UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 21st (2/2024) meeting held on 07.06.2024, the Syndicate in its 67th (3/2024) meeting held on 12.07.2024 approved the following curricula for implementation w.e.f. Fall 2024.

I.	BS in Climate Change.	(Annex-**'A'**)
II.	BS in Farm Management	(Annex-**'B'**)

(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/25/ 120

Dated: 31.01.2025

Distribution:

- Chairman, Department of Agronomy
- Controller of Examinations
- Director Academics

C.C:

- Dean, Faculty of Agriculture
- Principal College of Agriculture
- Director, QEC
- Additional Registrar (Affiliation & Registration)
- Secretary to the Vice-Chancellor
- PA to Registrar
- Notification File

Scheme of Studies
for
Bachelor of Science in Climate Change
(BS Climate Change)
2024

Department of Agronomy
College of Agriculture
University of Sargodha, Sargodha

Dr. Muhammad Ather Nadeem
Chairman
Department of Agronomy
College of Agriculture
University of Sargodha, Sargodha

Curriculum

1. **Title of Degree Program:** Bachelor of Science in Climate Change
2. **Rationale**: The BS Climate Change degree program addresses the urgent need for skilled professionals to tackle the profound impacts of climate change. In our rapidly changing climate, this program equips students with essential knowledge and skills in climate science, mitigation, and adaptation strategies, integrating natural and social sciences. Our curriculum includes specialized courses in areas like forestry, agriculture, and urban planning. We have eleven highly qualified faculty members and state-of-the-art facilities to support practical and theoretical learning. This program prepares graduates to lead and innovate in various sectors, contributing to global climate change mitigation and adaptation efforts.

3. **Department Overview:** The Department of Agronomy is engaged in developing human resource in crop production and tends to integrate knowledge about crop plants and field-oriented work to boost the country's national economy. Established in 2007, our department has highly qualified Ph.D faculty (11) and has a strong track record of providing a comprehensive education at the undergraduate, Master's, and Ph.D. levels. We conduct high-impact applied research in crop production, crop growth modeling, mechanization, weed science, natural resource management, and farm management, addressing immediate problems, future challenges, and climate change impacts. Our leadership in agronomic education through quality teaching, innovative research, and effective outreach practices equips students and professionals with the skills to ensure environmentally safe, health-efficient, and sustainable production mechanisms, ultimately enhancing farm productivity and contributing to the agricultural economy of country.

4. **Description of Degree program:** The Bachelor of Science (BS) in Climate Science degree program is an interdisciplinary course of study designed to equip students with a comprehensive understanding of the Earth's climate system, the factors influencing climate change, and the impacts of these changes on natural and human systems. This program integrates knowledge from atmospheric science, oceanography, geology, biology, and environmental science to provide students with a holistic perspective on climate dynamics. The importance of a BS in Climate Science lies in its ability to prepare graduates for careers in research, policy-making, environmental management, and education, where they can contribute to addressing one of the most pressing global challenges of our time. By fostering critical thinking, analytical skills, and a deep understanding of climate processes and mitigation strategies, this program empowers students to develop solutions for reducing greenhouse gas emissions, adapting to climate impacts, and promoting sustainability.

5. **Program Learning Objectives:** The students are equipped to understand, address and mitigate the effect of climate change through scientific research policy development advocacy and community engagement

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6. Program Structure:

Duration	Minimum 4-Years (8-Semesters), Maximum 6-Years (12-Semesters)
Admission Requirements:	Eligibility: At least 50% marks in HSSC (Part-I / II) or Equivalent. "Quota for Diploma in Engineering (DAE) or Diploma in Agricultural Sciences (Part-I / II) = 10 Seats"
Degree Completion Requirements:	Degree Requirements: 120-144 credit hours

7. General Education (Gen Ed) Requirements: (Mandatory/Core Curses):

The minimum requirement for Gen Ed is 30 credits hours and will be offered in first four semesters only.

Sr. No.	Semester	Course Code	Course Title	Credit Hours	Prerequisite
1.	1	URCG-5118	Functional English	3(3-0)	Nil
2.	1	URCG-5105 URCG-5126	Islamic Studies (Compulsory)/ OR Religious Education/Ethics (For Non-Muslims)	2(2-0)	Nil
3.	1	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
4.	2	URCG-5112	Fables, Wisdom Literature, and Epic	2(2-0)	Nil
5.	2	URCG-5116	Science of Society-I	2(2-0)	Nil
6.	2	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil
7.	2	URCG-5127	Seerat of the Holy Prophet (SAW)	1(1-0)	Nil
8.	2	URGC-5128	Pakistan Studies	2(2-0)	Nil
9.	2, 4, 6, 7	URCG-5111	Translation of Holy Quran	NC	Nil
10.	3	URCG-5119	Expository Writing	3(3-0)	Nil
11.	3	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
12.	3	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
13.	4	URCG-5115	The Science of Global Challenges	3(2-1)	Nil
14.	4	URCG-5124	Entrepreneurship	2(2-0)	Nil
15.	4	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
GE Courses Credit Hours Total				**33(29-2)**	

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8. Single Major Courses:

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	AGRO-5901	Basic Agriculture	2(1-1)	Nil
2.	CLCH-5101	Introduction to Climate Change	3(2-1)	Nil
3.	CLCH-5102	Agriculture and Climate Change	3(2-1)	Nil
4.	CLCH-5103	Global Warming	3(2-1)	Nil
5.	CLCH-5104	Atmospheric Chemistry and Climate	3(2-1)	
6.	CLCH-5105	Climate Change Impacts on Ecosystems	3(2-1)	Nil
7.	CLCH-5106	International Climate Agreements and Diplomacy	3(2-1)	Nil
8.	CLCH-5107	Climate Change and Global Politics	3(2-1)	Nil
9.	CLCH-5108	Biodiversity under Changing Climate	3(2-1)	Nil
10	CLCH-5109	Climate Smart Agricultural Technologies	3(2-1)	Nil
11	CLCH-5110	Climate Change and Farming Community	3(2-1)	Nil
12	CLCH-6111	Climate Resilient Crop Management	3(2-1)	CLCH-5101
13	SAES-6816	Environmental Pollution and Management	3(3-0)	CLCH-5102
14	CLCH-6112	Sustainability and Climate Solutions	3(2-1)	CLCH-5102
15	CLCH-6113	Climate Change Risks and Food Security	3(2-1)	CLCH-5106
16	CLCH-6114	Carbon Sequestration and Environmental Footprints	3(2-1)	CLCH-5109
17	CLCH-6115	Human Response and Climate Change	3(3-0)	CLCH-5103
18	CLCH-6116	Climate Change Modelling, Impacts and Adaptation	3(2-1)	GEOG-5109
19	CLCH-6117	Renewable Energy and Climate	3(2-1)	CLCH-5109
20	CLCH-6118	Climate and Human Health	3(2-1)	CLCH-5104
21	CLCH-6119	Research Methodology and Scientific Writing	3(2-1)	Nil
22	CLCH-6120	Industrialization and Climate Change	3(2-1)	CLCH-5105
23	CLCH-6121	Climate Change Mitigation Technologies	3(2-1)	GEOG-5109
24	CLCH-6122	Climate Data Analysis and Visualization	3(2-1)	STAT-5102
25	CLCH-6123	Climate Change Resilience and Adaptation	3(2-1)	CLCH-5109
26	CLCH-6124	Climate Change Impacts to Terrestrial and Aquatic Animals	3(2-1)	GEOG-6114
27	CLCH-6125	AI Solutions for Climate Change Issues	3(2-1)	CLCH-5110
28	CLCH-6126	Water and Environmental Governance	3(2-1)	GEOG-6114
29	CLCH-6127	Agroforestry and Climate Resilience	3(3-0)	CLCH-5102
Major Courses Credit Hours Total			**86(60-26)**	

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9. Interdisciplinary/Allied courses: minimum 12 credit hours:

1.	ZOOL-6141/ MATH-5128	Introduction to Biology-I (for Pre-Engineering students)/ Mathematics (for Pre-Medical students)	3(3-0)/ 3(3-0)	Nil
2.	GEOG-5109	Climatology	3(3-0)	Nil
3.	GEOG-6114	Oceanography	3(3-0)	Nil
4.	GEOG-6115	Remote Sensing	3(2-1)	Nil
5.	STAT-5102	Applied Statistics	3(3-0)	Nil
Interdisciplinary Courses Credit Hours Total			**15(14-1)**	

10. Field experience/internship: Minimum 03 credit hours:

Lasting 6-8 weeks and ideally scheduled after/during summer breaks after 4th semester.

