Scheme of Studies

Associate Degree in *Physics*
(For Affiliated Colleges)

Semester-I

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-1	URCG-5118	Functional English	3(3-0)	Nil
GE-2	URCG-5105 URCG-5126	Islamic Studies (OR) Religious Education/Ethics*	2(2-0)	Nil
GE-3	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
ID-1	MATH-5101	Calculus-I	3(3-0)	Nil
Major-1	PHYS-5101	Mechanics	3(3-0)	Nil
Major-2	PHYS-5102	Waves and Oscillations	3(3-0)	Nil
GE-4(i)	URCG-5111	Translation of Holy Quran***	NC	Nil

Semester Total Credit Hours: **17**

Semester-II

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-4	URCG-5112	Fables, Wisdom and EPICS	2(2-0)	Nil
GE-5	URCG-5116	Science of Society-I	2(2-0)	Nil
GE-6	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil
GE-7	URCG-5127	Seerat of the Holy Prophet (SAW)	1(1-0)	Nil
ID-2	MATH-5104	Calculus-II	3(3-0)	MATH-5101
Major-3	PHYS-5103	Introduction to Electromagnetism	4(3-1)	Nil

Semester Total Credit Hours: **15**

Semester-III

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-8	URCG-5119	Expository Writing	3(3-0)	Nil
GE-9	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
GE-10	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
ID-3	MATH-5105	Linear Algebra	3(3-0)	Nil
Major-4	PHYS-5104	Modern Physics	3(3-0)	Nil
Major-5	PHYS-5105	Physics Lab-I	3(0-3)	Nil
GE-4(ii)	URCG-5111	Translation of Holy Quran***	NC	Nil

Semester Total Credit Hours: **17**

Semester-IV

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-11	URCG-5114	Basic Science	3(2-1)	Nil
GE-12	URCG-5124	Entrepreneurship	2(2-0)	Nil
GE-13	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
ID-4	MATH-5109	Ordinary Differential Equations	3(3-0)	Nil
Major-6	PHYS-5106	Theory of Thermodynamics	3(3-0)	Nil
Major-7	PHYS-5107	Physics Lab-II	3(0-3)	Nil

Semester Total Credit Hours: **16**

Degree Program Total: **65**

Semester-I

URCE-5118 Functional English Cr.H-3(3-0)

Thecourseaimsatprovidingunderstandingofawriter'sgoalofwriting(i.e.clear,organizedandeffectivecontentandtousethatunderstandingandawarenessforacademicreadingandwriting.Theobjectivesofthecoursearetomakethestudentsacquireandmasterthegrammaticalacademicwritingskills.Thecoursewouldenablethestudentstodevelopargumentativewritingtechniques.Thestudentswouldbeabletologically addspecificdetailsonthetopicssuchasfacts,examplesandstatisticalornumericalvalues.Thecoursewillalsoprovideinsighttoconveytheknowledgeandideasinanobjectiveandpersuasivemanner.Furthermore,thecoursewillalsoenhancethestudents' understanding ofethicalconsiderationsinwritingacademicassignmentsandtopicsincludingcitation,plagiarism,formatting and referencing the sources as well as the technical aspects involved in referencing.

Contents:

1. DevelopingAnalyticalSkills
2. Transitionaldevices(word,phraseandexpressions)
3. Developmentofideasinwriting
4. ReadingComprehension
5. PreciseWriting
6. Developingargument
7. Sentencestructure:Accuracy,variation,appropriateness,andconciseness
8. Appropriateuseofactiveandpassivevoice
9. OrganizationandStructureof aParagraph
10. OrganizationandstructureofEssay
11. TypesofEssays.

Recommended Books:

1. Bailey,S.(2011).Academicwriting:Ahandbookforinternationalstudents(3rded.).NewYork:Routledge.
2. Eastwood,J.(2011).ABasicEnglishgrammar.Oxford: OxfordUniversityPress.
3. Swales,J.M.,&Feak,C.B.(2012).*Academicwritingforgraduatestudents:Essentialtasksandskills* (3rded.).AnnArbor:The Universityof MichiganPress.
4. Swan,M.(2018).*PracticalEnglish usage*(8thed.). Oxford:Oxford UniversityPress.

SuggestedBooks:

1. Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). *Longman grammarof spoken and written English*. HarlowEssex:MIT Press.
2. Cresswell,G.(2004).*Writing foracademicsuccess*.London:SAGE.
3. Johnson-Sheehan,R.(2019). *Writingtoday*.DonMills:Pearson.
4. Silvia,P.J.(2019).*Howtowritealot:Apracticalguidetoproductiveacademicwriting*.Washington:American PsychologicalAssociation.
5. Thomson,A.J.,&Martinet,A.V.(1986).*APracticalEnglishGrammar*.Oxford:OxfordUniversityPress

URCI-5105 Islamic Studies 2(2-0)

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources ofIslam;Qur'anandHadith,historyandparticularculturalcontexts.Theareaseekstoprovideanintroductiontoandaspecializationin Islamthroughalargevarietyofexpressions(literary,poetic,social,andpolitical)and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology).It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anicstudies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, cultureandtheologythrough thetextualstudyof Qir'an andSunnah..

Contents

IntroductiontoQur'anicStudies

1) BasicConceptsofQur'an
2) HistoryofQuran
3) Uloom-ul-Quran

مطالعہ قرآن (تعارف قرآن، منتخب آیات کا ترجمہ و تفسیر: سورۃ البقرہ آیات 5-1، 482-482؛ سورۃ الحجرات آیات 18-1؛ سورۃ

الفرقان آیات 77-26؛ سورۃ المومنون آیات 11-1؛ سورۃ الاحزاب آیات 2، 41-6466؛ 24، 5255-؛ سورۃ الانعام آیات 151-

156؛ سورۃ الصف آیات 112-؛ الحشر آیات 1844-؛ آل عمران آیات 154154-؛ النحل آیات 12-14؛ لقمان آیت 44، حم السجدہ
آیت 56)

Introduction to Sunnah

1) Introduction of Hadith
2) Legal Status of Hadith
3) History of the compilation of Hadith
4) Kinds of Hadith

حدیث کا تعارف، حدیث کی دینی حیثیت، حفاظت و تدوین حدیث، حدیث کی اقسام
متن، حدیث: 1 درج ذیل موضوعات پر احادیث کا مطالعہ
1۔ اعمال کا اجر نیت پر منحصر ہے۔ 4۔ بہترین انسان قرآن کا طالب علم اور اس کا معلم ہے۔ 6۔ کتاب و سنت گمراہی سے بچنے کا ذریعہ ہیں 2۔ ارکان اسلام 5۔ اسلام،
ایمان، احسان اور قیامت کی نشانیاں، 2۔ بچوں کی نماز کی تلقین 7۔ دین کا گہرا فہم اللہ کی خاص
عنایت ہے 8۔ حصول علم، تلاوت قرآن اور عمل کی اہمیت و فضیلت، 5۔ روز محشر کا محاسبہ، 14۔ حقوق اللہ کے ساتھ ساتھ حقوق

العباد کا لحاظ رکھنا بھی لازم ہے 11۔ حسن خلق کی عظمت اور فحش و بدگوئی کی مذمت 14۔
دنیا و آخرت کی بھلائی کی ضامن چار چیزیں، 16۔ ہلاک کر دینے والی سات چیزیں، 12۔ بے عمل مبلغ کا عبرتناک انجام 15۔ ہر شخص نگران ہے اور ہر شخص
مسئول

1) Sirah of the Prohet
2) Importance of the Study of Sirah
3) Character building method of the Prophet

(سیرت النبی ﷺ (مطالعہ سیرت کی ضرورت و اہمیت، تعمیر سیرت و شخصیت کا نبوی منہاج اور عملی نمونے، اقامت دین کا

نبوی طریق کار، اقامت دین بعہد خلافت راشدہ، میثاق مدینہ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ

، قرآن مجید میں سیرت سرور عالم کا بیان، غزوات نبوی ﷺ کے مقاصد و حکمتیں)

Islamic Culture & Civilization

1) BasicConceptsofIslamicCulture&Civilization
2) HistoricalDevelopmentofIslamicCulture&Civilization
3) CharacteristicsofIslamicCulture&Civilization
4) IslamicCulture&CivilizationandContemporaryIssues

.2 اسلامی تہذیب و تمدن(اسلامی تہذیب کا مفہوم، اسلامی کے عوامل و عناصر، اسلامی تہذیب کی خصوصیات، ، اسلامی تہذیب
، علمی، معاشرتی اور سماجی اثرات، تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ، تہذیبی تصادم کے اثرات و نتائج، طبعی،
حیاتیاتی اور معاشرتی علوم میں مسلمانوں کا کردار، نامور مسلمان سائنسدان

Recommended Books

1) HameedullahMuhammad,―EmergenceofIslam‖,IRI,Islamabad
2) HameedullahMuhammad,―MuslimConductofState
3) HameedullahMuhammad,_IntroductiontoIslam
4) AhmadHasan,―PrinciplesofIslamicJurisprudence‖IslamicResearch,Institute,InternationalIslamicUniversity, Islamabad (1993)
5) Dr.MuhammadZia-ul-Haq,―IntroductiontoAlShariaAlIslamia‖AllamaIqbalOpenUniversity,Islamabad(2001)
6) Dr.Muhammad ShahbazManj,Teleeemat-e-Islam.

UQCE-5126 ETHICS* 2(2-0)

This course is designed for the non-Muslim students.

