



UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

The Academic Council in its 19th (4/2023) meeting held on 13.09.2023, has recommended the curricula of the following academic programs for implementation on provisional basis for affiliated colleges w.e.f Fall 2023 subject to approval by the Syndicate:-

1.	Associate Degree in Urdu	(Annex-'A')
2.	Associate Degree in Islamic Studies	(Annex-'B')
3.	Associate Degree in English (Linguistics)	(Annex-'C')
4.	Associate Degree in English (Language & Literature)	(Annex-'D')
5.	Associate Degree in Information Management	(Annex-'E')
6.	Associate Degree in Arabic	(Annex-'F')
7.	Associate Degree in Persian	(Annex-'G')
8.	Associate Degree in Punjabi	(Annex-'H')
9.	Associate Degree in Media and Communication Studies	(Annex-'I')
10.	Associate Degree in Physical Education	(Annex-'J')
11.	Associate Degree in Chemistry	(Annex-'K')
12.	Associate Degree in Bio-Chemistry	(Annex-'L')
✓ 13.	Associate Degree in Physics	(Annex-'M')
14.	Associate Degree in Statistics	(Annex-'N')
15.	Associate Degree in Botany	(Annex-'O')
16.	Associate Degree in Mathematics	(Annex-'P')
17.	Associate Degree in Geography	(Annex-'Q')
18.	Associate Degree in Biotechnology	(Annex-'R')
19.	Associate Degree in Zoology	(Annex-'S')
20.	Associate Degree in History	(Annex-'T')
21.	Associate Degree in Pakistan Studies	(Annex-'U')
22.	Associate Degree in Education	(Annex-'V')
23.	Associate Degree in Commerce	(Annex-'W')
24.	Associate Degree in Sociology	(Annex-'X')
25.	Associate Degree in Social Work	(Annex-'Y')
26.	Associate Degree in Economics	(Annex-'Z')
27.	Associate Degree in Psychology	(Annex-'ZA')
28.	Associate Degree in International Relations	(Annex-'ZB')
29.	Associate Degree in Political Science	(Annex-'ZC')


(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/23/980

Dated: 18.10.2023

Distribution:

- Controller of Examinations (with the request to upload on University Website for affiliated Colleges)

C.C:

- Director Academics
- Director, QEC
- Additional Registrar (Affiliation & Registration)
- Secretary to the Vice-Chancellor
- PA to Registrar
- Notification File

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

S. Tenzar

Chairman,
Department of Physics,
University of Sargodha

Scheme of Studies

Associate Degree in *Physics* (For Affiliated Colleges)

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Major-1	PHYS-5101	Mechanics	3(3-0)	Nil
Major-2	PHYS-5102	Waves and Oscillations	3(3-0)	Nil
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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
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Semester Total Credit Hours: 16

Degree Program Total: 65

Semester-I

URCE-5118

Functional English

Cr.H-3(3-0)

The course aims at providing understanding of a writer's goal of writing (i.e. clear, organized and effective content) and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the grammatical academic writing skills. The course would enable the students to develop argumentative writing techniques. The students would be able to logically add specific details on the topics such as facts, examples and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in an objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation, plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

Contents:

1. Developing Analytical Skills
2. Transitional devices (word, phrase and expressions)
3. Development of ideas in writing
4. Reading Comprehension
5. Precise Writing
6. Developing argument
7. Sentence structure: Accuracy, variation, appropriateness, and conciseness
8. Appropriate use of active and passive voice
9. Organization and Structure of a Paragraph
10. Organization and structure of Essay
11. Types of Essays.

Recommended Books:

1. Bailey, S. (2011). *Academic writing: A handbook for international students* (3rd ed.). New York: Routledge.
2. Eastwood, J. (2011). *A Basic English grammar*. Oxford: Oxford University Press.
3. Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasks and skills* (3rd ed.). Ann Arbor: The University of Michigan Press.
4. Swan, M. (2018). *Practical English usage* (8th ed.). Oxford: Oxford University Press.