1.	CLCH-6128	Research Project / Internship	**3(0-3)**	

11. Capstone project: Minimum 03 credit hours:

This project, after the sixth semester, requires faculty supervision and evaluation following department guidelines

1.	CLCH-6129	Capstone Project	**3(0-3)**	

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SCHEME OF STUDIES

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 (Compulsory)/ OR Religious Education/Ethics (For Non-Muslims)	2(2-0)	Nil
GE-3	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
IDC-1	ZOOL-6141/ MATH-5128	Introduction to Biology-I (for Pre-Engineering students) / Mathematics (for Pre-Medical students)	3(3-0)/ 3(3-0)	Nil
Major-1	AGRO-5901	Basic Agriculture	2(1-1)	Nil
Major-2	CLCH-5101	Introduction to Climate Change	3(2-1)	Nil
Major-3	CLCH-5102	Agriculture and Climate Change	3(2-1)	Nil
Total Credit Hours			**19 (15-4)**	

Semester-II

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-4	URCG-5112	Fables, Wisdom Literature, and Epic	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
GE-9	URCG-5111	Translation of Holy Quran – I	NC	Nil
GE-8	URGC-5128	Pakistan Studies	2(2-0)	Nil
Major-4	CLCH-5103	Global Warming	3(2-1)	
Major-5	CLCH-5104	Atmospheric Chemistry and Climate	3(2-1)	Nil
IDC-2	GEOG-5109	Climatology	3(3-0)	Nil
Total Credit Hours			**19 (17-2)**	

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Semester-III

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-10	URCG-5119	Expository Writing	3(3-0)	Nil
GE-11	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
GE-12	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
Major-6	CLCH-5105	Climate Change Impacts on Ecosystems	3(2-1)	Nil
Major-7	CLCH-5106	International Climate Agreements and Diplomacy	3(2-1)	Nil
Major-8	CLCH-5107	Climate Change and Global Politics	3(2-1)	Nil
IDC-3	GEOG-6114	Oceanography	3(3-0)	Nil
Total Credit Hours			**20(17-3)**	

Semester-IV

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-13	URCG-5115	The Science of Global Challenges	3(2-1)	Nil
GE-14	URCG-5124	Entrepreneurship	2(2-0)	Nil
GE-15	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
GE-9	URCG-5111	Translation of Holy Quran – II	NC	Nil
Major-9	CLCH-5108	Biodiversity under Changing Climate	3(2-1)	Nil
Major-10	CLCH-5109	Climate Smart Agricultural Technologies	3(2-1)	Nil
IDC-4	GEOG-6115	Remote Sensing	3(2-1)	Nil
IDC-5	STAT-5102	Applied Statistics	3(3-0)	Nil
Total Credit Hours			**19(15-4)**	

Semester -V

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major 11	CLCH-5110	Climate Change and Farming Community	3(2-1)	Nil
Major-12	CLCH-6111	Climate Resilient Crop Management	3(2-1)	CLCH-5101
Major-13	SAES-6816	Environmental Pollution and Management	3(3-0)	CLCH-5102
Major-14	CLCH-6112	Sustainability and Climate Solutions	3(2-1)	CLCH-5102
Major-15	CLCH-6113	Climate Change Risks and Food Security	3(2-1)	CLCH-5106
Major-16	CLCH-6114	Carbon Sequestration and Environmental Footprints	3(2-1)	CLCH-5109
Major-17	CLCH-6115	Human Response and Climate Change	3(3-0)	CLCH-5103
Total Credit Hours			**21(16-5)**	

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Semester -VI

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-18	CLCH-6116	Climate Change Modelling, Impacts and Adaptation	3(2-1)	GEOG-5109
Major-19	CLCH-6117	Renewable Energy and Climate	3(2-1)	CLCH-5109
Major-20	CLCH-6118	Climate and Human Health	3(2-1)	CLCH-5104
Major-21	CLCH-6119	Research Methodology and Scientific Writing	3(2-1)	Nil
Major-22	CLCH-6120	Industrialization and Climate Change	3(2-1)	CLCH-5105
Major-23	CLCH-6121	Climate Change Mitigation Technologies	3(2-1)	GEOG-5109
GE-9	URCG-5111	Translation of Holy Quran-III	NC	Nil
Total Credit Hours			**18(12-6)**	

Semester -VII

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-24	CLCH-6122	Climate Data Analysis and Visualization	3(2-1)	STAT-5102
Major-25	CLCH-6123	Climate Change Resilience and Adaptation	3(2-1)	CLCH-5109
Major-26	CLCH-6124	Climate Change Impacts to Terrestrial and Aquatic Animals	3(2-1)	GEOG-6114
Major-27	CLCH-6125	AI Solutions for Climate Change Issues	3(2-1)	CLCH-5110
Major-28	CLCH-6126	Water and Environmental Governance	3(2-1)	GEOG-6114
Major-29	CLCH-6127	Agroforestry and Climate Resilience	3(3-0)	CLCH-5102
GE-9	URCG-5111	Translation of Holy Quran – IV	NC	Nil
Total Credit Hours			**18(13-5)**	

Semester -VIII

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Compulsory-1	CLCH-6128	Research Project / Internship	3(0-3)	
Compulsory-2	CLCH-6129	Capstone Project	3(0-3)	
Total Credit Hours			**06(0-6)**	

Note: The scheme of studies of BS. Climate Change has been prepared in accordance with the requirement/s of Higher Education Commission, Islamabad.

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SEMESTER-I

URCG-5118 **Functional English** **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 studentswould 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. Precis 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 Texts

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 andskills* (3rd ed.). Ann Arbor: The University of Michigan Press.
4. Swan, M. (2018). *Practical English usage* (8th ed.). Oxford: Oxford University Press.

Suggested Readings

1. Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). *Longmangrammar 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: OxfordUniversity Press

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URCG-5105 **Islamic Studies (Compulsory)** **2(2-0)**

Introductory/compulsory foundation course

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources of Islam; Qur'aan and Hadith, history and particular cultural contexts. The area 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 basis of Islam in fields that include Qur'aanic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'aan and Sunnah.

- To make students understand the relevance and pragmatic significance of Islam in theirlives.
- To make learners comprehend the true spirit of Islam with reference to modernworld.
- To generate a sense of Islamic principles as a code of living that guarantee the effective solutions to the current challenges ofbeing.
- To provide Basic information about IslamicStudies
- To enhance understanding of the students regarding IslamicCivilization
- To improve Students skill to perform prayers and otherworships
- To enhance the skill of the students for understanding the issues related to faith and religious life.

Contents

1.Introduction to Qur'aanic Studies تعارف قرآن مجید

1) Basic Concepts of Qur'aan قرآن مجید کا بنیادی تعارف

2) History of the compilation of Qur'aa تاریخ جمع وتدوین قرآن مجید

3) Uloom-ul-Qur'aan علوم القرآن

مطالعہ قرآن (تعارف قرآن مجید، منتخب آیات کا ترجمہ و تفسیر: سورۃ البقرہ آیات 1-5، 284-286؛ سورۃ الحجرات آیات 1-18؛ سورۃ الفرقان آیات 63-77؛ سورۃ المومنون آیات 1-11؛ سورۃ الاحزاب آیات 6، 21، 32- 33، 40، 56- 59؛ سورۃ الانعام آیات 151-153؛ سورۃ الصف آیات 1- 14؛ الحشر آیات 18- 20؛ آل عمران آیات 190- 192؛ النحل آیات 12-14؛ لقمن آیت 20، حم السجدہ آیت 53

2. Introduction to Hadith تعارف حدیث

1) Legal Status of Hadith حدیث کی قانونی حیثیت

2) History of the compilation of Hadith تاریخ جمع وتدوین حدیث

3) Classifications of Hadith حدیث کی اقسام

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متن، حدیث: 1 درج ذیل موضوعات پر احادیث کا مطالعہ

1۔ اعمال کا اجر نیت پر منحصر ہے۔ 2۔ بہترین انسان قرآن کا طالب علم اور اس کا معلم ہے۔ 3۔ کتاب و سنت گمراہی سے بچنے کا ذریعہ ہیں 4۔ ارکان اسلام 5۔ اسلام، ایمان، احسان اور قیامت کی نشانیاں، 6۔ بچوں کو نماز کی تلقین 7۔ دین کا گہرا فہم اللہ کی خاص عنایت ہے 8۔ حصول علم، تلاوتِ قرآن اور عمل کی اہمیت و فضیلت، 9۔ روز محشر میں ہونے والا محاسبہ، 10۔ حقوق اللہ کے ساتھ ساتھ حقوق العباد کا لحاظ رکھنا بھی لازم ہے 11۔ حسن خلق کی عظمت اور فحش و بد گوئی کی مذمت 12۔ دنیا و آخرت کی بھلائی کی ضامن چار چیزیں، 13۔ ہلاک کر دینے والی سات چیزیں، 14۔ بے عمل مبلغ کا عبرت ناک انجام 15۔ ہر شخص نگران ہے اور ہر شخص مسئول

3. Sirah of the Prophet (PBUH)	سیرت النبی ﷺ
1. Significance of Seerah Studies	مطالعہ سیرت کی ضرورت و اہمیت
2. Prophetic principles of Character building	تعمیر سیرت و شخصیت کا نبوی منہاج

اقامت دین کا نبوی طریق کار، اقامتِ دین بعہدِ خلافت راشدہ، میثاق مدینہ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ، قرآن مجید میں سیرت سرور عالم کا بیان، غزواتِ نبوی ﷺ کے مقاصد و حکمتیں

4. Islamic Culture & Civilization	اسلامی تہذیب و تمدن
1) Basic Concepts of Islamic Civilization	اسلامی تہذیب کا مفہوم
2) Historical evaluation of Islamic Civilization	اسلامی تہذیب کا تاریخی ارتقاء
3) Salient feature of Islamic Civilization	اسلامی تہذیب کی نمایاں خصوصیات
4) Islamic Civilization and ContemporaryIssues	اسلامی تہذیب و تمدن اور معاصر مسائل

اسلامی تہذیب کے عوامل و عناصر، اسلامی تہذیب کے 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

Pre-Requisite: Nil

Recommended Books

1) Hameed ullahMuhammad, —Emergence ofIslam ,IRI,Islamabad
2) Hameed ullah Muhammad, —Muslim Conduct ofState
3) Hameed ullah Muhammad, _Introduction tolslam
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, Teleeemat-e- Islam

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Department of Islamic Studies

URCG-5126 **ETHICS** **2(2-0)**

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). Christianityc). Islam
7. Professional Ethics:
   - a). Medical Ethics
   - b). Ethics of Students
   - c). Ethics of Teachersd). Business Ethics

REFERENCE 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. Culcutta: 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 of University

URCG-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, andassociated technologies. How computers can be used in the workplace, how communications systemscan 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, Power Point, Excel) or other similar tools depending on theoperating 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 HigherEducation; 26th edition.
2. Computers: Understanding Technology by Fuller, Floyd; Larson, Brian: edition 2018.