Contents:

1. MeaningandScopeofEthics.
2. RelationofEthicswith:
   - (a) Religion
   - (b) Science
   - (c) Law
3. HistoricalDevelopmentofMorality
   - :(a).InstinctiveMoralLife.
   - (b). Customary Morality.(c).Reflective Morality.
4. MoralTheories:
   - (a). Hedonism (Mill)(b).Intuitionism (Butler)
   - (c).Kant's MoralTheory.
5. MoralEthicsandSociety.
   - (a). Freedom and Responsibility.(b).Tolerance
   - (c). Justice
   - (d). Punishment(TheoriesofPunishment)
6. MoralTeachingsofMajorReligions:
   - a).Judaism
   - b). Christianityc). Islam
7. ProfessionalEthics:
   - a).MedicalEthicsb).Ethicsof Students
   - c). Ethics of Teachers.
   - d).BusinessEthics

RecommendedBooks:

1 WilliamLille.AnIntroductiontoEthics,LondonMethuen&Co.latest edition.
2 Titus,H.H.EthicsforToday.NewYork: AmericanBook,latest edition.
3 Hill,Thomas.EthicsinTheoryandPractice.N.Y.ThomasY.Crowel,latest edition
4 AmeerAli,S.TheEthicsofIslam.Culcutta:NoorLibraryPublishers,latestedition
5 Donaldson, D.M. Studies in Muslim Ethics. London: latest edition.
6 Sayeed, S.M.A.(Tr.) Ta'aruf-e-Akhlaqiat.Karachi:BCC&T,KarachiUniversity.

URCI-5123 Applications of Information Communication Technologies (ICT) 3 (2+1)

The course introduces students to information and communication technologies and their application inthe workplace. Objectives include basic understanding of computer software, hardware, and associatedtechnologies. How computers can be used in the workplace, how communications systems can help boostproductivity, and how the Internet technologies can influence the workplace. Students will get basicunderstanding of computer software, hardware, and associated technologies. They will also learn howcomputers are used in the workplace, how communications systems can help to boost productivity, andhowthe Internettechnologies can influence theworkplace.

Contents:

1. Introduction,OverviewofInformationTechnology.
2. Hardware:ComputerSystems&Components,StorageDevices.
3. Software:OperatingSystems,ProgrammingandApplicationSoftware.
4. DatabasesandInformationSystemsNetworks.
5. FileProcessingVersusDatabaseManagementSystems.
6. DataCommunicationandNetworks.
7. PhysicalTransmissionMedia&WirelessTransmissionMedia.
8. Applicationsofsmart phoneandusage.
9. TheInternet, BrowsersandSearch Engines.
10. Websitesandtheirtypes.
11. EmailCollaborativeComputingandSocialNetworking.
12. E-Commerce.
13. IT Securityandotherissues.
14. Cyber LawsandEthics ofusingSocialmedia.
15. UseofMicrosoftOfficetools(Word,PowerPoint,Excel)orothersimilartoolsdependingontheoperatingsystem.
16. Other ITtools/software specifictofieldofstudyofthestudentsif any.

RecommendedBook:

1. DiscoveringComputers2022:DigitalTechnology,Dataand DevicesbyMistyE.Vermaat,Susan L.sebok;17th edition.

Suggested Books:

1. ComputingEssentials2021byTimothyJ.O'LearyandLindaI.O'Leary,McGrawHillHigherEducation; 26th edition.
2. Computers:UnderstandingTechnologybyFuller,Floyd; Larson,Brian:edition2018.

MATH-5101 Calculus-I 3 (3-0)

Calculus is the mathematical study of continuous change. If quantities are continually changing, we need calculus to study what is going on. Calculus is concerned with comparing quantities which vary in a non-linear way. It is used extensively in science & engineering, since many of the things we are studying (like velocity, acceleration, current in a circuit) do not behave in a simple, linear fashion. Calculus has two major branches, differential calculus (Calculus-I) & integral calculus (Calculus-II); the former concerns instantaneous rates of change, & the slopes of curves, while integral calculus concerns accumulation of quantities, & areas under or between curves. This is the first course of the sequence, Calculus-I, II & III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts & skills needed for mathematical manipulation. It focuses on the study of functions of a single variable. Calculus-I is an introduction to differential & integral calculus: the study of change.

Contents

1 Functions & their graphs, Rates of change & tangents to curves

2 Limit of a function & limit laws, the precise definition of a limit
3 One-sided limits, continuity, Limits involving infinity; asymptotes of graphs
4 Differentiation: tangents & derivative at a point, the derivative as a function
5 Differentiation rules, the derivative as a rate of change
6 Derivatives of trigonometric functions, Chain rule, implicit differentiation
7 Related rates, linearization & differentials, higher derivatives
8 Applications of derivatives: extreme values of functions
9 Rolls' theorem, the mean value theorem, Monotonic functions & the first derivative test
10 Convexity, point of inflection & second derivative test, Concavity & curve sketching
11 Applied optimization, Antiderivatives, integration: area & estimating with finite sums
12 Sigma notation & limits of finite sums, definite integral, the fundamental theorem of calculus
13 Indefinite integrals & the substitution method, Substitution & area between curves
14 Applications of definite integrals: volumes using cross-sections
15 Volumes using cylindrical shells, arc length, Areas of surfaces of revolution
16 Transcendental functions: inverse functions & their derivatives
17 Natural logarithms, exponential functions, Indeterminate forms & L'Hôpital's rule
18 Inverse trigonometric functions

Recommended Texts

1. Thomas, G.B., Weir, M. D.,& Hass J. R. (2014).*Thomas' calculus: single variable*(13th ed./Latest). London: Pearson.
2. Stewart, J. (2015).*Calculus* (8th ed. /Latest). Boston: Cengage Learning.

Suggested Readings

1. Anton, H., Bivens I. C.,& Davis, S. (2016).*Calculus* (11th ed. /Latest). New York: Wiley.
2. Goldstein, L. J., Lay, D. C., Schneider, D. I.,& Asmar, N. H. (2017).*Calculus & its applications*(14th ed.). London: Pearson.
3. Larson, R.,& Edwards, B. H. (2013).*Calculus* (10th ed. /Latest).New York: Brooks Cole.

PHYS-5101 Mechanics Cr.H-3(3-0)

Course Brief:

Mechanics is all about motion of a body. It deals with forces, motion and further to the laws of motion in inertial frames specifically. This course provides the students a broad understanding of the physical principles of the mechanics, to describe mechanical events that involve forces acting on macroscopic objects. The main objective of this course is to create quantitative skills in the students and to motivate them to think creatively and critically about scientific problems and experiments. Students are encouraged to share their thinking with teacher and the other students to examine different problem-solving strategies.

Course Learning Objectives:

After completion of the course, students will be able

1- To understand the basic concepts of mechanics, kinematics and dynamics.

2- To understand the specific knowledge in mechanics particularly Newton's Laws and applications, dynamics of the object and conservation theorem.

3- To develop problem solving approach to answer problems in applied physics.

4- To recognize and distinguish the various types of motion like rotational motion, planetary motion and their relevant concepts.

Course Contents:

1 Motion in one/two/three dimensions.
2 Newtonian mechanics, Friction, Drag force, Work and kinetic/potential energy.
3 Linear momentum, Conservation of momentum/energy, Power, System of particles, Collisions in one/two dimensions.
4 Rotational dynamics, Moment of inertia, Principles of parallel and perpendicular axis theorem.
5 Determination of moment of inertia of various shapes.
6 Rotational dynamics of rigid bodies and its effect on the application of torque.
7 Angular momentum and its conservation, Effect of torque on the angular momentum.
8 The motion of planets and Kepler laws in detail, Motion of satellite and its energy consideration in planetary and satellite motion.
9 Fluid statics, Fluid dynamics.

Recommended Books:

1. Halliday, D., Resnick, R. & Walker, J. (2014). *Fundamentals of physics* (10th Ed.). New York: Wiley.
2. Halliday, D., Resnick, R. & Krane, K. S. (2003). *Physics* (5th Ed.). New York: Wiley.

Suggested Books:

1. Young, H. D., Freedman, R. A. & Ford, A. L. (2019). *University physics* (15th Ed.). New York: Pearson.
2. Serway, R. A. & Jewelt, J. W. (2014). *Physics for scientist and engineers* (9th Ed.). New York: Brooks/Cole.
3. Melissinos, A.C. (2008). *Experiments in modern physics.* New York: Academic press.

PHYS-5103 Waves and Oscillations 3(3-0)

Course Brief:

This course includes the very necessary and fundamental concepts of oscillations in start to develop a logical foundation for the generation of waves in a medium and even in the absence of a medium i.e electromagnetic waves. Damped oscillations in connection with resonance are elaborated followed by types of waves in terms of their respective media for propagation. Characteristic features of mechanical waves including waves in a stretched string and sound waves are learnt to students that include speed of waves, superposition, resonances, harmonics and Doppler Effect, to mention a few. Later in case of electromagnetic waves, their generation, propagation in various media, diffraction, reflection and refraction like properties are also elaborated.

Course Learning Objectives:

This course provides students an insight of the principles of waves as carriers of energy including sound and optical waves mainly. A student studying this course will understand classical as well modern physics and will also acquire the skills to apply principles to new and unfamiliar problems. Students are encouraged to share their thinking with teachers and peers and to examine different problem-solving strategies, in the said field.Students will learn that waves come from many interconnected (coupled) objects when they are vibrating together. We will discuss many of these phenomena, along with related topics, including mechanical vibrations and waves, sound waves, electromagnetic waves and optics.
S

Course Contents:

1 S.H.M and its application, energy consideration in S.H.M
2 S.H.M and uniform circular motion combination of harmonic oscillations
3 Damped harmonic oscillation, Forced oscillation, driven harmonic oscillation and resonance
4 Mechanical waves, traveling waves, linear wave equation, power & intensity in wave motion

5 Principle of superposition, standing waves, interference of waves, beats
6 Doppler effect & its applications, supersonic and shock waves
7 Measurement of speed of light by Roemer's and Fizeau's methods, reflection, refraction
8 Huygens's principle and its applications to reflection and refraction
9 Fermat's principle, conditions for interference
10 Young's double slit experiment, intensity distribution in double slit interference pattern, phasors
11 Interference from thin film
12 Introduction to diffraction pattern, single slit diffraction pattern
13 Intensity in single slit diffraction pattern using phasor, diffraction grating
14 X-ray diffraction
15 Polarization by selective absorption
16 Reflection.