Suggested Books:

1. Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). *Longman grammar of spoken and written English*. Harlow Essex: MIT Press.
2. Cresswell, G. (2004). *Writing for academic success*. London: SAGE.
3. Johnson-Sheehan, R. (2019). *Writing today*. Don Mills: Pearson.
4. Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing*. Washington: American Psychological Association.
5. Thomson, A. J., & Martinet, A. V. (1986). *A Practical English Grammar*. Oxford: Oxford University Press

URCI-5105

Islamic Studies

2(2-0)

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources of Islam; Qur'an and Hadith, history and particular cultural contexts. The course seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) 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'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'an and Sunnah.

Contents

Introduction to Qur'anic Studies

- 1) Basic Concepts of Qur'an
- 2) History of Quran

مطالہ قرآن (نعلو قرآن، منہج آیات کائنات جہو تفریر: سورۃ البقرہ	آیات 1-5، 482-482؛ سورۃ الحجرات	آیات 18-1؛ سورۃ
لہر قان آیات	77-26؛ سورۃ المؤمن آیات [1-1]؛ سورۃ الحزاب	آیات 2، 41، 64، 66، 24، 52، 55؛ سورۃ النعام آیات 151-
156؛ سورۃ الصفا آیات-112؛ الحشر آیات-1844؛ العمر آیات	154، 154؛ النحل آیات	12-14؛ لقمن آیات 44، حمل 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

منہج، حدیث: 1 در جدول موضوعات پر احادیث کا مطالعہ

1. اعمال کا اجرا و نیت پر مبنی حصرہ 4۔ بہترین انسان قرآن کا طالب علم اور اس کا علم 6۔ کتاب و سنت کچھ ایسے بچے کا ذریعہ ہے 2۔ ارکان اس الم 5۔ اس الم، اہمان، احسان اور زیادت کی مثالیں، 2۔ بچوں کو نرم از کی تہین 7۔ دین کا کھانا انعام بلا کی خاص عزت ہے 8۔ حصول علم، نالو تنہا اور عمل کی اہمیت و فضیلت، 5۔ روزم حشر کا ماسہ، 14 حقوق بلا کے ساتھ ان حقوق

العباد کا حاضر کہہ رہی الزم ہے 11 حسن خلق کی عظیم تاور فہم و نگوی کی مذمت 14۔

دنیا و آخرت کی بھالی بیکی ضامن چار چیزیں، 16۔ مال کو فروغ دینے والی بات چیزیں، 12۔ عمل جہاد کا عبرت ناکان جام 15۔ برش خاص نگران ہے اور برش

ص

مستول

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

اور علی بن مومنے، از امتدین کا

(مطالہ حضرت کی ضرورت و اہمیت، نغمہ سیرت و شورش حضرت کا بیرونی جہا ج

مہنقا ہدینہ، خطبہ حج الوداع، اخالق و عیال، شکیل اجنماع و تاور اسوہ مصریہ

تبدین باعد ۱۰ خال خال شدہ،

تربوی کے مقاصد و حکمتیں)

قرآن مجید میں سیرت سرور عالم کا بیان، غزوا

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

2. اس المی تعذیب و تمدن (اس المی تعذیب کا مفہوم، اس المی کے عوامل و عناصر، اس المی تعذیب کی خصوصیات، اس المی تعذیب

علمی، معاشرتی اور سماجی اثرات، تعذیب کے تعلق کے نظریے کا تریبی ج اثر، تعذیب و تصادم کے اثرات و نتائج، طبیعی،

حیاتیاتی اور معاشرتی علوم میں مسلم انوں کا کردار، نام و رہنما مہمان بنان

Recommended Books

- 1) Hameedullah Muhammad,—Emergence of Islam I, IRI, Islamabad
- 2) Hameedullah Muhammad,—Muslim Conduct of State
- 3) Hameedullah Muhammad,—Introduction to Islam
- 4) Ahmad Hasan,—Principles of Islamic Jurisprudence Islamic Research, Institute, International Islamic University, Islamabad (1993)
- 5) Dr. Muhammad Zia-ul-Haq,—Introduction to Al-Sharia Al-Islamia Allama Iqbal Open University, Islamabad (2001)
- 6) Dr. Muhammad Shahbaz Manj, Teleemat-e-Islam.