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ZOOL-6141 **Introduction to Biology-I** **3 (3-0)**

This subject aims to yield students with a sense of practical relevance of biology to everyday life. This will make students comprehend life by understanding some of the molecular processes that occur in and around cells, to make students cognizant of biologic phenomenon (nature, body, etc.) on an evolutionary, ecological, behavioral, physiologic, tissue, cellular, and molecular level. In this subject students will examine how life is organized into hierarchical levels; how living organisms use and produce energy; how life grows, develops, and reproduces; how life responds to the environment to maintain internal stability; and how life evolves and adapts to the environment. Moreover, it will also enable them to investigate the biological molecules, homeostasis in vertebrates, and the influence of hormones on coordination and control systems of animal body. Upon completion of this subject students will be having an enhanced knowledge and appreciation of the basics of growth and development plans of animals and can develop cogent and critical arguments based on the course material.

Contents

1. Introduction: Nature and scope of biology, Branches of biology, Relationship between biology and psychology
2. Biological molecules: Carbohydrates, Proteins, Fats, Nucleic acids,Water
3. The cell: Structure and function of cell, Cell organelles, Different types of cells
4. Homeostasis: Osmoregulation, Structure and functions of Nephron, Thermoregulation
5. Coordination and control: Structure and physiology of Neuron, Introduction to central and peripheral nervous system, Hormones
6. Basics of growth and development: Embryonic and post embryonic development

Recommended Texts

1. Michael, J. and Lenardo. (2013). *Immune Homeoststis: Methods and protocol*. Humama press.
2. Campbell, M. and Christopher J. P. (2016). *Organismal homeostatis*. Momentum press.

Suggested Readings

1. Lisa A. U., Michael L. C., Steven A. W., Peter V. M., Jane B. R. and Neil A. C. (2016). Campbell *biology*. 11th Pearson
2. Cambell, N. A. Mitchell, l. G. and Reece, J. B. (2009). *Biology: Concepts and connections*. 6th edition San Francisco: Addison Wesley, Longman
3. Anna A. S., Richard B. P. (2019). An Introduction to Conservation Biology 2nd Edition. Sinauer Associates is an imprint of Oxford University Press

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MATH-5128 **Mathematics** **3(3-0)**

To prepare the students, not majoring in mathematics, with the essential tools of algebra to apply the concepts and the techniques in their respective disciplines. Mathematics, as a study of patterns, both practical and abstract, involves analytical thought, logical reasoning, problem solving skills, and precise communication. Because of its power and versatility, mathematics has often been called the "Queen of the Sciences." There is no field of scientific inquiry that does not express itself through the language of mathematics. An undergraduate degree in mathematics provides an excellent foundation for students who are interested in pursuing an advanced degree in mathematics or in a related specialized profession. Mathematics can also provide an excellent foundation for students considering professional degrees in such allied fields such as Law, Business Administration, or Medicine. The kinds of analytical and logical thinking skills that one develops while studying mathematics are precisely the skills that recruiters look for in potential employees. Jobs involving significant mathematical background also consistently rank near the top of the list in annual career surveys.

Contents

1. Real Numbers
2. Relations and Functions
3. Inequalities
4. Quadratic Functions and Complex Numbers
5. Linear Equations and Quadratic Equations: Formation of Linear equation
6. Solving Linear equation involving one variable
7. Solution of Quadratic equation by factorization method
8. Solution of quadratic equation by square completion methods
9. Solution of quadratic equation by quadratic formula
10. Application of quadratic equation
11. Sequence and Series
12. Types of Sequences; A. P, A. M., G. P., H. P
13. Trigonometric Functions, Trigonometric Applications
14. Graph of Functions and Modelling
15. Limits and Continuity
16. Derivatives, Integration
17. Probability and Binomial Theorem.

Recommended Texts

1. Gantert, A. X. (2009). *Algebra 2 and trigonometry*. New York: AMCOS School Publication INC.
2. Kaufmann, J. E. (1994). *College algebra and trigonometry* (3th ed.). Boston: PWS-Kent Pub. Co.

Suggested Readings

1. Swokowski, E. W. (1993). *Fundamentals of algebra and trigonometry* (8th ed.). Boston: PWS-Kent Pub. Co.
2. Nauman, K. (2019). Basic mathematics-I: algebra and trigonometry (2nd ed.). Lahore: Al-Hassan Pub.
3. Anton, H. (1999). *Calculus: A new horizon* (6th ed.). New York: John Wiley.
4. Stewart, J. (2012). *Calculus* (7th ed.). Belmont: Brooks/Cole.

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AGRO-5901 **Basic Agriculture** **2(1-1)**

The main aim of this course is to provide the basic knowledge and background about Pakistan's Agriculture. Basic Agriculture is a graduate-level course which gives the students a basic knowledge of agriculture/ It will enable the students to understand the basic terminologies of agriculture, its different branches, allied disciplines, salient features of Pakistan's agriculture including climate, land resources etc. as well as the problems of Pakistan agriculture. Basic knowledge about agricultural inputs such as seed, fertilizer, irrigation etc. will be communicated. Crop growth related problems like weeds, insect pests will be elaborated. The students will be able to understand the conventional and international system of land measurement. The knowledge of post-harvest technology is also shared with the students.

Contents

Theory

1. Agriculture, history, importance, branches and allied sciences.
2. Salient features of Pakistan's agriculture.
3. Climate, land and water resources.
4. Tillage: objectives and types.
5. Seed: types and quality.
6. Crop nutrients, manures and fertilizers, sources and methods of application.
7. Irrigation: systems, types and management.
8. Harvesting, processing, storage and marketing of farm produce.

Practical

1. Land measuring units.
2. Demonstration of hand tools and tillage implements.
3. Identification of meteorological instruments.
4. Identification of crop plants, weeds and seeds.
5. Identification of organic and inorganic fertilizers.
6. Calculation of nutrient-cum-fertilizer unit value.
7. Demonstration of various irrigation methods.
8. Field visits.

Recommended Texts

1. Bashir, E. and Bantel, R.. (2001), *Soil Science*, Islamabad, National Book Foundation.
2. Brady, N.C. and Weil, R.R. (2013). *Elements of the Nature and Properties of Soils,* 3rd Ed. Upper Saddle River, NJ, USA, Pearson Education.

Suggested Readings

1. Hillel, D. (2008). *Soil in the Environment: Crucible of Terrestrial Life.* Burlington, MA, USA, Elsevier Inc.
2. Safdar, M.E., Javaid, M.M., Tanveer, A., Ali, H.H. and Kamran, M. (2019). Innovation in Agronomic Concepts. Higher Education Commission, Islamabad.
3. Das, D.K. (2011). *Introductory Soil Science* (3rd ed.). New Delhi-110002, India, Kalyani Publ.

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CLCH-5101 **Introduction to Climate Change** **3(2-1)**

The objective of this course is to provide foundational knowledge to students about science of climate change, including its causes, impacts, and mitigation strategies and to develop an understanding of the interdisciplinary nature of climate change and its implications for society, ecosystems, and global sustainability.

CONTENTS

Theory

1. Introduction to climate change: Definition and concept of climate change
2. Historical perspective and scientific basis of climate change
3. Causes of climate change
4. Greenhouse gases and their sources
5. Climate System Components; atmosphere, hydrosphere, cryosphere, biosphere
6. Climate Change Impacts: Global temperature rise and its effects, Sea level rise, ocean acidification, extreme weather events
7. Climate change mitigation and adaptation
8. Climate change policy and economics.

Practical

1. Climate data analysis: Graphical representation of climate trends.
2. Climate impact assessment
3. Case studies on local and global climate change effects

Recommended Texts

1. Maslin, M. (2021). *Climate Change: A Very Short Introduction* (4th ed.). Oxford University Press.
2. Haque, S. E. (2023). *Historical perspectives on climate change and its influence on nature. In Visualization techniques for climate change with machine learning and artificial intelligence* (pp. 15-38). Elsevier.
3. Laukkonen, J., Blanco, P. K., Lenhart, J., Keiner, M., Cavric, B., & Kinuthia-Njenga, C. (2009). Combining climate change adaptation and mitigation measures at the local level. *Habitat international*, *33*(3), 287-292.

Suggested Readings

1. Kolbert, E. (2014). *The Sixth Extinction: An Unnatural History.*
2. Awoyemi, P. N. (2020). *The Components of the Climate System and Its Importance in the Climate Change Conundrum.*
3. Kitchen, D. (2016). *Global climate change: Turning knowledge into action.* Routledge.

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CLCH-5102 **Agriculture and Climate Change** **3(2-1)**

To enable students to understand the interactions between agriculture and climate change, including impacts on crop production, livestock, and rural communities and to explore adaptation and mitigation strategies for sustainable agriculture in the face of changing climatic conditions.