Recommended Texts:

1 Resnick, R., Halliday, D. &Krane, K. S. (2002). *Physics (*5th ed.) New York: Wiley.
2 Halliday, D., Resnick, R. & Walker, J. (2014). *Fundamental of physics* (10th ed.) New York: Wiley.

Suggested Readings:

1. Sears, F. W., Zemansky, M. W. & Young, H. D. (2000). *University physics* (8th ed.) Massachusetts: Addison-Wesley.
2. Alonso, M. & Finn, E. J. (1999). *Physics* MA: Addison-Wesley.
3. Serway, R. A. &Jewelt, J. W. (2004). *Physics for scientists and engineers* (6th ed.). New York: Thomson Brooks.

4.	**URCQ-5111**	**Translation of the Holy Quran –I**	**1(1—0)NC**

ئ

6. □ئوسواں پارہ۔نا ظرہ مع تجوید
7. □بنیادی عربی گرامر
8. اسم اور اسکے متعلقات: اسم فاعل، مفعول، تفضیل، مبالغہ فعل اور
اسکی اقسام: ماضی، مضارع، امر، نہی
9. حروف علت ، حروف جارہ، مشبہ بالفعل: حرف اور اسکی اقسام
10. **Memorization**:(حفظ مع ترجمہ) تیسویں پارے کی آخری بیس سورتیں

Semester-II

URCG-5112	**Fables, Wisdom Literature, and Epic**	**2(2-0)**

The course will enable students to explore human experiences, cultivate an appreciation of the past, enrich their capacity to participate in the life of their times, and enable an engagement with other cultures and civilizations, both ancient and modern. But independently of any specific application, the study of these subjects teaches understanding and delight in the highest achievements of humanity. The three components of the course, including fables, wisdom literature and epic, will enable the learners to explore and understand the classic tradition in literature. Development of personal virtue, a deep Sufi ethic and an unwavering concern for the permanent over the fleeting and the ephemeral are some of the key themes explored in the contents that will develop an intimate connection between literature and life.

Contents

1. Fables
   The Fables of Bidpai
   The Lion and the Bull
   The Ring-dove
   The Owls and the Crows

   Selected poem from Bang-i-Dara

2. Gulistan-e- Sa'di
   Ten ḥikāyāt from John T. Platts, The Gulistan
3. Epic
   THE SHĀHNĀMA OF FIRDAUSI

Recommended Texts

1. John T. P. (1876). The Gulistan; or, Rose Garden of Shaikh Muslihu'd- Dīn Sa'dī of Shīrāz. London: Wm. II. Allen.
2. Chishti, Y.S. (1991). Sharaḥ-i bāng-i darā. Lāhaur: Maktaba-i taʿmīr-i insāniyat

Suggested Readings

1. Thackston, W. (2000). A Millennium of Classical Persian Poetry. Maryland: Ibex Publishers.
2. Wood, R. (2013). Kalila and Dimna: Fables of Conflict and Intrigue. United Kingdom: Medina Publishing, Limited.

URCG-5116 Science of Society-I 2 (2-0)

Course Description:

This course will introduce students with the subject matter of social science, its scope, nature and ways of looking at social phenomenon. It will make the participants acquaintance with the foundations of modern society, state, law, knowledge and selfhood. While retaining a focus on Pakistani state and society, students will encounter theoretical concepts and methods from numerous social science disciplines, including sociology, politics, economics anthropology and psychology and make them learn to think theoretically by drawing on examples and case studies from our own social context. Students will be introduced to the works of prominent social theorists from both western and non-western contexts. Instruction will include the use of written texts, audio-visual aids and field visits.

Learning Outcomes:

The course has following outcomes:
It will

- Introduce student with the nature of human social behavior and foundations of human group life
- Analyze the reciprocal relationship between individuals and society.
- Make student aware with the nature of societies existing in modern world
- Make students familiar with the philosophy of knowledge of social sciences
- Introduce students with the works of prominent theories explain human group behavior
- Help students to understand the foundations of society including culture, socialization, politics and economy
- Introduce students with various dimensions of social inequalities with reference to gender, race, ethnicity and religion
- Make them aware about the understanding of various themes pertains to social science in local context
- Help them recognize the difference between objective identification of empirical facts, and subjective formulation of opinionated arguments

Course Outlines:

1. **Introduction to Social Sciences**
   - Social world, Human Social behavior, Foundations of society
   - Evolution of Social sciences
   - Philosophy of Science
   - Scope and nature of social sciences
   - Modernity and social sciences
   - Branches of social science: Sociology, Anthropology, Political Science, Economics

Society and Community, Historical evolution of Society

   - Types of Societies
   - Foraging society, Horticultural society, Pastoralist society
   - Agrarian societies, Industrial society, Postindustrial society

2. **Philosophy of Knowledge in social Science and social inquiry**
   - Understanding social phenomenon
   - Alternative ways of knowing
   - Science as a source to explore social reality
   - Objectivity, Value-Free research
   - Positivism vs Interpretivism
   - Qualitative vs Quantitative

3. **Culture and Society**
   - Idea of Culture, Assumptions of Culture
   - Types, Components, Civilization and culture
   - Individual and culture. Cultural Ethnocentrism, Cultural Relativism
   - Outlook of Pakistani culture
   - Global Flows of culture, Homogeneity, Heterogeneity
4. **Social Stratification and Social inequality**
   - Dimensions of inequality, Social class
   - Gender, Race, Religion, Ethnicity, Caste
   - Patterns of social stratification in Pakistan
   - Class, caste system in agrarian society
   - Ascription vs Achievement, Meritocracy
   - Global stratification in modern world, Global patterns of inequality
5. **Personality, Self and Socialization**
   - Concept of self, Personality
   - Nature vs Nurture, Biological vs Social
   - Development of Personality
   - Socialization as a process, Agents of socialization
   - Socialization and self/group identity
6. **Gender and Power**
   - Understanding Gender
   - Social construction of Patriarchy
   - Feminism in Historical context, Gender Debates
   - Gender and Development
   - Gender issues in Pakistani society, Women Participation in politics, economy and education
   - Toward a gender sensitive society, Gender mainstreaming

Pakistan: State, Society, Economy and Polity

   - Colonialism, colonial legacy, National identity
   - Transformation in Pakistani society: Traditionalism vs Modernism
   - Economy, Informality of Economy, Modern economy and Pakistan
   - Political Economy, Sociology of Economy

Recommended Textbooks and Reading Materials:

1. Giddens, A. (2018). Sociology (11th ed.). UK: Polity Press.
2. Henslin, J. M. (2018). Essentials of Sociology: A Down-to-Earth Approach.(18th Edition) Pearson Publisher.
3. Macionis, J. J. (2016). Sociology (16th ed.). New Jersey: Prentice-Hall.
4. Qadeer, M. (2006) Pakistan - Social and Cultural Transformation in a Muslim Nation.
5. Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'Introducing Economic Sociology', Princeton University Press, Princeton.
6. Systems of Stratification | Boundless Sociology (no date). Available at: https://courses.lumenlearning.com/boundless-sociology/chapter/systems-of-stratification/
7. Jalal, A. (ed.) (1995) 'The colonial legacy in India and Pakistan', in Democracy and Authoritarianism in South Asia: A Comparative and Historical Perspective. Cambridge: Cambridge University Press (Contemporary South Asia)
8. Zaidi, S. A. (2015) Issues in Pakistan's Economy: A Political Economy Perspective. Oxford University Press. Chapter 26
9. Akhtar, A. S. (2017) The Politics of Common Sense: State, Society and Culture in Pakistan. Cambridge: Cambridge University Press.

Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'Introducing Economic Sociology', Princeton University Press, Princeton.

URCQ-5120 Exploring Quantitative Skills 3(3-0)

Since ancient times, numbers, quantification, and mathematics has played a central role in scientific and technological development. In the 21st century Quantitative Reasoning (QR) skills are essential for life as they help to better understand socio-economic, political, health, education, and many other issues an individual now faces in daily life. The skills acquired by taking this course will help the students to apply QR methods in their daily life and professional activities. This course will also change student's attitude about mathematics. It will not only polish their QR skills, but also enhance their abilities to apply these skills.

Contents:

1 What is quantitative reasoning?
2 Overview of history of mathematics and contributions of Muslim scholars.
3 Different types of standard numbers and their role in practical life scenarios.
4 Understanding relationship between parts and whole.
5 Practical life scenarios involving parts & whole.
6 Practical life scenarios involving units and rate.
7 Unit analysis as a problem solving tool
8 Understanding our World through numbers.
9 Dealing with very big and small numbers & their applications.
10 Understanding uncertainty and its applications.
11 Stock exchange and economy.
12 Money management (profit, loss, discount, zakat, simple interest, compound interest and taxation).
13 Money management in practical life scenarios like investments and federal budget.
14 Practical scenarios involving expressions.
15 Equating two expressions in one variable & using it to solve practical problems.
16 Social and economic problems involving expressions.
17 Introduce geometrical objects through architecture and landscape.
18 Dealing with social and economic issues involving geometrical objects
19 Practical scenarios involving sets and Venn diagrams.
20 Ven diagrams and their applications in different disciplines.