UOCE-5126

ETHICS*

2(2-0)

This course is designed for the non-Muslim students.

Contents:

1. Meaning and Scope of Ethics.
2. Relation of Ethics with:
 - (a) Religion
 - (b) Science
 - (c) Law
3. Historical Development of Morality:
 - (a). Instinctive Moral Life.
 - (b). Customary Morality.
 - (c). Reflective Morality.
4. Moral Theories:
 - (a). Hedonism (Mill)
 - (b). Intuitionism (Butler)
 - (c). Kant's Moral Theory.
5. Moral Ethics and Society.
 - (a). Freedom and Responsibility.
 - (b). Tolerance
 - (c). Justice
 - (d). Punishment (Theories of Punishment)
6. Moral Teachings of Major Religions:
 - a). Judaism
 - b). Christianity
 - c). Islam
7. Professional Ethics:
 - a). Medical Ethics
 - b). Ethics of Students
 - c). Ethics of Teachers.
 - d). Business Ethics

Recommended Books:

- 1 William Lille. An Introduction to Ethics, London Methuen & Co. latest edition.
- 2 Titus, H.H. Ethics for Today. New York: American Book, latest edition.
- 3 Hill, Thomas. Ethics in Theory and Practice. N. Y. Thomas Y. Crowel, latest edition
- 4 Ameer Ali, S. The Ethics of Islam. Calcutta: Noor Library Publishers, latest edition
- 5 Donaldson, D.M. Studies in Muslim Ethics. London: latest edition.
- 6 Sayeed, S.M.A. (Tr.) Ta'aruf-e-Akhlaqiat. Karachi: BCC&T, Karachi University.

URCI-5123

Applications of Information Communication Technologies (ICT)

3

(2+1)

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

Contents:

1. Introduction, Overview of Information Technology.
2. Hardware: Computer Systems & Components, Storage Devices.
3. Software: Operating Systems, Programming and Application Software.
4. Databases and Information Systems Networks.
5. File Processing Versus Database Management Systems.
6. Data Communication and Networks.
7. Physical Transmission Media & Wireless Transmission Media.
8. Applications of smart phone and usage.
9. The Internet, Browsers and Search Engines.
10. Websites and their types.
11. Email Collaborative Computing and Social Networking.
12. E-Commerce.
13. IT Security and other issues.
14. Cyber Laws and Ethics of using Social media.
15. Use of Microsoft Office tools (Word, PowerPoint, Excel) or other similar tools depending on the operating system.
16. Other IT tools/software specific to field of study of the students if any.

Recommended Book:

1. Discovering Computers 2022: Digital Technology, Data and Devices by Misty E. Vermaat, Susan L. Sebok; 17th edition.

Suggested Books:

1. Computing Essentials 2021 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 26th edition.
2. Computers: Understanding Technology by Fuller, Floyd; Larson, Brian: edition 2018.

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 Rolle's 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, hyperbolic 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. & Jewett, 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. & Jewett, 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

6. □ نوسواں پارہ بنظر مہم عنچوئد
7. □ ابنیادی عربی گرامر
8. اسم اور اس کے منقولات: اسمناعل، مفعول، مفعول، مفعول، مفعول اور
اس کی اقسام: ماضی، مضارع، امر، نہی
9. حروف غت، حروف جارہ، مشجلیدعل: حرف اور اس کی 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 hikāyāt 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 ta'mīr-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 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 صلی اللہ علیہ وسلم 1(1-0)