CONTENTS

Theory

1. Overview of agriculture's vulnerability to climate change
2. Impacts of climate change on agriculture: Effects on crop yields, water availability and soil fertility
3. Livestock production challenges under changing climate conditions
4. Climate-resilient farming practices; Agro-ecological approaches to enhance resilience, Drought-tolerant crops and varieties.
5. mitigation strategies in agriculture: Carbon sequestration in soils and agroforestry, Reduced emissions from deforestation and agricultural practices
6. Climate change and food security: Global food supply chains and climate-related risks, Addressing food security challenges through sustainable agriculture
7. Key concepts and strategies in climate-smart agriculture

Practical

1. Climate risk assessment for agricultural systems
2. Analysis of climate data to assess potential risks to specific crops or regions
3. Case studies in climate-resilient farming
4. Designing climate-smart farming plans for different agro-ecological zones

Recommended Texts

1. Hasanuzzaman, M. (Ed.). (2023). *Climate-Resilient Agriculture, Vol 1: Crop Responses and Agroecological Perspectives.* Springer Nature.
2. Food and Agriculture Organization (FAO). (2021). *The Impact of Disasters and Crises on Agriculture and Food Security.* Italy: Bernan Distribution.
3. Pandey, D. N. (2002). Carbon sequestration in agroforestry systems. *Climate policy*, *2*(4), 367-377.

Suggested readings

1. Aggarwal, P., & Krishna, S. M. (2017). *Climate Change and Agriculture: An Integrated Approach to Adaptation and Mitigation.* CRC Press.
2. Lipper, L., McCarthy, N., Zilberman, D., Asfaw, S., & Branca, G. (2017). *Climate smart agriculture: building resilience to climate change* (p. 630). Springer Nature.
   Kumar, A., & Srivastava, S. (Eds.). (2018). *Agriculture and Climate Change: Impacts, Adaptation, and Mitigation.* Springer.

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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 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.

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General Education Cluster: Social Sciences

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
2. **Society and Community, Historical evolution of Society**
   - Types of Societies
   - Foraging society, Horticultural society, Pastoralist society
   - Agrarian societies, Industrial society, Postindustrial society
3. **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

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4. **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

5. **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

6. **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

7. **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

8. **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/

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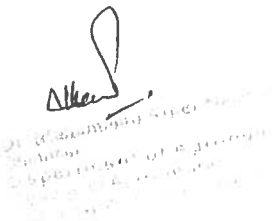
7. Jalal, A. (ed.) (1995) 'The colonial legacy in India and Pakistan', in Democracy and Authoritarianism in South Asia: A Comparative and Historical Perspective. Cambridge: Cambridge University Press (Contemporary South Asia)
8. Zaidi, S. A. (2015) Issues in Pakistan's Economy: A Political Economy Perspective. 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.
10. Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'Introducing Economic Sociology', Princeton University Press, Princeton.



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 حالات 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 عالمگیر اثرات
10	خصائص النبیؐ	ناموس رسالتؐ
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	السیرۃ النبویۃ
2	مولاناشبلی نعمانی ، سید سلمان ندوی	سیرۃ النبی صلی اللہ علیہ وسلم
3	قاضی محمد سلیمان سلمان منصور پوری	رحمۃ 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

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URCG-5111 Translation of the Holy Quran – I (Non-Credit) ~~1(0-1)~~

Topic	Details
Semester/Level	In some discipline 1st semester and in some discipline 2nd Semester/ ADP Program 1st Year
Course Code	URCQ-5111
Course Title	Translation of the Holy Quran – I
Credit Hours	1(0-1)
Objectives	• To familiarize the students to keys and fundamentals of recitation ofthe holy Quran. • To develop the skill of the students of recitation the last revelation. • Students will learn the basic Arabic grammar in a practical way. • To develop an eagerness among the students to explore the lastdivine Book.
Course Contents :	• تیسواں پارہ - ناظرہ مع تجوید • بنیادی عربی گرامر • اسم اور اس کے متعلقات: اسم فاعل، مفعول، تفضیل، مبالغہ • فعل اور اس کی اقسام: ماضی، مضارع، امر، نہی • حرف اور اس کی اقسام: حروف علت، حروف جارہ، مشبہ بالفعل
Memorization:	• تیسویں پارے کی آخری بیس سورتیں (حفظ مع ترجمہ)

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URCG-5128 **Pakistan Studies** **2(2-0)**

This course is designed to provide students with a comprehensive exploration of Pakistan's identity, spanning geographical, historical and cultural dimensions. It delves into the diverse landscape, ancient civilizations, and rich cultural heritage that define Pakistan. Moreover, it examines the socio-cultural and political transformations in Pakistan over time including democratic transitions and military interventions. The aim of this course is to inculcate in students a nuanced understanding of Pakistan's past, present, and potential future trajectories, enabling them to critically evaluate the complex dynamics shaping the nation's development.

Course Learning Outcomes

By the end of this course, student will be able to:

1. Have enhanced knowledge of the geographical, historical and political aspects of Pakistan.
2. Understand the society and cultural of Pakistan.
3. Understand and explain the scio-economics developments in Pakistan.
4. Explore contemporary issues and challenges faced by Pakistan and their implications for the future.

Contents

1. **Introduction to Pakistan:**
   - Geographical location and significance.
   - Historical background: Ancient civilizations in the region.
   - Factors leading to the creation of Pakistan
2. **Political History of Pakistan:**
   - Formative phase
   - Military interventions and democratic transitions.
3. **Geography of Pakistan:**
   - Physiography: Mountains, plains, plateaus, deserts, valleys and coastal areas.
   - River system: Indus river and its tributaries;
   - Climatic regions of Pakistan.
4. **Society and Culture of Pakistan:**
   - Socio- cultural diversity.
   - Language and literature of Pakistan.
5. **Economics Development of Pakistan:**
   - Agriculture and industrial sectors of Pakistan.
   - Economic challenges of Pakistan.
6. **Contemporary Issues:**
   - Foreign relations of Pakistan.
   - Security challenges: terrorism, extremism, regional conflicts.
   - Environmental problems and sustainable development (SDGs).
   - Media and social change.

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SUGGESTED READING MATERIALS

1. "Jinnah of Pakistan" by Stanley Wolpert
2. "The sole Spokesman: Jinnah, the Muslim League, and the Demand for Pakistan" by Ayesha Jalal
3. "The struggle for Pakistan" by Ishtiaq Hussain Qureshi
4. "Pakistan, the Formative Phase, 1857-1948" by Khalid B. Sayeed
5. "Pakistan Studies: A Book of Readings" by Sikandar Hayat
6. "Constitutional and Political History of Pakistan" by Hamid Khan
7. "Trek to Pakistan" by Ahmad Saeed and Kh. Mansur Sarwar
8. "Pakistan: A Modern History" by Ian Talbot
9. "Politics in Pakistan: The Nature and Direction of Change" by Khalid B. Sayeed
10. "Physical Geography of Pakistan" by Umar Jahangir
11. "A Geography of Pakistan: Environment, people, and Economy" by Fazle Karim Khan
12. "Pakistan's Foreign Policy: An Historical Analysis" by S.M. Burke
13. "Separatism in East Pakistan" by Rizwan Ullah Kokab
14. "Being Pakistani: Society, Culture and the Arts" by Raza Rumi
15. "Pakistani's Culture Heritage: Socio-Economic and Technological Aspects" edited by Abdul Jabbar Khan
16. "Language and Politics in Pakistan" by Tariq Rahman
17. Sociology" by Horton and Hunt
18. "Pakistan in the Twentieth Century: A Political History" by Lawrence Ziring
19. "Economic Development of Pakistan" by Ishrat Husain
20. "Issues in Pakistan's Economy" by S. Zaidi

CLCH-5110 Climate Change and Farming Community 3(2-1)

To familiarize the students with the impacts of climate change on farming communities, including social, economic, and cultural aspects. To explore strategies to enhance climate resilience and adaptation among farming populations and Investigate policies and initiatives aimed at supporting and empowering farming communities in addressing climate-related challenges.

CONTENTS

Theory

1. Overview of climate change and farming communities
2. Understanding vulnerability and adaptive capacity of farming populations
3. Socioeconomic impacts of climate change on rural livelihoods
4. Climate-smart technologies and innovations for smallholder farmers
5. Community-based climate adaptation planning: participatory approaches in identifying climate risks and priorities
6. Gender and social equity in climate resilience: analyzing gender-specific impacts of climate change on farming communities
7. Promoting inclusive and equitable climate adaptation strategies,
8. Role of government programs, NGOs, and community-based organizations in climate adaptation

Practical

1. Community vulnerability assessment
2. Analyzing data to identify key resilience factors and adaptation needs
3. Climate resilience planning simulation: Role-playing exercises to simulate community meetings for climate adaptation planning
4. Developing action plans and strategies to build resilience at the local level

Recommended Texts

1. King, B., & Wallace, M. (Eds.). (2019). Rural Resilience and Climate Change Adaptation: The Role of Farming Communities. Routledge.
2. Elias, M., & Tröster, S. (Eds.). (2020). Gender, Climate Change, and Agriculture: Emerging Practices and Policies. Routledge.
3. Berke, P., & Beatley, T. (2017). Community-Based Climate Adaptation and Resilience Planning. CRC Press.