Recommended Books:

1 Using and understanding mathematics, 6th edition by Jeffrey Bennet and William Briggs, published by Pearson USA.
2 Mathematical thinking and reasoning 2008 by Aufmann, Lockwood, Nation & Clegg published by Houghton Mifflin Company USA.
3 Pre-calculus by Robert Blitzer 5th edition published by Pearson USA.
4 Pre-calculus Graphical, Numerical, Algebraic 8th edition by Franklin D. Demana, Bert K. Waits, Gregory D. Foley & Daniel Kennedy published by Addison Wesley USA.
5 Pre-calculus Mathematics for Calculus, 6th edition by James Stewart, Lothar Redlin and Saleem Watson published by Brooks/Cole Cengage Learning USA.
6 GRE Math Review https://www.ets.org/s/gre/pdf/gre_math_review.pdf
7 OpenAlgebra.com A free math study guide with notes and YouTube video tutorials

Additional Resources:

1 Beauty and power of mathematics: https://youtu.be/VIbjHIGMjQM
2 Types of numbers: https://youtu.be/6YytojexiOg
3 Mathematics in daily life: https://youtu.be/VIbjHIGMjQM
4 Geometry through architecture: https://youtu.be/z2Fb0R2EYo4
5 Trigonometric ratios: https://youtu.be/Jsiy4TxgIME
6 Inverse trigonometric functions: https://youtu.be/JGU74wbZMLg
7 Solving word problems involving linear equations: https://youtu.be/DfbQjiSooOo
8 GRE Preparation Materials: https://ScholarDen.com

URCG-5127 **Seerat of the Holy Prophet** مطالعہ سیرت النبی صلی اللہ علیہ وسلم **1(1-0)**

Title	Description
Semester	
Nature of Course	
Total Teaching weeks	18
Objectives of the Course	۱۔طلباء کو مطالعہ سیرۃ طیبہ کی ضرورت و اہمیت سے آگاہ کرنا ۲۔ تعمیر شخصیت میں مطالعہ سیرۃ طیبہ کے کردار کو واضح کرنا ۳۔بعثت نبوی کے موقع پر اقوام عالم کی عمومی صورت حال سے آگاہ کرنا ۴۔رسول اکرم صلی اللہ علیہ وسلم کی مکی اور مدنی زندگی کا اس طرح مطالعہ کروانا کہ طلباء ان واقعات سے نتائج کا استنباط کر سکیں ۵۔ طلباء کو عہد نبوی کی معاشرت ، سیاست ، معیشت سے آگاہ کرنا

Course Description

S.No.	Title	Description
1	حضور صلی اللہ علیہ وسلم کے ابتدائی حالاتِ زندگی	۱۔ حضور صلی اللہ علیہ وسلم کا خاندانی حسب و نسب ۲۔ پیدائش اور ابتدائی تربیت ۳۔ لڑکپن اور جوانی کے حالات زندگی
2	بعثت نبوی کے وقت دنیا کے حالات(۱)	۱۔ بعثت نبوی کے وقت اہم تہذیبیں ۲۔ عرب، مصر، حبشہ، بازنطینی، ساسانی
3	بعثت نبوی	۱۔ مکی عہد میں دعوت اسلام
4	بعثت نبوی	۱۔ مدنی عہد میں دعوت اسلام
5	خصائص النبیؐ	آپ ؐ بطور پیغامبر امن
6	خصائص النبیؐ	بحثیت استاد و معلم
7	خصائص النبیؐ	بحثیت تاجر
8	خصائص النبیؐ	بحثیت سربراہ ریاست
9	خصائص النبیؐ	ذاتی محاسن اور عا لمگیر اثرات
10	خصائص النبیؐ	ناموس رسالتؐ

غیر مسلموں سے تعلقات	اسوہ حسنہ اور عصر حاضر	11
اسوہ حسنہ کی روشنی میں گھریلو زندگی	اسوہ حسنہ اور عصر حاضر	12
مستشرقین اور مطالعہ سیرت	اسوہ حسنہ اور عصر حاضر	13
وطن سے محبت اور سیرت	اسوہ حسنہ اور عصر حاضر	15
مستشرقین کے اعتراضات اور ان کے جوابات	اسوہ حسنہ اور عصر حاضر	16

نصابی کتب

نمبر شمار	نام مؤلف	نام کتاب
1	ابن ہشام	السیرۃ النبویۃ
2	مولاناشبلی نعمانی ، سید سلمان ندوی	سیرۃ النبی صلی اللہ علیہ وسلم
3	قاضی محمد سلیمان سلمان منصور پوری	ر حمۃ اللعالمین
4	مولانا سیدابو الحسن علی ندوی	نبی رحمت صلی اللہ علیہ وسلم
5	ڈاکٹر یسین مظہر صدیقی	عہد نبوی کا نظام حکومت
6	ڈاکٹر خالد علوی	انسان کامل

حوالہ جاتی کتب

نمبر شمار	نام مؤلف	نام کتاب
1	سید ابوالاعلیٰ مودودی	سیرت سرور عالم صلی اللہ علیہ وسلم
2	مولانا صفی الرحمن مبارکپوری	الرحیق المختوم
3	پیر محمد کرم شاہ الازہری	ضیاء النبی صلی اللہ علیہ وسلم
4	ڈاکٹر اکرم الضیاء العمری	السیرۃ النبویۃ الصحیحۃ
5	مولاناعبدالرؤف دانا پوری	اصح السیر

MATH-5104 Calculus-II 3(3-0)

This is the second course of the basic sequence Calculus serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts & skills needed for mathematical manipulation. As continuation of Calculus-I, it focuses on the study of functions of a single variable. This Core Curriculum course is designed to meet the following four learning goals: Students will construct and evaluate logical arguments. Students will apply and adapt a variety of appropriate strategies to solve mathematical problems. Students will recognize and apply mathematics in contexts outside of mathematics. Students will organize and consolidate mathematical thinking through written and oral communication. Students will integrate transcendental functions, including logarithms, exponential, trigonometry and inverse trigonometric, hyperbolic and inverse hyperbolic functions, apply methods of integration, such as algebraic substitution, trigonometric substitution, partial fractions, integration by parts, and use a table of integrals, solve limit problems involving indeterminate forms with La'Hopital's Rule and convert parametric representation of curves to rectangular coordinates, represent a curve using polar coordinates, and integrate functions expressed in polar coordinates.

Contents

1 Techniques of integration: Using Basic Integration Formulas, Integration by Parts
2 Trigonometric Integrals, Trigonometric Substitutions
3 Integration of Rational Functions by Partial Fractions
4 Integral Tables & Computer Algebra Systems, Numerical Integration, Improper Integrals
5 Sequences & Infinite Series, The Integral Test, Comparison Tests
6 Absolute Convergence, The Ratio & Root Tests
7 Alternating Series & Conditional Convergence
8 Power Series, Taylor & Maclaurin Series, Convergence of Taylor Series
9 The Binomial Series & Applications of Taylor Series

10 Parametrizations of Plane Curves
11 Calculus with Parametric Curves, Polar Coordinates
12 Graphing Polar Coordinate Equations
13 Areas & Lengths in Polar Coordinates, Conic Sections, Conics in Polar Coordinates

Pre-requisite: **Calculus-I**

Recommended Texts

1 Thomas, G. B., Weir, M. D.,& Hass, J. R. (2014). *Thomas' calculus: single variable* (13th ed. /Latest).London: Pearson.
2 Stewart, J. (2012). *Calculus*, (8th ed. /Latest). New York: Cengage Learning.

Suggested Readings

1 Anton, H., Bivens, I. C.,& Davis, S. (2016). *Calculus*, (11th ed. /Latest). New York: Wiley.
2 Goldstein, L. J., Lay, D. C., Schneider, D. I., & Asmar, N. H. (2017). *Calculus &its applications* (14th ed.). London: Pearson.
3 Larson, R., & Edwards, B. H. (2013). *Calculus* (10th ed. /Latest). New York: Brooks Cole.

PHYS-5103 Introduction to Electromagnetism 3(3-0)

Course Brief:
PHYS-5103 gives an introduction in electromagnetism with emphasis on the following topics: Electric fields and currents, magnetic fields and induction, simple electrical circuits and electromagnetic oscillations.

Course Learning Objectives:
The objectives of this course are to tease out the laws of electromagnetism from our everyday experience by specific examples of how electromagnetic phenomena manifest themselves. The students would be able to describe, in words, the ways in which various concepts in electromagnetism come into play in particular situationand to predict outcomes in other similar situations.The overall goal is to use the scientific method to come to understand the enormous variety of electromagnetic phenomena in terms of a few relatively simple laws.

Course Contents:
1. Coulomb's law in vacuum, Electric field due to discrete/continuous charges distributions, Electric dipole, Electric flux, Gauss's law and its applications.
2. Electric potential due to discrete/continuous charges distributions.
3. Work and Electric potential energy.
4. Capacitors and capacitance, Capacitance for various geometries, Capacitance with Dielectrics, Energy transfer in electric circuit.
5. Power in electric circuits, Calculating current in a single loop and multiple loop by using Kirchhoff laws, Circuit analysis.
6. Growth and decay of current in RC-circuits and its analytical treatment. Magnetic field, Magnetic forces on a single point charge/current carrying conductor.
7. Torque on a current carrying loop and magnetic dipole, Biot & Savart Law and its analytical treatment and application.
8. Ampere's law and its applications, Electromagnetic induction and its laws.
9. Inductance,Inductance for various configurations, LR circuits, Growth and decay of current in RL circuits.