Title	Description
Semester	
Nature of Course	
Total Teaching weeks	18
Objectives of the Course	<p>۱. طلباء کو مطالعہ سیرۃ طیبہ کی ضرورت و اہمیت سے آگاہ کرنا</p> <p>۲. تعمیر شخصیت میں مطالعہ سیرۃ طیبہ کے کردار کو واضح کرنا</p> <p>۳. بعثت نبوی کے موقع پر اقوام عالم کی عمومی صورت حال سے آگاہ کرنا</p> <p>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</p> <p>۵. طلباء کو عہد نبوی کی معاشرت، سیاست، معیشت سے آگاہ کرنا</p>

Course Description

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

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

نصابی کتب

نمبر شمار	نام مؤلف	نام کتاب
1	ابن ہشام	السيرة النبوية
2	مولانا شبلی نعمانی، سید سلمان ندوی	سيرة النبي صلى الله عليه وسلم
3	قاضی محمد سلیمان سلمان منصور پوری	رحمة للعالمين
4	مولانا سید ابو الحسن علی ندوی	نبی رحمت صلی اللہ علیہ وسلم
5	ڈاکٹر یسین مظہر صدیقی	عهد 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 النبوی صلی اللہ علیہ وسلم
4	ڈاکٹر اکرم الضیاء العمری	السيرة النبوية الصحيحة
5	مولانا عبدالرؤف دانا پوری	اصح السير

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 situations and 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 sonometer/ 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. & Jewett, J. W. (2014). *Physics for scientist and engineers* (9th ed.). New York: Brooks/Cole.

Semester-III

URCE- 5119

Expository Writing

3 (3-0)

This course prepares undergraduate students to become successful writers and readers of English. The course helps students develop their fundamental language skills with a focus on writing so that they can gain the confidence to communicate in oral and written English outside the classroom. The course is divided into five units and takes a Project-based Learning approach. Unit themes target the development of 21st century skills and focus on self-reflection and active community engagement. The course completion will enable the students to develop communication skills as reflective and self-directed learners. They will be able to intellectually engage with different stages of writing process, and develop analytical and problem-solving skills to address various community-specific challenges.

Contents

1. Self-Reflection
 - Introduction to the basics of the writing process
 - Introduction to the steps of essay writing
 - Prewriting activities: Brainstorming, listing, clustering and free writing
 - Practicing Outlining of the essay
2. Personalized Learning
 - Learning Process, Learning Styles, Goal Setting and Learning Plan
3. Oral Presentation
 - Structure and Significance, Content Selection and Slide Presentation, Peer Review
4. Critical Reading Skills
 - Introducing Authentic Reading (Dawn and non-specialist academic books/texts)
 - Reading Strategies and Practice: Skimming, scanning, SQW3R, Annotating, Detailed reading and note-taking, Standard Test Practice: TOEFL and IELTS, Model Review Reports and Annotated Bibliographies
5. Community Engagement
 - Student-led brainstorming on local versus global issues, Identifying research problems
 - Drafting research questions, Drafting interview/survey questions for community research (in Eng

lishor L1)

- Engaging students in Critical reading, Presenting interview/survey information, Fieldwork
- Writing Community Engagement Project

6. Letter to the Editor

- Types of letters, Format and purpose of letter to the editor, Steps in writing letter-to-editor

Recommended books

1. Bailey, S. (2011). *Academic writing: A handbook for international students* (3rd ed.). New York: Routledge.
2. Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasks and skills* (3rd ed.). Ann Arbor: The University of Michigan Press.

Suggested Readings

1. Cresswell, G. (2004). *Writing for academic success*. London: SAGE.
2. Johnson-Sheehan, R. (2019). *Writing today*. Don Mills: Pearson.
3. Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing*. Washington: American Psychological Association.

URCO-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--webeducation-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/prec calculus_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)

This course focuses on ideological background of Pakistan. The course is designed to give a comprehensive insight about the constitutional developments of Pakistan. Starting from the Government of India Act, 1935 till to date, all important events leading to constitutional developments in Pakistan will be the focus of course. 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 and posing 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, distribution of powers, the rights and various remedies, the supremacy of parliament and the independence of judiciary.