Suggested Readings

1. Sivakumar, M. V. K., & Hansen, J. (Eds.). (2015). Climate Change and Agriculture: Socioeconomic Impacts and Adaptation Strategies in Rural Communities. Routledge.
2. Flachs, A. J., & Haendel, J. (2017). Farmers and Climate Change: A Cross-National Perspective. Palgrave Macmillan.
3. Bulkan, J., Palmer, J., Larson, A. M., & Hobley, M. (Eds.). (2022). *Routledge Handbook of Community Forestry.* London: Routledge.
4. Van Aalst, M. K., Cannon, T., & Burton, I. (2008). *Community level adaptation to climate change: The potential role of participatory community risk assessment.* Global environmental change, 18(1), 165-179.

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CLCH-5103 **Global Warming** **3(2-1)**

To familiarize the students with science behind global warming, including the greenhouse effect, causes of temperature rise, and climate feedback mechanisms. To examine the impacts of global warming on ecosystems, biodiversity, human health, and socio-economic systems and to investigate mitigation strategies and policies aimed at reducing greenhouse gas emissions and addressing global warming challenges. Develop practical skills in analyzing climate data, conducting impact assessments, and proposing solutions to mitigate global warming.

CONTENTS

Theory

1. Introduction to global warming: Definition, history, and scientific basis of global warming
2. Greenhouse gases and the role of human activities
3. The greenhouse effect and radiative forcing
4. Impacts of global warming: Changes in temperature, CO_2 concentration, precipitation patterns, and extreme weather events, Effects on oceans, polar regions, and global ecosystems
5. Global warming and human health: Public health impacts of global warming, including heat waves, vector-borne diseases
6. Global warming impact on agricultural productivity
7. Socio-economic consequences of global Warming
8. Global warming mitigation strategies: Renewable energy technologies, Energy efficiency measures and carbon sequestration techniques

Practical

1. Climate data analysis: Analyzing temperature records, CO_2 concentrations, and climate model outputs
2. Conducting vulnerability assessments for different regions or sectors
3. Developing adaptation and mitigation strategies based on projected climate scenarios

Recommended Texts

1. Houghton, J. (2009). *Global warming: the complete briefing.* Cambridge university press.Khan, A. A. (2024). An Analytical Study on The Impact of Global Warming: Effects on environment. *Recent trends in commerce, management, accountancy and business economics*. 54.
2. Ussiri, D. A., & Lal, R. (2017). *Carbon sequestration for climate change mitigation and adaptation* (pp. 287-325). Cham, Switzerland: Springer International Publishing.
3. Hawken, P. (Ed.). (2017). Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming. Penguin Books.

Suggested Readings

1. Kolbert, E. (2014). The Sixth Extinction: An Unnatural History. Henry Holt and Company.
2. Klein, N. (2014). This Changes Everything: Capitalism vs. The Climate. Simon & Schuster.
3. Romm, J. (2016). Climate Change: What Everyone Needs to Know (2nd ed.). Oxford University Press.

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CLCH-5104 **Atmospheric Chemistry and Climate** **3(2-1)**

To develop understand of the students about fundamental principles of atmospheric chemistry and its role in shaping Earth's climate system. Explore the interactions between atmospheric constituents, including greenhouse gases and aerosols, and their impact on climate variability and change. Moreover, analytical skills in students to assess atmospheric processes and their influence on radiactive forcing and climate feedback mechanisms also are the part of learning. Investigate the chemistry of air pollutants and their implications for air quality, human health, and climate.

CONTENTS

Theory

1. Introduction to atmospheric chemistry
2. Composition and structure of Earth's atmosphere
3. Chemical reactions and processes in the troposphere and stratosphere
4. Greenhouse gases and radiative forcing: Role of greenhouse gases in radiative balance
5. Climate feedback mechanisms and amplification of global warming
6. Aerosols and climate: Sources, types, and properties of atmospheric aerosols, Aerosol-cloud interactions and their impact on climate
7. Chemistry of ozone layer: Ozone chemistry in the stratosphere and ozone layer dynamics
8. Human impacts on ozone depletion
9. Air quality and climate change: Relationship between air pollution, particulate matter, and climate
10. Impacts of air quality regulations on climate mitigation and adaptation

Practical

1. Measurement of greenhouse gas concentrations: Gas chromatography techniques for analyzing atmospheric samples
2. Estimating CO_2 fluxes and carbon sequestration rates
3. Aerosol characterization and cloud formation: Particle size distribution analysis using optical and electron microscopy
4. Cloud condensation nuclei measurements and cloud chamber experiments

Recommended Texts

1. Seinfeld, J. H., & Pandis, S. N. (2016). *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change* (3rd ed.). Wiley.
2. Jacob, D. J. (1999). *Introduction to Atmospheric Chemistry*. Princeton University Press.
3. Burrows, J. P., & Müller, R. (Eds.). (2003). *The Changing Chemistry of the Atmosphere*. Royal Society of Chemistry.
4. *Atmosphere: Theory, Experiments, and Applications*. Academic Press.

Suggested Readings

1. Jacobson, M. Z. (2012). Air Pollution and Global Warming: History, Science, and Solutions. Cambridge University Press.
2. National Research Council, Division on Earth, Life Studies, Board on Atmospheric Sciences, Climate Research Committee, & Panel on Climate Change Feedbacks. (2004). Understanding climate change feedbacks. National Academies Press.
3. Finlayson-Pitts, B. J., & Pitts Jr., J. N. (2000). Chemistry of the Upper and Lower

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GEOG-5109 **Climatology** **3(3-0)**

The course provides an overview of the physical processes responsible for determining global and regional climate. This course gives a general introduction to meteorology and climatology. Meteorology topics include energy balance, moisture and cloud development in the atmosphere, atmospheric dynamics, small and large scale circulations, storms and cyclones, and weather forecasting. Climatology topics include the interaction between the atmosphere and oceans over long time periods, climate classification, and the potential for climatic change. It brings together information from rural communities, indigenous peoples and research workers on how they use agro-biodiversity to cope with climate change. It stimulates communication between agro-biodiversity researchers, users and maintainers. It identifies tools and practices relevant to using agro-biodiversity for coping with climate change and making these widely available. It also promotes awareness of the vital role of agro-biodiversity in adapting to climate change among key audiences, including donors, development agents and the global biodiversity community.

Course Contents:

1. Introduction.
2. Key concepts in climatology and meteorology.
3. Structure and composition of atmosphere.
4. Elements and factors of climate.
5. Insolation and Terrestrial heat budget.
6. Temperature distribution.
7. Humidity and its types; Condensation and their forms, Precipitation, formation and their types.
8. Atmospheric Pressure and global pressure belts.
9. Atmospheric Circulation: (Upper and Lower) air stability and instability, storms; Cyclones (hurricanes, typhoons) and tornadoes
10. Air masses and fronts.
11. Classification of climates; critical study of the Koppen, Miller and Thornthwaite classifications of major climates.
12. Climate variability and climate change: Natural and anthropogenic; Greenhouse gasses; global warming; acid rain, ozone layer depletion El-Niño and La-Niña, impact on precipitation distribution.
13. Climatic regions of Pakistan and their characteristics
14. Climatic data: sources, collection, analysis and presentation. Problems associated with data quality (spatial, temporal).

Recommended Texts:

1. Miller A. (2001). *Climatology*. Haryana: Shubhi Publications.
2. Barry. R. (1998). *Atmosphere, weather and climate*. London: Routledge.

Suggested Readings:

1. Shamshad, K.M. (1988). *The meteorology of Pakistan*. Karachi: Royal Book Co.
2. Strahler, A. N. (1998). *Elements of physical geography*. New York: John Wiley.
3. Diwan A. P. &Arora. D. K. (1995). *Origin of ocean*. New York: John Wiley.

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SEMESTER-III

URCG- 5119 **Expository Writing** **3 (3-0)**

This course prepares undergraduates to become successful writers and readers of English. The coursehelps students develop their fundamental language skills with a focus on writing so that they can gainthe confidence to communicate in oral and written English outside the classroom. The course is dividedinto 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. Theywill 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 freewriting
   - 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 English or L1)
   - Engaging students in Critical reading, Presenting interview/ survey information, Field work
   - 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 Texts

1. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). NewYork: Routledge.
2. Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasksand 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.

Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing.* Washington: American Psychological Association.

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General Education Cluster: Quantitative Reasoning

URCG-5120 **Exploring Quantitative Skills** **3(3-0)**

This is an introductory-level undergraduate course that focuses on the fundamentals related to the quantitative concepts and analysis. The course is designed to familiarize students with the basic concepts of mathematics and statistics and to develop students' abilities to analyze and interpret quantitative information. Through a combination of theoretical concepts and practical exercises, this course will also enable students cultivate their quantitative literacy and problem solving skills while effectively expanding their academic horizon and breadth of knowledge of their specific major / field of study.

Course Learning Outcomes

By the end of this course, students shall have:

1. Fundamental numerical literacy to enable them work with numbers, understand their meaning and present data accurately;
2. Understanding of fundamental mathematical and statistical concepts;
3. Basic ability to interpret data presented in various formats including but not limited to tables, graphs, charts, and equations etc.

Contents

1. Numerical Literacy:
    i. Numbers system and basic arithmetic operations;
    ii. Units and their conversions, dimensions, area, perimeter and volume;
    iii. Rates, ratios, proportions and percentages;
    iv. Types and sources of data;
    v. Measurement scales;
    vi. Tabular and graphical presentation of data;
    vii. Quantitative reasoning exercises using number knowledge.

2. Fundamental mathematical concepts:
    i. Basics of geometry (lines, angles, circles, polygons etc.);
    ii. Sets and their operations;
    iii. Relations, functions, and their graphs;
    iv. Exponents, factoring and simplifying algebraic expressions;
    v. Algebraic and graphical solutions of linear and quadratic equations and inequalities;
    vi. Quantitative reasoning exercises using fundamental mathematical concepts.

