. Chanle, "Numerical Methods for Engineers with Personal Computer Applications", McGraw-Hill,1990. 5. S. C. Chapra, "Applied Numerical Methods with MATLAB for Engineers and Scientists", McGraw-Hill, 2nd ed. 2006.
Course Description	
Computer Languages: A brief introduction of the computer languages like Basic, C. Pascal etc. and known software packages of computation **Numerical Methods:** Numerical Solutions of equations, Regression and interpolation, Numerical integration and differentiation. Error analysis and technique for elimination of systematic and random errors **Modeling & Simulations:** Conceptual models, the mathematical models, Random numbers and random walk, doing Physics with random numbers, Computer simulation, Relationship of modeling and simulation. Some systems of interest for physicists such as Motion of Falling objects, Kepler's problems, Oscillatory motion, Many particle systems, Dynamic systems, Wave phenomena, Field of static charges and current, Diffusion, Populations genetics etc.	

Course Code	
Course Title	Methods of Experimental Physics
Credit Hours	3
Remarks	Elective
Recommended Books	1. F. James, "Statistical Methods in Experimental Physics", Wor Scientifi Company, 2nd ed. 2006. 2. M. H. Hablanian, "High-Vacuum Technology", Marcel Dekke 2nd ed.1997 3. P. Bevington and D. K. Robinson, "Data Reduction and Err Analysis for Physical Science", McGraw-Hill, 3rd ed. 2002 4. S. Tavernier, "Experimental Techniques in Nuclear and Partic Physics",Springer, 2010. 5. J. B. Topping, "Errors of Observations and Their Treatment Springer, 4th ed. 1972.
Course Description	

Vacuum Techniques, Radiation Detection and Measurement, Sensor Technology, Electronics and Electronic Instruments, Computer Introduction: Introduction to computers, Data Analysis.

Course Code	
Course Title	Introduction to Laser Physics
Credit Hours	3
Remarks	Elective
Recommended Books	1. W.T selfvast, "Laser Fundamentals", Cambridge University Press, 2nd ed.(2008). 2. O. Sevelto, "Principles of Lasers", Springers, 5th ed.(2009) 3. J. Hecht Understanding lasers: an entry-level guide, New York: IEEE Press(1994). 4. K. Thyagarajan, A.K Ghatak. "Laser Theory and Applications" New Jersey Prentice Hall. (1995).
Course Description	
Introductory concepts, energy levels of molecules and semiconductors, Radiation & thermal equilibrium, population inversion & gain, laser systems, laser applications.	

Course Code	
Course Title	Electronic Materials & Devices
Credit Hours	3
Remarks	Elective
Recommended Books	1. R. F. Pierret, "Semiconductor Device Fundamentals", Addison Wesley, 2nd ed. 1996. 2. N. Braithwaite, and G. Weaver, "Electronic Materials", MA: Butterworth, 2nd ed. 1990. 3. S. O. Kasap, "Electronic Materials and Devices", McGraw-Hill, 3rd ed. 2005. 4. R. C. O'Handley, "Modern Magnetic Materials: Principles and Applications", Wiley Inter-Science, 1999. 5. D. Jiles, "Introduction to Magnetism and Magnetic Materials", Chapman & Hall, 2nd ed. 1998.

Course Description
Semiconductor Fundamentals, Device Fabrication Processes, *PN* Junction and Bipolar Junction Transistor, Dielectric Materials, Optoelectronic Devices, Magnetism and Magnetic Materials.

Course Code	
Course Title	Functional Materials
Credit Hours	3
Remarks	Elective
Recommended Books	1. Moulson, A. J. and Herbert, J. M. "Electro-ceramics: Materials, Properties, and Applications". John and Wiley and Sons, 2003. 2. Pillai, S. O, Pillai, Sivakami, "Rudiments of Materials Science". New Age International (P) Limited Publishers, New Delhi, 2005. 3. Gersten J. I. and Smith F. W. "The Physics and Chemistry of Materials" John Wiley & Sons, Inc. New York, 2001. 4. Hidayat Ullah Khan, thesis on "Phase Transition s in Li-doped Ag(NbxTa1-x)O3 perovskite ceramics". Department of Materials Science and Engineering, The University of Sheffield, UK. Available at the Department of Physics, University of Peshawar. 5. Gersten J. I. and Smith F. W. "The Physics and Chemistry of Materials" John Wiley & Sons, Inc. New York, 2001.
Course Description	
Introduction to the functions of materials, Dielectrics, Pyroelectrics, Piezoelectrics, Ferroelectrics, Electro-Optic Materials.	

Course Code	
Course Title	Introduction to Nanoscience & Nanotechnology
Credit Hours	3
Remarks	Elective
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 Description	
Introduction, Quantum Effects, Surfaces and Interfaces, Material Properties, Tools and Instrumentation, Fabricating Nano Structures, Electrons in Nano Structures, Molecular Electronics, Nano Materials Nano Biotechnology, Nanotechnology the Road Ahead.	