Contents:

- 1 **Ideology of Pakistan**
Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
Two Nation Theory and Factors leading to Muslim separatism.
- 2 **Constitutional Developments**
Salient Feature of the Government of India Act 1935
Salient Feature of Indian Independence Act 1947
Objectives Resolution
Salient Feature of the 1956 Constitution
Developments leading to the abrogation of Constitution of 1956
Salient features of the 1962 Constitution
Causes of failure of the Constitution of 1962
Comparative study of significant features of the Constitution of 1956, 1962 and 1973
- 3 **Fundamental rights**
 - a. Principles of policy
 - b. Federation of Pakistan
President
Parliament

- The Federal Government
- c. Provinces
 - Governors
 - Provincial Assemblies
 - The Provincial Government
- 4 The Judiciary
 - Supreme Court
 - High Courts
 - Federal Shariat Courts
 - Supreme Judicial Council
 - Administrative Courts and Tribunals
- 5 Islamic Provisions in Constitution
- 6 Significant Amendments of Constitution of Pakistan 1973.

Recommended Books:

1. Constitutional and Political History of Pakistan by Hamid Khan
2. Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd edn. Lahore: Legal Research Centre, 1996.
3. Munir, Muhammad. Constitution of the Islamic Republic of Pakistan: Being a Commentary on the Constitution of Pakistan, 1973. Lahore, Law Pub., 1975.
4. Rizvi, Syed Shabbar Raza. Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary. 2nd edn. Lahore: Vanguard, 2005.
5. The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).
6. Fundamental Law of Pakistan by A.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.

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

Suggested Readings:

- Beiser, A. (2003). *Concepts of modern physics* (6th ed.). New York: McGraw Hill.
- Serway, R. A. & Jewett, 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:

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

Recommended Texts:

- 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:

- Mark, H. &Olsono, H. T. (2004). *Experiments in modern physics*. New York: McGraw-Hill
- 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. & Jewett, 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. ایمانیات اور عبادات
 8. بلاہر ایمان، نرسنتوں پر ایمان، رسولوں پر ایمان، آسمانی کتابوں پر ایمان
 9. یوم آخرت پر ایمان، نسیی پر ایمان، روزہ، زکوٰۃ، حج، جہاد
 10. معاشرے کے حقوق
 11. خاندان کی تکوین
 12. حقہر
 13. رضاعت و حمل
 14. اولاد کو نیک کرنے کے مہمانت
 15. شوہر کی نافرمانی
 16. طالق
 17. بیوی عدت کے احکام
 18. نکاح کی غامبی بیچا
 19. عورت کی وراثت (اس کے شوہر کی طرف سے)
 20. والدین کے حقوق
 21. بیویوں اور اولاد کے بیچ عداوت
 22. خاندان کے حقوق
 23. مہمان کی عزت
 24. اجازت طلب کرنے کے اصول
 25. مچاس کے آداب
 26. تعاون اور بہانی چارہ
 27. گروہ بندی
 28. محبت
 29. لوگوں کے درمیان صلح
 30. غفور و درگزر، غصہ پر قابو اور معاف کرنا
 31. شہر و قبیلہ
 32. لوگوں کے بیچ اختلاف

33. حمایت و نگہبانی

34. Grammar:

35. قرآن کی عربی گرامر کے اصول اور ان کے اطلاقات (من قرآن ویر اطلاق سے)

36. توضیحات

37. Details of Chapters and Verse Numbers:

38.