3. Fundamental Statistical Concepts:
    i. Population and sample;
    ii. Measures of central tendency, dispersion and data interpretation;
    iii. Rules of counting (multiplicative, permutation and combination);
    iv. Basic probability theory;
    v. Introduction to random variables and their probability distributions;
    vi. Quantitative reasoning exercises using fundamental statistical concepts.

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Recommended Texts

1. Sevilla, A., & Somers, K. (2012). *Quantitative reasoning: tools for today's informed citizen*. New Jersey, John Wiley & Sons.
2. Burzynski, D., & Ellis, W. (2008). *Fundamentals of mathematics*. USA, Saunders College Publishing.

Suggested Readings

1. Zaslow, E. (2020). *Quantitative reasoning: thinking in numbers*. Cambridge, Cambridge University Press.
2. de Mesquita, E. B., & Fowler, A. (2021). *Thinking clearly with data: A guide to quantitative reasoning and analysis*. New Jersey, Princeton University Press.
3. Bennett, J., & Briggs, W. (2019). *Using & understanding mathematics: a quantitative reasoning approach*. Pearson.
4. Rosen, K. H., & Krithivasan, K. (2012). *Discrete mathematics and its applications* (Vol. 6). New York: McGraw-Hill.
5. Chatfield, C. (2018). *Statistics for technology: a course in applied statistics*. Routledge.
6. Lock, R. H., Lock, P. F., Morgan, K. L., Lock, E. F., & Lock, D. F. (2020). *Statistics: Unlocking the power of data*. New Jersey, John Wiley & Sons.

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General Education Cluster: Quantitative Reasoning

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

This is a sequential undergraduate course that focuses on logical reasoning supported with mathematical and statistical concepts and modeling / analysis techniques to equip students with analytical skills and critical thinking abilities necessary to navigate the complexities of modern world. The course is designed to familiarize students with the quantitative concepts and techniques required to interpret and analyze numerical data and to inculcate ability in students the logical reasoning to construct and evaluate arguments, identify fallacies, and think systematically. Keeping the pre-requisite course of Quantitative reasoning (I) as its base, this course will enable students further their quantitative. Logical and critical reasoning abilities to complement their specific major field of study

Course Learning Outcomes

By the end of the course, student shall have:

1. Understanding of logic and logical reasoning:
2. Understanding the basic quantitative Modeling and Analyses.
3. Logical reasoning skills and abilities to apply them to solve quantitative problems and evaluate arguments;
4. Ability to critically evaluate quantitative information to make evidence based decisions through appropriate computational tools.

Contents

1. Logic, Logical and Critical Reasoning:
    i. Introduction and importance of logic,
    ii. Introductive, deductive and abductive approaches of reasoning,
    iii. Propositions, arguments (valid; invalid), logical connectives, truth tables and propositional equivalences,
    iv. Logical fallacies,
    v. Venn Diagrams,
    vi. Predicates and quantifiers,
    vii. Quantitative reasoning exercises using logical reasoning concepts and techniques.
2. Mathematical Modeling and Analyses:
    i. Introduction to deterministic models,
    ii. Use of linear function for modeling in real-world situations,
    iii. Modeling with the system of linear equation and linear solutions,
    iv. Elementary introduction to derivatives in mathematical modeling,
    v. Linear and exponential growth and decay models,
    vi. Quantitative reasoning exercises using mathematical modeling.
3. Statistical Modeling and Analyses:
    i. Introduction to probabilistic models,
    ii. Bivariate analysis, scatter plots,
    iii. Simple linear regression model and correlation analysis,
    iv. Basics of estimation and confidence interval,
    v. Testing of hypothesis (z-test; t-test),
    vi. Statistical inference in decision making,
    vii. Quantitative reasoning exercise using statistical modeling.

Recommended Texts

1. Bennett, J., & Briggs, W. (2019). *Using & understanding mathematics: a quantitative reasoning approach*. Pearson.
2. Rosen, K. H., & Krithivasan, K. (2012). *Discrete mathematics and its applications* (Vol. 6). New York: McGraw-Hill.

Suggested Readings

1. Epp, S. S. (1990). *Discrete mathematics with applications*. Wadsworth Publ. Co..
2. Budnick, F. S., Quinn, S., Bowser, K., & Flaherty, E. H. (1993). *Applied mathematics for business, economics, and the social sciences*. New York: McGraw-Hill.
3. Bluman, A. (2014). *Elementary Statistics: A step by step approach 9e*. McGraw Hill.
4. Mann, P. S. (2007). *Introductory statistics*. John Wiley & Sons.
5. Babones, S. (2013). Applied statistical modeling. *(No Title)*.
6. Green, S. W., Wolf, I.k., Stewrat, B. W. (2022). SAT Study Guide Premium. Barrons

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URCG-5122 **Ideology and Constitution of Pakistan** **2(2-0)**

Course Description:

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

Outline:

- **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.
- **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
- **Fundamental rights**
- **Principles of policy**
- **Federation of Pakistan**
  - President
  - Parliament
  - The Federal Government
- **Provinces**
  - Governors
  - Provincial Assemblies
  - The Provincial Government
- **The Judicature**
  - Supreme Court
  - High Courts
  - Federal Shariat Courts
  - Supreme Judicial Council
  - Administrative Courts and tribunals
- **Islamic Provisions in Constitution**
- **Significant Amendments of Constitution of Pakistan 1973**

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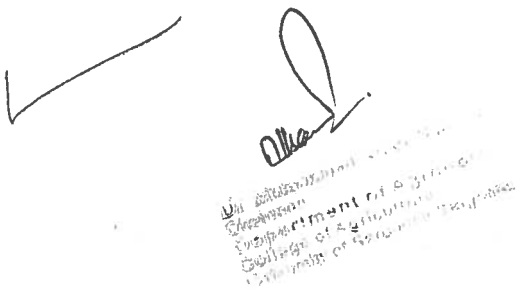
Recommended Books:

1. Constitutional and Political History of Pakistan by Hamid Khan
2. Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd re 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 re edn. Lahore: Vanguard, 2005.
5. The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).
6. Fundamental Laws of Pakistan by A.K. Brohi



CLCH-5105 Climate Change Impacts on Ecosystems 3(2-1)

To familiarize students with complex interactions between climate change and terrestrial, freshwater, and marine ecosystems and to explore the ecological processes and feedback mechanisms affected by climate variability and global warming. It enables them to nalyze the vulnerability of different ecosystems to climate change impacts and develop skills in assessing and monitoring ecosystem responses to climate change. By the end of this course, students will be able to explain the mechanisms by which climate change affects ecosystem structure and function. They will be able to identify key indicators of ecosystem health and resilience in response to climate stressors. They can evaluate case studies of climate change impacts on terrestrial, freshwater, and marine ecosystems.

CONTENTS

Theory

Introduction to Climate Change and Ecosystems: Overview of climate change drivers and impacts on global ecosystems, Ecological concepts related to resilience, adaptation, and thresholds. Climate Change and Terrestrial Ecosystems: Effects of temperature, precipitation, and extreme events on vegetation dynamics, Impacts on forest ecosystems, grasslands, and arctic tundra, Climate Change and Freshwater Ecosystems: Alterations in hydrological cycles, river flows, and lake dynamics, Implications for aquatic biodiversity, water quality, and freshwater resources, Climate Change and Marine Ecosystems:

Ocean acidification, sea level rise, and changes in marine biodiversity, Coral reef bleaching, coastal erosion, and impacts on marine food webs, Ecosystem Services and Human Well-being: Linkages between ecosystem functions, ecosystem services, and human livelihoods, Economic valuation of climate change impacts on ecosystems

Practical

Field Surveys of Ecosystem Health: Conducting ecological surveys to assess biodiversity, species composition, and habitat quality, Monitoring climate-related changes in vegetation cover, soil characteristics, and aquatic ecosystems, Data Analysis and Modeling: Using ecological modeling software to predict ecosystem responses to climate scenarios, Analyzing historical data and climate projections to identify ecological trends and patterns

Recommended Texts

1. Newman, J. A., & Anand, M. (2019). *Climate Change Biology*. CABI.
2. Lovejoy, T. E., & Hannah, L. (Eds.). (2005). *Impacts of Climate Change on Ecosystems and Biodiversity*. Yale University Press.
3. Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-being: Synthesis*. Island Press.

Suggested Readings

4. Lovejoy, T. E., & Hannah, L. (Eds.). (2005). *Climate Change and Biodiversity*. Yale University Press.
5. Caylor, K. K., Jackson, R. L., & Roberts, S. L. (Eds.). (2011). *Ecological Consequences of Climate Change: Mechanisms, Conservation, and Management*. CRC Press.

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CLCH-5106 International Climate Agreements and Diplomacy 3(2-1)

To familiarize students with the international climate agreements, treaties, protocols role of diplomacy, negotiation in shaping global climate policies and actions. To understand the structure and functions of key international organizations and initiatives related to climate governance. By the end of this course, students will be able to describe the major international climate agreements and their significance in addressing global warming and analyze the diplomatic strategies and negotiations involved in crafting climate agreements. They can evaluate the effectiveness and limitations of existing international climate governance frameworks.