10. Electromagnetic Oscillation (Qualitative and Quantitative analysis using differential equations), Forced electromagnetic oscillations and resonance.
11. Alternating current circuits, Single loop RLC circuits (series and parallel), Power in AC circuits and phase angles
12. Measurement of resistance using a Neon flash bulb and condenser
13. Conversion of a galvanometer into Voltmeter & an Ammeter
14. To determine the self inductance of given coil.
15. To determine the mutual inductance b/w two coils.
16. To determine frequency of AC supply by electromagnetic sonsmeter/ Melde's experiment.
17. Measurement of low resistance coil by a Carey Foster Bridge.

Recommended Texts:

1. Halliday, D., Resnick, R. & Walker, J. (2014). *Fundamental of Physics* (10th ed.). New York: Wiley.
2. Halliday, D., Resnick, R. & Krane, K. S. (2003). *Physics* (5th ed.). New York: Wiley.

Suggested Readings:

1. Young, H. D., Freedman, R. A. & Ford, A. L. (2019). *University physics* (15th ed.). New York: Pearson.
2. Ohanian, H. C. & Markert, J. T. (2006).*Physics for engineers and scientists* (3rd ed.). New York: W. W. Norton.
3. Serway, R. A. & Jewelt, J. W. (2014). *Physics for scientist and engineers* (9th ed.). New York: Brooks/Cole.

Semester-III

URCE- 5119 Expository Writing 3 (3-0)

Thiscourse preparesundergraduatestobecomesuccessfulwritersandreadersofEnglish.Thecoursehelpsstudents develop their fundamental language skills with a focus on writing so that they can gain theconfidence to communicate in oral and written English outside the classroom. The course is divided intofiveunitsandtakesaProject-basedLearningapproach.Unitthemestargetthedevelopmentof21st centuryskills and focus on self-reflection and active community engagement. The course completion will enablethe students to develop communication skills as reflective and self-directed learners. They will be able tointellectually engage with different stages of writing process, and develop analytical and problem-solvingskillstoaddress various community-specificchallenges.

Contents

1. Self-Reflection
    - Introductiontothebasicsofthewritingprocess
    - Introductiontothestepsofessaywriting
    - Prewritingactivities:Brainstorming,listing,clusteringandfree writing
    - PracticingOutliningoftheessay
2. PersonalizedLearning
    - LearningProcess, LearningStyles, Goal Settingand LearningPlan
3. OralPresentation
    - StructureandSignificance,ContentSelectionandSlidePresentation,Peer Review
4. CriticalReadingSkills
    - IntroducingAuthenticReading(Dawnandnon-specialistacademicbooks/texts)
    - Reading Strategies and Practice: Skimming, scanning, SQW3R, Annotating, Detailed readingand note-taking, Standard Test Practice: TOEFL and IELTS, Model Review Reports andAnnotatedBibliographies
5. CommunityEngagement
    - Student-ledbrainstormingonlocalversusglobalissues,Identifyingresearchproblems
    - Draftingresearchquestions,Draftinginterview/surveyquestionsforcommunityresearch(inEng

lishor L1)
- EngagingstudentsinCritical reading,Presentinginterview/surveyinformation,Fieldwork
- WritingCommunityEngagement Project

6. Lettertothe Editor
    - Typesofletters, Format andpurposeoflettertotheeditor,Stepsinwritingletter-to-editor

Recommeded bookss

1. Bailey,S.(2011).Academicwriting:Ahandbookforinternationalstudents(3rded.).NewYork:Routledge.
2. Swales,J.M.,&Feak,C.B.(2012).*Academicwritingforgraduatestudents:Essentialtasksandskills* (3rded.).Ann Arbor:The Universityof MichiganPress.

SuggestedReadings

1. Cresswell,G.(2004).*Writingforacademicsuccess*.London:SAGE.
2. Johnson-Sheehan,R.(2019). *Writingtoday*.DonMills: Pearson.
3. Silvia,P.J.(2019).*Howtowritealot:Apracticalguidetoproductiveacademicwriting*.Washington: American PsychologicalAssociation.

URCQ-5121 Tools for Quantitative Reasoning 3(3-0)

This course is based on the course exploring quantitative skills offered in semester-III. Students will be introduced to more tools necessary for quantitative reasoning skills to live in the fast paced 21st century. Students will be introduced to importance of mathematical skills in different professional settings, social and natural sciences. These quantitative reasoning skills will help students to better participate in national and international issues like political and health issues. This course will prepare the students to apply quantitative reasoning tools more efficiently in their professional and daily life activities. This course will help them to better understand the information in form of numeric, graphs, tables, and functions.

Contents:

1. Investigating relationships between variables.
2. Exploring tools to find relationship between variables.
3. Resources and population growth.
4. Dealing with Economical, environmental and social issues.
5. Graphical and analytical approaches to solve a problem.
6. Applications of graphical & analytical approaches in social & economic problems.
7. Understanding inequalities around us.
8. Dealing with practical problems involving inequalities in different disciplines.
9. Golden ratio in sculptures.
10. Comparison of statements and their use in social and economic problems.
11. Number patterns and their applications.
12. Survival in the modern World.
13. Propositions and truth values.
14. Applications of logic.
15. Exploring and summarizing data, misleading graphs.
16. Finding a representative value in a data.
17. Measure and spread of a data, measuring degree of relationship among variables.
18. Counting the odds.

Suggested readings:

1 Bennett, J. & Briggs, W. (2015). Using and understanding mathematics (6th Edition). Pearson Education, Limited. http://xn--webducation-dbb.com/wp-content/uploads/2019/09/Jeffrey-Bennett-WilliamBriggs-Using-Understanding-Mathematics_-A-Quantitative-Reasoning-Approach-Pearson-2015.pdf

2 Blitzer, R. (2014). Precalculus. (5th Edition). Pearson Education, Limited. https://www.ilearnacademy.net/uploads/3/9/2/2/3922443/precalculus__edition_5f.pdf

Further readings:

1 Using and understanding mathematics, 6th edition by Jeffrey Bennet and William Briggs, published by Pearson USA.
2 Mathematical thinking and reasoning 2008 by Aufmann, Lockwood, Nation & Clegg published by Houghton Mifflin company USA.
3 Pre-calculus by Robert Blitzer 5th edition published by Pearson USA.
4 Pre-calculus Graphical, Numerical, Algebraic 8th edition by Franklin D. Demana, Bert K. Waits, Gregory D. Foley & Daniel Kennedy published by Addison Wesley USA.
5 Pre-calculus Mathematics for Calculus, 6th edition by James Stewart, Lothar Redlin and Saleem Watson published by Brooks/Cole Cengage Learning USA.
6 https://www.ets.org/s/gre/pdf/gre_math_review.pdf
7 OpenAlgebra.com A free math study guide with notes and YouTube video tutorials.
8 https://www.ScholarDen.com

Additional Resources (Optional):

1 Direct proportion: https://youtu.be/kuvdMCDqmKg
2 Inverse proportion: https://youtu.be/xEFyfL9YdHA
3 Identifying a linear function: https://youtu.be/AZroE4fJqtQ
4 Functions: https://youtu.be/GY6Q2f2kvY0
5 Linear functions: https://youtu.be/MXV65i9g1Xg
6 Applications of linear equations: https://youtu.be/UAYCkFMU-YM
7 Solving system of linear equations: https://youtu.be/2DzmE3_QS-E
8 Scatter Plot and correlation: https://youtu.be/qscgK78No70
9 Mean Median and Mode: https://youtu.be/B1HEzNTGeZ4
10 Pearson's correlation coefficient: https://youtu.be/jBQz2RGxCek

URCP-5122 Ideology and Constitution of Pakistan Cr.H-2(2-0)

ThiscoursefocusesonideologicalbackgroundofPakistan.Thecourseisdesignedtogiveacomprehensiveinsight abouttheconstitutionaldevelopmentsofPakistan.StartingfromtheGovernmentofIndiaAct,1935till to date, all important events leading to constitutional developments in Pakistan will be the focus ofcourse. Failure of the constitutional machinery and leading constitutional cases on the subject. Moreover,students will study the process of governance, national development, issues arising in the modern age andposing challenges to Pakistan. It will also cover the entire Constitution of Pakistan 1973. However,emphasis would be on the fundamental rights, the nature of federalism under the constitution, distributionofpowers,therightsandvariousremedies,thesupremacyofparliamentandtheindependenceofjudiciary.

Contents:

1 **Ideology ofPakistan**
IdeologicalrationalewithspecialreferencetoSirSyedAhmedKhan,AllamaMuhammadIqbaland Quaid-e-AzamMuhammad AliJinnah.
TwoNationTheoryandFactorsleadingtoMuslimseparatism.

2 ConstitutionalDevelopments
Salient Feature of the Government of India Act 1935Salient Feature of Indian Independence Act 1947ObjectivesResolution
SalientFeature ofthe1956Constitution
DevelopmentsleadingtotheabrogationofConstitutionof1956Salientfeaturesofthe 1962Constitution
CausesoffailureoftheConstitutionof1962
ComparativestudyofsignificantfeaturesoftheConstitutionof1956,1962and1973

3 Fundamentalrights

a. Principlesofpolicy
b. Federation of PakistanPresidentParliament

TheFederalGovernment

c. **Provinces**
   Governors
   ProvincialAssemblies
   TheProvincial Government

4 TheJudicature
   Supreme
   CourtHighC
   ourts
   Federal Shariat
   CourtsSupremeJudicial
   Council
   AdministrativeCourtsandtribunals

5 IslamicProvisionsinConstitution

6 SignificantAmendmentsofConstitutionofPakistan1973.

RecommendedBooks:

1. ConstitutionalandPoliticalHistoryofPakistanbyHamidKhan
2. Mahmood,ShaukatandShaukat,Nadeem.ConstitutionoftheIslamicRepublicofPakistan,3rdreedn. Lahore:LegalResearchCentre,1996.
3. Munir,Muhammad.ConstitutionoftheIslamicRepublicofPakistan:BeingaCommentaryon theConstitution ofPakistan, 1973. Lahore,Law Pub.,1975.
4. Rizvi,SyedShabbarRaza.ConstitutionalLawofPakistan:Text,CaseLawandAnalytical Commentary. 2nd re edn. Lahore:Vanguard, 2005.
5. TheTextoftheConstitutionoftheIslamicRepublicofPakistan,1973(asamended).
6. FundamentalLawsofPakistanbyA.K.Brohi.