39. مزین آیات مخرجم و نچوئ
 40. البقرہ (117، 118، 119، 120، 121، 122، 123، 124، 125، 126، 127، 128، 129، 130، 131، 132، 133، 134، 135، 136، 137، 138، 139، 140، 141، 142، 143، 144، 145، 146، 147، 148، 149، 150، 151، 152، 153، 154، 155، 156، 157، 158، 159، 160، 161، 162، 163، 164، 165، 166، 167، 168، 169، 170، 171، 172، 173، 174، 175، 176، 177، 178، 179، 180، 181، 182، 183، 184، 185، 186، 187، 188، 189، 190، 191، 192، 193، 194، 195، 196، 197، 198، 199، 200)
 41. 42، 43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100، 101، 102، 103، 104، 105، 106، 107، 108، 109، 110، 111، 112، 113، 114، 115، 116، 117، 118، 119، 120، 121، 122، 123، 124، 125، 126، 127، 128، 129، 130، 131، 132، 133، 134، 135، 136، 137، 138، 139، 140، 141، 142، 143، 144، 145، 146، 147، 148، 149، 150، 151، 152، 153، 154، 155، 156، 157، 158، 159، 160، 161، 162، 163، 164، 165، 166، 167، 168، 169، 170، 171، 172، 173، 174، 175، 176، 177، 178، 179، 180، 181، 182، 183، 184، 185، 186، 187، 188، 189، 190، 191، 192، 193، 194، 195، 196، 197، 198، 199، 200)
 42. 278، 279، 280، 281، 282، 283، 284، 285، 286، 287، 288، 289، 290، 291، 292، 293، 294، 295، 296، 297، 298، 299، 300، 301، 302، 303، 304، 305، 306، 307، 308، 309، 310، 311، 312، 313، 314، 315، 316، 317، 318، 319، 320، 321، 322، 323، 324، 325، 326، 327، 328، 329، 330، 331، 332، 333، 334، 335، 336، 337، 338، 339، 340، 341، 342، 343، 344، 345، 346، 347، 348، 349، 350، 351، 352، 353، 354، 355، 356، 357، 358، 359، 360، 361، 362، 363، 364، 365، 366، 367، 368، 369، 370، 371، 372، 373، 374، 375، 376، 377، 378، 379، 380، 381، 382، 383، 384، 385، 386، 387، 388، 389، 390، 391، 392، 393، 394، 395، 396، 397، 398، 399، 400)
 43. 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100، 101، 102، 103، 104، 105، 106، 107، 108، 109، 110، 111، 112، 113، 114، 115، 116، 117، 118، 119، 120، 121، 122، 123، 124، 125، 126، 127، 128، 129، 130، 131، 132، 133، 134، 135، 136، 137، 138، 139، 140، 141، 142، 143، 144، 145، 146، 147، 148، 149، 150، 151، 152، 153، 154، 155، 156، 157، 158، 159، 160، 161، 162، 163، 164، 165، 166، 167، 168، 169، 170، 171، 172، 173، 174، 175، 176، 177، 178، 179، 180، 181، 182، 183، 184، 185، 186، 187، 188، 189، 190، 191، 192، 193، 194، 195، 196، 197، 198، 199، 200)
 44. النساء (4، 5، 6، 7، 8، 9، 10، 11، 12، 13، 14، 15، 16، 17، 18، 19، 20، 21، 22، 23، 24، 25، 26، 27، 28، 29، 30، 31، 32، 33، 34، 35، 36، 37، 38، 39، 40، 41، 42، 43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 45. 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 46. 27، 28، 29، 30، 31، 32، 33، 34، 35، 36، 37، 38، 39، 40، 41، 42، 43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 47. النعام (88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 48. العمران (12، 13، 14، 15، 16، 17، 18، 19، 20، 21، 22، 23، 24، 25، 26، 27، 28، 29، 30، 31، 32، 33، 34، 35، 36، 37، 38، 39، 40، 41، 42، 43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 49. المائدہ (54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 50. الاعراف (43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 51. التوبہ (71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 52. بود (87)
 53. الزمر (2)
 54. النور (54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)
 55. محمد (33)
 56. ازل (18، 19، 20، 21، 22، 23، 24، 25، 26، 27، 28، 29، 30، 31، 32، 33، 34، 35، 36، 37، 38، 39، 40، 41، 42، 43، 44، 45، 46، 47، 48، 49، 50، 51، 52، 53، 54، 55، 56، 57، 58، 59، 60، 61، 62، 63، 64، 65، 66، 67، 68، 69، 70، 71، 72، 73، 74، 75، 76، 77، 78، 79، 80، 81، 82، 83، 84، 85، 86، 87، 88، 89، 90، 91، 92، 93، 94، 95، 96، 97، 98، 99، 100)