CONTENTS

Theory

1. Introduction to international climate governance
2. Historical overview of global climate negotiations and agreements
3. Key milestones and events in international climate diplomacy
4. Analysis of major agreements (Kyoto Protocol, Paris Agreement etc.), comparison of mitigation, adaptation, and financing mechanisms
5. Diplomacy and negotiation in climate agreements: Understanding diplomatic strategies and tactics in multilateral negotiations
6. Role of international summits and panels in climate diplomacy,
7. Climate diplomacy and geopolitics: Geopolitical considerations and interests in climate negotiations, North-South divide and equity issues in climate governance,
8. Stakeholder engagement and diplomatic outreach: Engagement of non-state actors (NGOs, corporations) in climate diplomacy
9. Public diplomacy and media influence in shaping climate discourse

Practical

1. Simulation of Climate Negotiations: Role-playing exercises to simulate UNFCCC (United Nations Framework Convention on Climate Change) negotiationsDrafting position papers and negotiating strategies based on assigned roles
2. Case studies in climate diplomacy: Analyzing case studies of successful and failed climate negotiations, Identifying lessons learned and best practices in international climate diplomacy

Recommended Texts

1. Harris, P. G. (Ed.). (2014). *Routledge handbook of global environmental politics* (No. s 31). New York: Routledge.
2. Bodansky, D. (2017). *International Climate Change Law* (Vol. 296). Oxford University Press.Savaşan,
3. Z. (2019). *Paris Climate Agreement: A Deal for Better Compliance?*. Springer International Publishing.

Suggested Readings

1. Nordhaus, W. (2013). The Climate Casino: Risk, Uncertainty, and Economics for a Warming World. Yale University Press.
2. Mintzer, I. M., & Leonard, J. A. (1994). Negotiating Climate Change: The Inside Story of the Rio Convention. Cambridge University Press.

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CLCH-5107 Climate Change and Global Politics 3(2-1)

To educate the students about intersection of climate change and global politics; including the role of international relations in addressing climate challenges. To analyze the geopolitical implications of climate change, including resource conflicts, migration, and security issues. They will be able to understand the policy responses of nation-states and international organizations to climate change. By the end of this course, students will be able to critically analyze the political dimensions of climate change and its impact on global governance and to evaluate the role of key actors, such as governments, NGOs, and multinational corporations, in climate politics. To assess, the effectiveness of international treaties and agreements to find out the way forward and address the climate-related challenges. To develop the policy analysis skills and strategies for enhancing international cooperation among countries to address the climate issues.

CONTENTS

Theory

1. Introduction to climate politics: Defining climate politics and its relationship to global governance
2. Political economy of climate change: Impact of economic systems and development models on climate policies
3. Trade-offs between economic growth and environmental sustainability
4. Geopolitics of climate change: Resource competition and conflicts over water, energy, and land
5. Role of international organizations: UNFCCC (United Nations Framework Convention on Climate Change) and IPCC (Intergovernmental Panel on Climate Change)
6. Role of regional blocs (EU, ASEAN) in climate governance
7. Climate change and security: Climate-related risks (food security, water scarcity, displacement)
8. Military responses and peace building efforts in climate-vulnerable regions

Practical

1. Developing advocacy strategies and policy briefs on specific climate issues
2. Simulation of climate negotiations: Conducting mock climate negotiations to understand diplomatic challenges and negotiation dynamics
3. Role-playing exercises as representatives of different countries or stakeholders

Recommended Texts

1. Wainwright, J., & Mann, G. (2018). *Climate Leviathan: A Political Theory of Our Planetary Future*. Verso.
2. Baylis, J., Smith, S., & Owens, P. (Eds.). (2020). *The globalization of world politics: An introduction to international relations*. Oxford university press, USA.
3. Giddens, A. (2009). *The Politics of Climate Change*. Polity Press.

Suggested Readings

1. Hulme, M. (2009). *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity*. Cambridge University Press.
2. Harris, P. G. (Ed.). (2009). *Climate change and foreign policy: Case studies from east to west*. Routledge.

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GEOG-6114 **Oceanography** **3(3-0)**

It describes knowledge about world's oceans their distribution, and its resources. To produce the students with the applicable knowledge about existence of oceans, formation of ocean floors, their distribution and effects of climate and ocean resource management. It may identify the impact of basic and applied knowledge of oceanography, to impart skills on the ocean distribution, existence of oceans, and availability of resources in oceans.This study focus on the spatial distribution of oceans and their effects Land, Ocean and atmosphere relationship, to study ocean currents, variability, and Mechanism. It will also discuss the law of sea and country rights for associated oceans and seas. It will discuss the ocean habitat to study the ocean resources and law of ocean territory.

Course Contents:

1. Introduction
2. Origin of oceans and seas
3. Major water masses and their distribution.
4. Morphology of the ocean basins.
5. Ocean floor deposits.
6. Their characteristics and classification.
7. Temperature, salinity and density of ocean water
8. Distribution, causes and effects
9. Oceanic circulation: waves, currents and tides, their nature, causes, effects and impact on environment.
10. Special phenomena: tropical storms; Tsunami.
11. Oceanography of Arabian Sea with special reference to Exclusive Economic Zone.

Lab. Work

Drawing features of the Ocean floor, mapping of the ocean currents, tides and associated phenomena.

Recommended Texts:

1. Douglas A. Segar. (1998). *Ocean sciences.*Boston: Wadsworth publishing Company.
2. Barnes, H. (2000). *Apparatus & methods of oceanography*. London: George Allen &Unwin Ltd.

Suggested Readings:

1. Duxbury, A.B & Duxbury, A.C. (1994). *An introduction to the world oceans.* Oxford: WMC Brown Publishers.
2. King, C.A.M. (2000). *Oceanography for geographers*. London: Edward Arnold Publishers, Ltd.
3. Pinet, P.R. (2002). *Invitation to oceanography.* London: Jones & Bartlett Publishers.

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SEMESTER-IV

URCG-5115 The Science of Global Challenges 3 (2-1)

Theory:

1. Climate Change i.e., Global Warming, Natural and Anthropogenic
2. Activities and their impact; Energy i.e., Renewable and non-renewable energy resources;
3. Water Security i.e., water scarcity andwaste water treatment;
4. Land Degradation i.e., salinity, water logging, deforestation, land erosion;
5. Food Security and roll of Biotechnology in food production;
6. Global Health Pandemics i.e., Infectious diseases, vaccine, development of drug discovery for newly explored diseases

Practical:

1: Preparation of standard solution and their standardizations
2: Soil and Water Analysis

Recommended Text:

Usman, M. (2022). *Science of Global Challenges*. Ilmi Kitab Khana, Lahore

Suggested Books

1: Thieman, W.J. & Palladino, M.A. (2014*). Introduction to biotechnology*. Edinburgh Gate UK: Pearson Education Limited.
2: Daugherty, E. (2012). *Biotechnology: Science for the New Millennium*, 1st Edition, Revised, USA: Paradigm Publication.
3: Karaduman, I. C. (Ed.) (2014) *Global Challenges for the world.* Obronnosc. Zeszytl Naukowe. Turkey

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URCG-5124 **Entrepreneurship** **2(2-0)**

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.

Course Learning Objectives

1. To enhance the 'entrepreneurial intentions' of the students by improving their natural willingness to start a business.
2. To understand the process of entrepreneurship and learn the ways to manage it by working individually in the class and in the form of groups outside the class to conduct field assignments.
3. To educate the students about the practical underpinnings of the entrepreneurship with the aid of practical assignments and idea pitching.

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 Ideas 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-minutes pitch, funding negotiation and launching.

Recommended Texts:

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 Readings:

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

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URCG-5125 **Civics and Community Engagement** **2(2-0)**

Course Description:
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.

Learning outcomes
After completing this course, students will be able to

- Understand the concepts of civic engagement, community development, and social responsibility.
- Understand rights and responsibilities of citizenship
- Understand cultural diversity in local and global context
- Analyze significance of civic participation in promoting social justice, equity and democracy.
- Examine the historical and contemporary examples of successful civic and community engagement initiatives.
- Identify and assess community needs, assets, and challenges to develop effective strategies for community improvement.
- Explore the ethical implications and dilemmas associated with civic and community engagement.
- Develop practical skills for effective community organizing, advocacy, and leadership.
- Foster intercultural competence and respect for diversity in community engagement efforts.
- Collaborate with community organizations, stakeholders, and fellow students to design and implement community-based projects.
- Reflect on personal growth and learning through self-assessment and critical analysis of community engagement experiences.

Course Content:

Introduction to Civics & Community Engagement

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

Citizenship and Community Engagement

- Introduction to Active Citizenship: Overview of the Ideas, Concepts, Philosophy and Skills
- Approaches and Methodology for Active Citizenship

Identity, Culture, and Social Harmony

- Concept and Development of Identity, Group identities
- Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity, Globalization and Culture, Social Harmony,
- Religious Diversity (Understanding and affirmation of similarities & differences)
- Understanding Socio-Political Polarization
- Minorities, Social Inclusion, Affirmative actions

Multi-cultural society and inter-cultural dialogue

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

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Active Citizen: Locally Active, Globally Connected

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

Human rights, constitutionalism and citizens' responsibilities

- Introduction to Human Rights
- Human rights in constitution of Pakistan
- Public duties and responsibilities
- Constitutionalism and democratic process

Social Institutions, Social Groups, Formal Organizations and Bureaucracy

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

Civic Engagement Strategies

- Grassroots organizing and community mobilization
- Advocacy and lobbying for policy change
- Volunteerism and service-learning opportunities

Social issues/Problems of Pakistan

- Overview of major social issues of Pakistani society

Social Action Project

Recommended Books:

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

Reference 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. TheCapitol.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.