MATH-5105 Linear Algebra 3(3-0)

Linear algebra is the study of linear systems of equations, vector spaces, and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in science and engineering. Linear Algebra plays a significant role in many areas of mathematics, statistics, engineering, the natural sciences, and the computer sciences. It provides a foundation of important mathematical ideas that will help students be successful in future coursework. The main objective of this course is to help students to learn in rigorous manner, the tools & methods essential for studying the solution spaces of problems in mathematics and in other fields& develop mathematical skills needed to apply these to the problems arising within their field of study and to various real-world problems. The student will become competent in solving linear equations, performing matrix algebra, calculating determinants, finding eigenvalues & eigenvectors and the student will come to understand a matrix as a linear transformation relative to a basis of a vector space.

Contents

1 Representation of linear equations in matrix form
2 Solution of linear system, Gauss-Jordan & Gaussian elimination method
3 Vector space, definition, examples & properties
4 Subspaces, Linear combination & spanning set
5 Linearly Dependent & Linearly Independent sets
6 Bases & dimension of a vector space
7 Intersections, sums & direct sums of subspaces, Quotient Spaces, Change of basis
8 Linear transformation, Rank & Nullity of linear transformation
9 Matrix of linear transformations

10 Eigen values & eigen vectors, Dual spaces
11 Inner product Spaces with properties, Projection
12 Cauchy inequality
13 Orthogonal & orthonormal basis
14 Gram Schmidt process & diagonalization

Recommended Texts

1. Dar, K.H. (2007). *Linear algebra* (1st ed.). Karachi: The Carwan Book House.
2. Kolman, B.,& Hill, D. R. (2005). *Introductory linear algebra* (8th ed.). London: Pearson/Prentice Hall.

Suggested Readings

1. Cherney, D., Denton, T., Thomas, R.,& Waldron, A. (2013). *Linear algebra* (1st ed.). California: Davis.
2. Anton, H., & Rorres, C. (2014). *Elementary linear algebra: applications version* (11th ed.). New York: John Wiley & Sons.
3. Grossman, S. I. (2004). *Elementary linear algebra* (5th ed.). New York: Cengage Learning.

PHYS-5104 Modern Physics 3(3-0)

The modern physics also termed as post-Newtonian concepts in physics deals with the major advances made in the twentieth century. To get the correct understanding of the natural world, we still use these ideas as given in the course contents.

Course Learning Objectives:

The purpose of this course is to provide students with a foundation in the concepts, fundamental principles and analytic techniques needed to solve problems arising in the context of contemporary physics.

Course Contents:

1. Black Body Radiation.
2. Plank's Radiation Law and Quantum of Energy, Derivation of Stefan's Law and Wien's Displacement Law from Planck's Radiation Law.
3. Quantization of Energy, Light Quantization and Photoelectric Effect. The Compton Effect.
4. Wave Nature of Matter and de-Broglie Hypothesis and its Experimental Verification, Wave Packet and its Localizations in Space and Time.
5. Hydrogen Spectrum, Bohr Theory of Atomic Structure, Deficiencies of the Bohr Model,
6. Bohr Correspondence Principle, Experimental Evidence for Quantization and Determination of Critical Potential (Frank-Hertz Experiment).
7. Nuclear Structure and the Basic Properties of the Nucleus (Nuclear Size, Binding Energy, Angular Momentum of the Nucleus.
8. Magnetic Moment and parity) Meson Theory of Nuclear Force.
9. Radioactivity and Laws of Radioactive Decay, Conservation Laws in Radioactive Decays. Radioactive Isotopes and Carbon Dating.
10. Nuclear Reactions and Q-values, The Compound Nucleus, Nuclear Fission and Fusion Applications of Nuclear Physics.

Recommended Texts:

1. Halliday, D. Resnick, R. & Walker, J. (2014). Fundamentals of physics (10th ed.). New York: Wiley.

2. Halliday, D. Resnick, R. & Krane, K. S. (2003). Physics (5th ed.). New York: Wiley.
3. Young, H. D., Freedman, R. A. & Ford, A. L. (2019). University physics (15th ed.). New York: Pearson.

Suggested Readings:

1. Beiser, A. (2003). Concepts of modern physics (6th ed.). New York: McGraw Hill.

2. Serway, R. A. & Jewelt, J. W.(2019). Physics for scientist and engineers (10th ed). New York: Cengage Learning.

PHYS-5105 Physics Lab - I 3(0-3)

The main emphasizes of this course is on graphical analysis, error calculation, and on system of S.I. units in the beginning of session. This course will help the student develop a broad array of basic skills and tools of experimental physics and data analysis.The purpose of this course is to prepare students with the latest development in this course and its associated technologies.

Course Learning objectives:

- The students will be to design and develop a strong background in the fundamentals of physics such as mechanics, optics, magnetism and electricity, modern physics and electronics.
- The students will be able to use the different components and equipment in physics practical.
- The students will also be able to work effectively and safely in the laboratory environment independently and as well as in teams
- The students will be able to enhance their expertise in setting up experiments, collecting and analyzing data
- The purpose of this home-grown laboratory for basic experimental training is to enhance research driven culture among the students.
- It helps students to develop critical and scientific thinking skills needed for the understanding of fundamental concepts in physics.

Course Contents:

1. Modulus of Rigidity by Static & Dynamic method (Maxwell's needle, Barton's Apparatus).
2. To determine the value of "g" by compound pendulum/Kater's Pendulum.
3. To study the conservation of energy (Hook's law).
4. To determine elastic constants by spiral springs.
5. To study the laws of vibration of stretched string using sonometer.
6. To determine Horizontal/Vertical distance by Sextant.
7. To determine the stopping potential by photo cell.

Recommended Texts:

1. Melissinos, A. C. & Napolitano, J. (2003). *Experiments in modern physics.* New York: Gulf Professional Publishing.
2. Shamos, M. H. (2012). *Great experiments in physics: firsthand accounts from Galileo to Einstein.* New York: Courier Corporation.

Suggested Readings:

2. Mark, H. &Olsono, H. T. (2004). *Experiments in modern physics*. New York: McGraw-Hill
3. Young, H. D., Freedman, R. A. & Ford, A. L. (2019). *University physics* (15th ed.). New York: Pearson.

4. Musaddiq, M. H. (2008). *Experimental physics*. Lahore: Allied Book Center.
5. Serway, R. A. &Jewelt, J. W. (2014). *Physics for scientist and engineers* (9th ed.). New York: Brooks/Cole.

6. **URCQ-5111**	**Translation of Holy Quran-II**	**1(1-0) NC**

7. o ایمانیات اور عبادات
8. بالاپر ایمان ،فرشتوں پر ایمان،رسولوں پر ایمان،آسمانی کتابوں پرایمان
9. یوم آخرت پر ایمان ،تقدیر پر ایمان نماز،روزہ،زکوۃ،حج،جہاد
10. oمعاشرے کے حقوق
11. □ خاندان کی تکوین
12. □ حقمہر
13. □ رضاعتوحمل
14. □ اولادکوقتلکرنےکےممانعت
15. □ شوہرکیفرمانی
16. □ طالق
17. □ بیوہکی عدت کے احکام
18. □ نکاحکاپیغامبھیجنا
19. □ عورتکیوراثت(اسکےشوہرکیطرفسے)
20. □ والدین کے حقوق
21. □ بیویوں اور اولادکےبیچعداوت
22. oخاندان کے حقوق
23. □ مہمانکیعزت
24. □ اجازتطلبکرنےکےاصول
25. □ مجلس کے آداب
26. □ تعاون اوربھائیچارہ
27. □ گروہبندی
28. □ محبت
29. □ لوگوںکےدرمیانصلح
30. □ عفوودرگزر،غصہپرقابواورمعافکرنا
31. □ شعوبو قبائل
32. □ لوگوںکےبیچاختلافات
33. □ حمایت ونگہبانی

Grammar: .34

35. □ قرآنیعربیگرامرکے اصولاور انکے اطلاقات)منقرآنیپر اطلاقسے
36. (توضیحات
37. Details ofChapters andverseNumbers:
38.