57. □ الرعد (3)
 58. □ الطالق (5)
 59. □ الحج (4)
 60. □ ابراهيم (38,55)
 61. □ السراء (38,58)
 62. □ الحقائق (47)
 63. □ المؤمنون (18)
 64. □ العنكبوت (2, 48, 25)
 65. □ النحل (88)
 66. □ ايمان (57, 47, 5)
 67. □ الحزاب ((43, 14, 23, 25)
 68. □ الشعراء (1)
 69. □ الروم (78)
 70. □ مريم (57, 28)

71. □ المجانله (87, 77)

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. (2019). 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. Urmans, P., Pastur, G. M & Iversion L. R. (2018). Ecosystem services from forest landscapes: broadscale 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

This course addresses the unique entrepreneurial experience of conceiving, evaluating, creating, managing, and potentially selling a business idea. The goal is to provide a solid background with practical application of important concepts applicable to the entrepreneurial environment. Entrepreneurial discussions regarding the key business areas of finance, accounting, marketing and management include the creative aspects of entrepreneurship. The course relies on classroom discussion, participation, the creation of a feasibility plan, and building a business plan to develop a comprehensive strategy for launching and managing a new venture.

Contents:

1. **Background:** What is an Organization, Organizational Resources, Management Functions, Kinds of Managers, Mintzberg's Managerial Roles.
2. **Forms of Business Ownership:** The Sole Proprietorship, Partnership, Joint Stock Company
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits of Entrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding the Entrepreneurial Fire.
4. **The Challenges of Entrepreneurship:** The Cultural Diversity in Entrepreneurship, The Power of "Small" Business, Putting Failure into Perspective, The Ten Deadly Mistakes of Entrepreneurship, How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics of Entrepreneurship.
5. **Inside the Entrepreneurial Mind:** From Idea to Reality: Creativity, Innovation, and Entrepreneurship, Creativity—Essential to Survival, Creative Thinking, Barriers to Creativity, How to Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process, Protecting Your Ideas, Idea Discussions & Selection of student Projects.
6. **Products and technology, identification opportunities**
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan:** Building a strategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulate strategic options and select the appropriate strategies, Discussion about execution of Students' Project.
8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:** Conducting a Feasibility Analysis, Industry and market feasibility, Porter's five forces model, Financial feasibility analysis. Why Develop a Business Plan, The Elements of a Business Plan, What Lenders and Investors Look for in a Business Plan, Making the Business Plan Presentation.
9. **Building a Powerful Marketing Plan:** Building a Guerrilla Marketing Plan, Pinpointing the Target Market, Determining Customer Needs and Wants Through Market Research. Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics for Entrepreneurial Marketing
10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into E-Commerce, Ten Myths of E-Commerce, Strategies for E-Success, Designing a Killer Web Site, Tracking Web Results, Ensuring Web Privacy and Security, Feed Back & Suggestions on Student Project.
11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies and Tactics, Pricing Strategies and Methods for Retailers, The Impact of Credit on Pricing
12. **Attracting Venture Capitalist:** Projected Financial Statements, Basic Financial Statements, Ratio Analysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back & Suggestions on Student Project,
13. **Idea Pitching:** Formal presentation, 5-minute pitch, funding negotiation and launching.

Recommended Books:

1. Scarborough, N.M. (2011). *Essentials of entrepreneurship and small business management*. Publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458..