39. منتخب آیاتمعترجمہ وتجوید
40. □ البقرہ))١١٧، ١١٧،٢٧٨،١١٨،٤٥،٢٣٨، ٤٥ ، ٤٢٨،٧١٨،١٥٨،٣٤٧، ٤٢٨ ،٥٣،
41. ،٤٧،٢٨٧،٣٤٨،٢٢،٨٢،٢٨٧،٤٢٨،٢٤٨،١١٧،٢٣٧،٢٢٧،١١٨،٥٢٧،٣٢٧
42. ،٢٧٨،٢٤٧،٧٥٨،٢٢٧،١٨٨،٢٨٨،١٣٨،٢٨٨،٢٨٨،٧٣٨،١٣٨،٤٣٨،١٣٨
43. ٨٢،٥٢٧،٣٣٨،٨٢٧،١٢٧،٣٢)
44. □ النساء)٢٨٧،٤٣،٨٧،٢١٧،٢٣،١٢،٢٢،٢٢،٣٧،١٢،٢٢،٢٣٧،٢٤،٨٢،٤٢،
45. ،٥٣،٧٧،٥،٢١٧،٥٨،٤٨،٧٧،٧٧،٢٨٧،٧٢٧،٤٣،١٨،٤٣،٧٢٧،٢،٧،١٨،٧
46. ٢٧،٢٥٧،٥٤،٢٨٧،٧٢)
47. □ االنعام)٥٤،٢٥،٧٤٧،٨٢،٥٧،١٣٧،٨٨)
48. □ آلعمران)٧،٢٧،٥٥٧،٥٢،٤٨٧،٤٢،٢٣،١٢)
49. □ المائدہ)٤،٨،٨٢،٢٣،٢٧،٨٢،٨،٤،٥٤)
50. □ االعراف)٢٢٧،٢٢٧،٤٣)
51. □ التوبہ)١٨، ٢٧،٧١)
52. □ ہود)٨٧)
53. □ الزمر)٢)
54. □ النور)٢٨،١٢،١٨،٨٤،٢٨،٥٤)
55. □ محمد)٣٣)
56. □ انفال)٨٢، ١٨)

57. الرعد)٣(
58. الطالق)٥(
59. الحج)٤(
60. ابراہیم))٣٨،٥٥(
61. االسراء)٣٨،٥٨(
62. االحقاف)٤٧(
63. المومنون)١٨(
64. العنکبوت)٢٥،٤٨، ٢(
65. النحل)٨٨(
66. لقمان)٥،٤٧، ٥٧(
67. االحزاب))٢٥،٢٣،١٤،٤٣(
68. الشعراء)١(
69. الروم)٧٨(
70. مریم)٢٨،٥٧(
71. المجادلہ)٧٧،٨٧(

Semester-IV

URCG-5114	Basic Science	Cr. Hrs 3 (2-1)

Life, its characteristics, natural science, biology and its branches; Importance of Flora & Fauna in biodiversity; Importance of Natural Compounds in daily life, medicine and human health; Latest developments in natural sciences (Biotechnology); Ecosystem and its components; Environment and its components; Pollutants and their effect on the environment (Greenhouse effect, global warming, acid rains, water pollution and ozone depletions etc); Introduction to micro-organism and its types (bacteria, fungi, viruses)

Practical:

1: Field Survey of Flora & Fauna and their identification
2: Study of herbarium
3: Study of Museum

Recommended Texts.

1. Keddy, P.A. (2017). Plant ecology origins, processes, consequences. Cambridge, University Press.
2. Canadell, J.G., Diaz, S., Heldmaier, G., Jackson, R.B., Levia, D.F., Schulze, E.D. & Sommer, U. (20 19). Ecological studies. Springer.
3. Bhat, S.V., Nagasampagi, B.A. & Sirakumar, M. (2006). Chemistry of Natural Products. Springer Science
4. De, A.K. (2019). Environmental Chemistry. New Age International Press

Suggested Books

1. Fath, B. (2018). Encyclopedia of' ecology. Elsevier.
2. Ajith, H .. Urmas. P., Pastur, G. M & Iversion L. R. (2018). Ecosystem services from forest landscpes: broadsclaes consideration. 1st Edition. Springer International Publishing AG.
3. Xu, R., Ye, Y. & Zhao, W. (2011). Introduction to Natural Product Chemistry. CRC Press
4. Tayler, D.J., Green, N.P.O. & Stout, G.W. (1997). Biological Science 1&2. Cambridge University Press
5. Tayler, M.R., Simon, E.J., Dickey, D.J. & Hogan, K.A. (2020). Campbell Biology: Concepts & Connections (10th Edition). Pearson

URCE-5124 Entrepreneurship 2(2-0)

Thiscourseaddressestheuniqueentrepreneurialexperienceofconceiving,evaluating,creating,managing,and potentiallysellingabusinessidea.Thegoalistoprovideasolidbackgroundwithpracticalapplicationofimportaconceptsapplicabletotheentrepreneurialenvironment.Entrepreneurialdiscussionsregardingthe key business areas of finance, accounting, marketing and management include the creative aspects ofentrepreneurship.Thecoursereliesonclassroomdiscussion,participation,thecreationofafeasibilityplan,and building a business plan to develop a comprehensive strategy for launching and managing a newventure.

Contents:

1. **Background:** What is an Organization, Organizational Resources, Management Functions, KindsofManagers,Mintzberg'sManagerialRoles.
2. **Formsof BusinessOwnership:**TheSoleproprietorship,Partnership,Joint StockCompany
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits ofEntrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding theEntrepreneurial Fire.
4. **TheChallengesofEntrepreneurship:**TheCulturalDiversityinEntrepreneurship,ThePowerof"Small"Business,PuttingFailureintoPerspective,TheTenDeadlyMistakesofEntrepreneurship,How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics ofEntrepreneurship.
5. **InsidetheEntrepreneurialMind:**FromIdeastoReality:Creativity,Innovation,andEntrepreneurship,Creativity–EssentialtoSurvival,CreativeThinking,BarrierstoCreativity,Howto Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process,ProtectingYour Ideas,IdeaDiscussions &SelectionofstudentProjects.
6. **Productsandtechnology,identificationopportunities**
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan:** Building astrategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulatestrategic options and select the appropriate strategies, Discussion about execution of Students'Project.
8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:**Conducting aFeasibilityAnalysis,Industryandmarketfeasibility,Porter'sfiveforcesmodel,Financialfeasibilityanalysis.WhyDevelopaBusinessPlan,TheElementsofaBusinessPlan,WhatLendersandInvestors LookforinaBusinessPlan,MakingtheBusinessPlan Presentation.
9. **Building a Powerful Marketing Plan:** Building a Guerrilla Marketing Plan, Pinpointing theTarget Market, Determining Customer Needs and Wants Through Market Research.Plotting aGuerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions onStudent Project, Islamic EthicsforEntrepreneurialMarketing
10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into E-Commerce,TenMythsofE-Commerce,StrategiesforE-Success,DesigningaKillerWebSite,TrackingWebResults,EnsuringWebPrivacyandSecurity,Feed Back&SuggestionsonStudentProject.
11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies andTactics,PricingStrategiesandMethods forRetailers,TheImpact of Credit on Pricing
12. **AttractingVentureCapitalist:**ProjectedFinancialStatements,BasicFinancialStatements,RatioAnalysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back &Suggestions on StudentProject,
13. **IdeaPitching:**Formal presentation,5-minutespitch,fundingnegotiationandlaunching.

RecommendedBooks:

1.Scarborough,N.M.(2011).*Essentialsofentrepreneurshipandsmallbusinessmanagement*.Publishingas Prentice Hall,One Lake Street,Upper Saddle River, NewJersey07458..

SuggestedBooks:

1.Burstiner,I.(1989). S*mallbusinesshandbook*.PrenticeHallPress.

URCC-5125 Civics and Community Engagement 2(2-0)

The Civics and Community Engagement course is designed to provide students with an understanding oftheimportanceofcivicparticipation,cultureandculturaldiversity, basicfoundationsofcitizenship,groupidentitiesandtheroleofindividualsincreatingpositivechangewithintheircommunities.Thecourseaimsatdevelopingstudents'knowledge,skillsandattitudesnecessaryforactiveandresponsiblecitizenship.

Content:

1 IntroductiontoCivics&CommunityEngagement

(i) Overviewofthecourse: Civics&CommunityEngagement
(ii) Definitionandimportanceofcivics
(iii) Keyconcepts incivics:citizenship,democracy, governance,andtherule oflaw
(iv) Rightsandresponsibilitiesofcitizens

2 CitizenshipandCommunityEngagement

(i) IntroductiontoActiveCitizenship:OverviewoftheIdeas,Concepts,PhilosophyandSkills
(ii) ApproachesandMethodologyforActiveCitizenship

3 Identity,Culture,andSocialHarmony

(i) ConceptandDevelopmentofIdentity,Groupidentities.
(ii) Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Culturalrelativism,Understandingculturaldiversity,GlobalizationandCulture,Social Harmony,
(iii) ReligiousDiversity(Understandingandaffirmationofsimilarities&differences)
(iv) UnderstandingSocio-PoliticalPolarization.
(v) Minorities,SocialInclusion,Affirmativeactions

4 Multi-culturalsocietyandinter-culturaldialogue

(i) Inter-culturaldialogue(bridgingthedifferences,promotingharmony)
(ii) Promotingintergroupcontact/Dialogue
(iii) Significanceofdiversityanditsimpact
(iv) Importanceanddomains ofInter-cultural dialogue

5 ActiveCitizen:LocallyActive,GloballyConnected

(i) Importanceofactivecitizenshipatnational andgloballevel
(ii) Understandingcommunity
(iii) Identificationofresources(human,naturalandothers)
(iv) Utilizationofresourcesfordevelopment(communityparticipation)
(v) Strategicplanning,fordevelopment(communitylinkagesandmobilization)

6 Humanrights,constitutionalismandcitizens'responsibilities

(i) IntroductiontoHumanRights
(ii) HumanrightsinconstitutionofPakistan
(iii) Publicdutiesandresponsibilities
(iv) Constitutionalismanddemocraticprocess

7 Social Institutions,SocialGroups,FormalOrganizations andBureaucracy

(i) TypesofGroups,Groupidentities,Organizations
(ii) Bureaucracy,Weber'smodelofBureaucracy
(iii) Roleofpoliticalparties,interestgroups,andnon-governmental organizations

8 CivicEngagementStrategies

(i) Grassrootsorganizingandcommunitymobilization
(ii) Advocacyand lobbyingforpolicychange
(iii) Volunteerismandservice-learningopportunities