Suggested Books:

1. Burstiner, I. (1989). *Small business handbook*. Prentice Hall Press.

The Civics and Community Engagement course is designed to provide students with an understanding of the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities. The course aims at developing students' knowledge, skills and attitudes necessary for active and responsible citizenship.

Content:

1 Introduction to Civics & Community Engagement

- (i) Overview of the course: Civics & Community Engagement
- (ii) Definition and importance of civics
- (iii) Key concepts in civics: citizenship, democracy, governance, and the rule of law
- (iv) Rights and responsibilities of citizens

2 Citizenship and Community Engagement

- (i) Introduction to Active Citizenship: Overview of the ideas, concepts, philosophy and skills
- (ii) Approaches and methodology for Active Citizenship

3 Identity, Culture, and Social Harmony

- (i) Concept and development of identity, group identities.
- (ii) Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity, Globalization and Culture, Social Harmony,
- (iii) Religious Diversity (Understanding and affirmation of similarities & differences)
- (iv) Understanding Socio-Political Polarization.
- (v) Minorities, Social Inclusion, Affirmative actions

4 Multi-cultural society and inter-cultural dialogue

- (i) Inter-cultural dialogue (bridging the differences, promoting harmony)
- (ii) Promoting intergroup contact/Dialogue
- (iii) Significance of diversity and its impact
- (iv) Importance and domains of Inter-cultural dialogue

5 Active Citizen: Locally Active, Globally Connected

- (i) Importance of active citizenship at national and global level
- (ii) Understanding community
- (iii) Identification of resources (human, natural and others)
- (iv) Utilization of resources for development (community participation)
- (v) Strategic planning, for development (community linkages and mobilization)

6 Human rights, constitutionalism and citizens' responsibilities

- (i) Introduction to Human Rights
- (ii) Human rights in constitution of Pakistan
- (iii) Public duties and responsibilities
- (iv) Constitutionalism and democratic process

7 Social Institutions, Social Groups, Formal Organizations and Bureaucracy

- (i) Types of Groups, Group identities, Organizations
- (ii) Bureaucracy, Weber's model of Bureaucracy
- (iii) Role of political parties, interest groups, and non-governmental organizations

8 Civic Engagement Strategies

- (i) Grassroots organizing and community mobilization
- (ii) Advocacy and lobbying for policy change
- (iii) Volunteerism and service-learning opportunities

9 Social issues/Problems of Pakistan

- (i) Overview of major social issues of Pakistani society

10 Social Action Project

Recommended Books:

1. Kennedy, J. K., & Brunold, A. (2016). Regional context and Citizenship education in Asia and Europe. New York: 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*. New York: Pearson Education

Suggested Books:

1. Glencoe/McGraw-Hill. (n.d.). *Civics Today: Citizenship, Economics, and Youth*.
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 and Democracy in the United States*. Kettering Foundation Press.
4. Bloemraad, I. (2006). *Becoming a Citizen: Incorporating Immigrants and Refugees in the United States and Canada*. University of California Press.
5. Kuyek, J. (2007). *Community Organizing: Theory and Practice*. Fernwood Publishing.
6. DeKieffer, D. E. (2010). *The Citizen's Guide to Lobbying Congress*. The Capitol Net.
7. Rybacki, K. C., & Rybacki, D. J. (2021). *Advocacy and Opposition: An Introduction to Argumentation* (8th ed.). Routledge.
8. Kretzmann, J. P., & McKnight, J. L. (1993). *Building Communities from the Inside Out: A Path Towards Finding and Mobilizing a Community's Assets*. ACTA Publications.
9. Patterson, T. E. (2005). *Engaging the Public: How Government and the Media Can Reinvigorate American Democracy*. Oxford University Press.
10. Love, N. S., & Mattern, M. (2005). *Doing Democracy: Activist Art and Cultural Politics*. SUNY Press.

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, Riccati'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:

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

Suggested Readings:

72. Mark, H. & Olson, 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)