9 Socialissues/ProblemsofPakistan

(i) OverviewofmajorsocialissuesofPakistani society

10 SocialActionProject

RecommendedBooks:

1. Kennedy. J. K., & Brunold, A. (2016). Regional context and Citizenship education in Asia andEurope.New Yourk:Routledge, Falmer.
2. Henslin, James M. (2018). Essentials of Sociology: A Down to Earth Approach (13th ed.). New York:Pearson Education

3. Macionis,J.J., &Gerber,M.L. (2020).Sociology. NewYork: Pearson Education
SuggestedBooks:
1. GlencoeMcGraw-Hill.(n.d.).CivicsToday:Citizenship,Economics,andYouth.
2. Magleby, D. B., Light, P. C., & Nemacheck, C. L. (2020). Government by the People (16th ed.).Pearson.
3. Sirianni, C., & Friedland, L. (2005). The Civic Renewal Movement: Community-Building andDemocracyin the United States. KetteringFoundationPress.
4. Bloemraad, I. (2006). Becoming a Citizen: Incorporating Immigrants and Refugees in the UnitedStatesand Canada. Universityof California Press.
5. Kuyek,J.(2007).CommunityOrganizing:TheoryandPractice.FernwoodPublishing.
6. DeKieffer,D.E.(2010).TheCitizen'sGuidetoLobbyingCongress.TheCapitol.Net.
7. Rybacki, K. C., & Rybacki, D. J. (2021). Advocacy and Opposition: An Introduction toArgumentation(8thed.). Routledge.
8. Kretzmann,J. P.,&McKnight,J.L.(1993). BuildingCommunitiesfromthe InsideOut:APathTowardsFindingandMobilizinga Community'sAssets. ACTAPublications.
9. Patterson,T.E.(2005).EngagingthePublic:HowGovernment andtheMediaCanReinvigorateAmericanDemocracy. Oxford UniversityPress.
10. Love, N. S., & Mattern, M. (2005). Doing Democracy: Activist Art and Cultural Politics. SUNYPress.

MATH-5109 Ordinary Differential Equations 3(3-0)

This course introduces the theory, solution, & application of ordinary differential equations. Topics discussed in the course include methods of solving first-order differential equations, existence & uniqueness theorems, second-order linear equations, power series solutions, higher-order linear equations, systems of equations, non-linear equations, Sturm-Liouville theory, & applications. The relationship between differential equations & linear algebra is emphasized in this course. An introduction to numerical solutions is also provided. Applications of differential equations in physics, engineering, biology, & economics are presented. The goal of this course is to provide the student with an understanding of the solutions & applications of ordinary differential equations. The course serves as an introduction to both nonlinear differential equations & provides a prerequisite for further study in those areas.

Contents

1 Introduction to differential equations: Preliminaries & classification of differential equations
2 Verification of solution, existence of unique solutions, introduction to initial value problems
3 Basic concepts, formation & solution of first order ordinary differential equations
4 Separable equations, linear equations, integrating factors, Exact Equations
5 Solution of nonlinear first order differential equations by substitution, Homogeneous Equations,
6 Bernoulli equation, Ricaati's equation & Clairaut equation
7 Modeling with first-order ODEs: Linear models, Nonlinear models
8 Higher order differential equations: Initial value & boundary value problems
9 Homogeneous & non-homogeneous linear higher order ODEs & their solutions, Wronskian,
10 Reduction of order, homogeneous equations with constant coefficients,
11 Nonhomogeneous equations, undetermined coefficients method, Superposition principle
12 Annihilator approach, variation of parameters, Cauchy-Euler equation,
13 Solving system of linear differential equations by elimination
14 Solution of nonlinear differential equations
15 Power series, ordinary & singular points & their types, existence of power series solutions
16 Frobenius theorem, existence of Frobenius series solutions
17 The Bessel, Modified Bessel, Legendre & Hermite equations & their solutions

18 Sturm-Liouville problems: Introduction to eigen value problem, adjoint & self-adjoint operators,
19 Self-adjoint differential equations, eigen values & eigen functions
20 Sturm-Liouville (S-L) boundary value problems, regular & singular S-L problems

Recommended Texts

1 Boyce, W. E., & Diprima, R. C. (2012). *Elementary differential equations & boundary value problems* (10th ed.) USA: John Wiley & Sons.
2 Zill, D.G., & Michael, R. (2009) *Differential equations with boundary-value problems* (5th ed.) New York: Brooks/Cole.

Suggested Readings

1 Arnold, V. I. (1991). *Ordinary differential equations* (3rd ed.). New York: Springer.
2 Apostol, T. (1969). *Multi variable calculus &linear algebra* (2nd ed.). New York: John Wiley & sons.

PHYS-5106 Theory of Thermodynamics 3(3-0)

Thermodynamics literally means heat in motion.The subject of thermodynamics deals with transformation of heat energy in to mechanical energy and vice versa. It describes processes that involve changes in temperature, transformation of energy, relationships between heat and work. To get a deeper inside and understanding in to the laws of thermodynamics, the molecular concept of matter is incorporated into the study of thermodynamics by means of statistical mechanics. Objectives of this course are to enable students to be conversant with the terminology associated with thermodynamics. They can understand the origin of heat and temperature, the basic laws of thermodynamics, the applications of these laws for analyzing and controlling the thermodynamic system.

Course Learning Objectives:

At the end of this course students will have basic knowledge of climate changes as a result of global warming around the globe, flow of energy in the form of heat in different substances, composition of atmosphere around the earth, laws of thermodynamics, working principle of heat engine, refrigerator, air condition and heat pumps. They will also be able to understand the Time flow in everyday life.

Contents:

1 Kinetic theory of gases, derivation of fundamental equation of kinetic theory of gases. Phase transition and phase diagram.
2 Maxwell distribution of molecular speeds and energies, modification of kinetic theory for real gas, the Van der Waal's equation, Zeroth law of thermodynamics and thermodynamic equilibrium.
3 Thermodynamic processes and types of thermodynamic systems. First law of thermodynamics, Its Consequences, applications on different types of systems and work-energy calculations.
4 Second law of thermodynamics and the concept of entropy, entropy measurements for reversible and irreversible process.
5 Combined first and second law of thermodynamics, entropy changes in the ideal gases.
6 Carnot cycle and efficiency measurements.
7 The Joule-Thomson experiment.
8 The third law of thermodynamics and its consequences. Free energy.
9 Thermodynamic Potentials and Maxwell relations.
10 Transfer of heat and its distribution, Mean free path and microscopic calculations of mean free path.
11 Thermoelectricity

Recommended Books:

1. Halliday, D., Resnick, R. & Krane, K. S. (2016). *Physics* (5th ed.). New York: Wiley.
2. Young, H. D., Freedman R. A., Ford, A. L., Seers, F. W. & Zemansky, P. (2008). *University physics* (13th ed.). San Francisco: Addison Wesley.

Suggested Books:

1. Serway, R. A. & Jewelt, J. W.(2019). *Physics for scientist and engineers* (10th ed). New York: Cengage Learning.
2. Halliday, D., Resnick, R. & Walker, J. (2014). *Fundamental of physics* (10th ed.). New York: Wiley.
3. Garg, S. C., Bansal, R.M. & Ghosh, C.K. (2012). *Thermal physics* (2nd ed.). India: McGraw Hill Education.

PHYS-5107 Physics Lab- II 3(0-3)

Physics is an experimental science. This lab helps the students in improvising their approach towards the subject. This physics lab aids a student in establishing the relevance of the theory. It brings clarity in the mind of the students regarding the basic concept of the subject. Experiments carried out in this lab work helps students in learning how to be patient and careful while taking observation and hitherto. In order to enhance scientific and critical thinking for the understanding of basic concepts in this course, they are encouraged to share their knowledge and results with their teachers.

Course Learning objectives:

- The students will be to design and develop a strong background in the fundamentals of physics and basic electronics.
- The students will have a good foundation in the fundamentals related to the experiments included in this course and their advanced applications.
- The students will be able to learn practically aboutaccepter and rejector circuits, diode, logic gates,and amplifiers.
- The students will get motivated to develop small experiments related to these techniques and develop their physical understanding.
- The students will also be able to work effectively and safely in the laboratory environment independently and as well as in teams.
- After completion of this course students will be able to design and carry out scientific experiments.
- Students will be able to learn how to present their results in the form of a report.

Course Contents:

1. Resonance frequency of an acceptor circuit
2. Resonance frequency of a Rejecter Circuit.
3. Determination of ionization potential of mercury.
4. Characteristics of a semiconductor diode (Compare Si with Ge diode)
5. Setting up of half & full wave rectifier & study of filtration factors
6. To set up and study various logic gates (AND, OR, NAND etc) using diode and to develop their truth tables.
7. To determine static characteristics of a transistor.
8. To determine wavelength of light by diffraction grating.

Recommended Texts:

1. Melissinos, A. C. & Napolitano, J. (2003). *Experiments in modern physics*. New York: Gulf Professional Publishing.

Shamos, M. H. (2012). *Great experiments in physics: firsthand accounts from Galileo to Einstein.* New York: Courier Corporation.

Suggested Readings:

72. Mark, H. & Olsono, H. T. (2004). *Experiments in modern physics*. New York: McGraw-Hill
73. Young, H. D., Freedman, R. A. & Ford, A. L. (2019). *University physics* (15th ed.). New York: Pearson.
74. Musaddiq, M. H. (2008). *Experimental physics*. Lahore: Allied Book Center.
75. Arora, C.L. (2010). *B.Sc practical physics.* New Delhi: Chand & Company.
1. Singh, H. & Hemne, P.S. (2000). *B.Sc practical physics.* New Delhi: Chand & Company

URCE-5124 Internship/Field Experience
3(3-0)