URCG-5111 **Translation of the Holy Quran - II** **Non-Credit**

Topic	Details
Semester/Level	In some discipline 3rd semester and in some discipline 4th Semester/ ADP Program 2nd Year
Objectives	▪ Students will come to know about the real nature, significance and relevance of the Islamic beliefs in light of the text of the Holy Quran. ▪ Students will seek knowledge of translation and transliteration of the Holy Book Quran. ▪ To familiarize the students with the concept of Ibādah (Its significance, scope and relevance) and its types in Islam. ▪ Students will learn literal and idiomatic way of translation of the Holy Book. ▪ Students will learn about the polytheism and its incompatibility in Islam highlighted by the Holy Quran. ▪ To highlight the significance of learning through using all human faculties provided by the almighty Allah and familiarize the students about condemnation of ignorance mentioned in the Quranic text. ▪ To develop Awareness among the students about rights and duties of different circles of society in the light of Holy Quran. ▪ To introduce the students to Quranic Arabic grammar in practical manner.
Course Contents:	○ ایمانیات اور عبادات اللہ پر ایمان ،فرشتوں پر ایمان ،رسولوں پر ایمان ،آسمانی کتابوں پر ایمان یوم آخرت پر ایمان ، تقدیر پر ایمان نماز ،روزہ ،زکوۃ،حج ،جہاد ○ معاشرے کے حقوق • خاندان کی تکوین • حق مہر • رضاعت و حمل • اولاد کو قتل کرنے کے ممانعت • شوہرکی نافرمانی • طلاق • بیوہ کی عدت کے احکام • نکاح کا پیغام بھیجنا • عورت کی وراثت (اس کے شوہر کی طرف سے) • والدین کے حقوق • بیویوں اور اولاد کے بیچ عداوت ○ خاندان کے حقوق • مہمان کی عزت • اجازت طلب کرنے کے اصول • مجلس کے آداب • تعاون اور بھائی چارہ • گروہ بندی • محبت • لوگوں کے درمیان صلح • عفو ودرگزر، غصہ پر قابو اور معاف کرنا • شعوب و قبائل • لوگوں کے بیچ اختلافات • حمایت و نگہبانی
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of	▪ منتخب آیات مع ترجمہ وتجوید

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Chapters and verse Numbers:	▪ البقره ((١٧٧، ٢٣٨، ٣٥، ٢٧٧، ٢١٩، ١١٠، ٣٥، ١٥٣، ٢٣٧، ٢٠١، ٢٨٥، ٣٣، ٢٨٥، ١٥، ١٢٩، ٢٥٣، ٩٨، ٦٢، ١٢٦، ٢٨٥، ٢٥٦، ١٧٧، ١٣٦، ١٨٩، ٢٠٠، ١٨٤، ١٨٣، ٢١٨، ١٥٨، ٢٣١،١٩٩، ٢٢٧، ٢٢٦، ٢٣٧، ٢٢٨، ٢٢٩، ٢٣١، ٢٣٧، ٢٣٥، ٢٣٠ ، ٨٢ ، ١٨٣، ٢٣٣، ١٨٢، ١٦٠، ٨٣) ▪ النساء (٩٥، ٩٢، ٥٩، ١٣٦، ٦٩، ٨٠، ١٣، ٦٩، ٨٦،٨٠، ٣٦، ١٧٦، ١٢، ٣٥، ١٢٨، ٣٣، ١١، ٣، ١٧٦، ٢٣، ٢٥، ١١، ١١، ١٢٨، ١٩١، ٣٥، ٢٠، ٣٥، ١٩١، ٦، ١، ٢٠، ١، ١٦، ١٣٦، ٥٣، ١٢٨، ٨١) ▪ الانعام (٢٢، ١٣٧،١٣،٩٢، ١٥١، ٣٨، ٥٣) ▪ آل عمران (٩٧، ٣٩، ٨٥، ١٢٥، ٨٣، ١٣٣، ١،١٩) ▪ المائده (٥٣، ٢، ٩٢، ٣٩،١٩، ٨٢، ٢، ٥) ▪ الاعراف (٣٥، ١٨٩، ١٨٩) ▪ التوبه (٢٠، ١٦،٧١) ▪ بود (١٢) ▪ الزمر (٦) ▪ النور (٥٣، ٢٨،٥٢، ٢٧، ٦٠، ٢٩) ▪ محمد (٣٣) ▪ انفال (٨٢، ٢٠) ▪ الرعد (٣) ▪ الطلاق (٣) ▪ الحج(٥) ▪ ابراهيم ((٣٣،٢٣) ▪ الاسراء (٢٣، ٢٣) ▪ الاحقاف (١٥) ▪ المومنون (٢٧) ▪ العنكبوت (٢٥،٣٨، ٨) ▪ النحل (٢٢) ▪ لقمان (١٥،٣، ١٣) ▪ الاحزاب ((٣٥، ٥٠،٣٨، ٣٩) ▪ الشعراء (٧) ▪ الروم (٢١) ▪ مريم (١٣،٢٦) ▪ المجادله (١٢، ١١)

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CLCH-5108 **Biodiversity under Changing Climate** **3(2-1)**

To teach students about the impact of climate change on biodiversity at different levels of ecological organization and interactions between biodiversity and climate variability, including adaptation and resilience mechanisms. To analyze the consequences of biodiversity loss and ecosystem shifts under changing climatic conditions. By the end of this course, students will be able to explain the concept of biodiversity and its importance for ecosystem functioning and to evaluate the impacts of climate change on species distributions, population dynamics, and community composition.

CONTENTS

Theory

1. Introduction to biodiversity and climate change
2. Definition of biodiversity and its components (genetic, species, ecosystem diversity), overview of climate change impacts on biodiversity
3. Effects of temperature, precipitation, and extreme events on species interactions (competition, predation, mutualism)
4. Range shifts and phenological changes in response to climate variability
5. Genetic diversity and adaptive potential of species under climate stress
6. Evolutionary responses to changing environmental conditions
7. Linkages between biodiversity, ecosystem services, and human well-being
8. Enhancing ecosystem resilience through biodiversity conservation
9. Protected area management and climate-smart conservation planning

Practical

1. Analyze species range shifts
2. Measure genetic diversity and climate resilience in species
3. Develop climate-smart conservation plans for ecosystems
4. Field surveys to assess climate impacts on local biodiversity

Recommended Texts

1. Lovejoy, T. E., & Hannah, L. (Eds.). (2005). *Biodiversity and Climate Change: Transforming the Biosphere*. Yale University Press.
2. Lovejoy, T. E., & Hannah, L. (Eds.). (2005). *Climate Change and Biodiversity*. Yale University Press.
3. Sodhi, N. S., & Ehrlich, P. R. (Eds.). (2010). *Conservation Biology for All*. Oxford University Press.

Suggested Readings

4. Kolbert, E. (2014). *The Sixth Extinction: An Unnatural History*. Picador.
5. Lovejoy, T. E., & Hannah, L. (Eds.). (2005). *Climate Change and Biodiversity*. Yale University Press.

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CLCH-5109 **Climate Smart Agricultural Technologies** **3(2-1)**

To enable the students about the concepts of climate-smart agriculture (CSA) and its importance for sustainable food production and to explore innovative agricultural technologies designed to enhance climate resilience and adaptation. The assessment of the feasibilities and effects of climate-smart agricultural practices in different agro-ecological zones. Develop practical skills in implementing and assessing climate-smart agricultural techniques. By the end of this course, students will be able to define climate-smart agriculture and explain principles and objectives; they can identify key climate-smart technologies and practices for improving agricultural resilience and analyze the socio-economic and environmental impacts of climate-smart agricultural interventions.

CONTENTS

Theory

1. Introduction to climate-smart agriculture: Definition, goals and principles
2. Climate-resilient crop management: Drought-tolerant crop varieties and water-saving irrigation techniques, Agroforestry and intercropping systems for enhancing resilience,
3. Farm mechanization technologies for climate resilience
4. Soil health and carbon management: Conservation agriculture practices (e.g., no-till farming, cover cropping), Soil carbon sequestration and organic matter management
5. Climate-adaptive livestock and fisheries: Livestock breed selection for heat tolerance and disease resistance
6. Sustainable aquaculture practices in changing environmental conditions
7. Renewable energy and energy-efficient technologies: Integration of solar energy and biogas systems in agricultural operations
8. Climate smart post-harvest technologies

Practical

1. On-farm demonstration of climate-smart practices
2. Field visits to climate-smart agriculture demonstration sites to observe and assess implementation techniques
3. Collecting data on crop performance, soil health indicators, and resource use efficiency
4. Predicting yield changes and resource requirements under different climate conditions

Recommended Texts

1. Palombi, L., & Sessa, R. (2013). *Climate-smart agriculture: sourcebook* (pp. xi+-557).
2. Lipper, L., McCarthy, N., Zilberman, D., Asfaw, S., & Branca, G. (2017). *Climate smart agriculture: building resilience to climate change* (p. 630). Springer Nature.Tanner, T., & Horn-Phathanothai, L. (2014). *Climate change and development*. Routledge.
   Gliessman, S., Friedmann, H., & H Howard, P. (2019). Agroecology and food sovereignty.

Suggested Readings

1. Bundschuh, J., & Hoinkis, J. (2012). *Renewable Energy Applications for Freshwater Production*. CRC Press.
2. Pillay, T. V. R. (2008). *Aquaculture and the Environment*. John Wiley & Sons.
3. Dubey, P. K., Singh, G. S., & Abhilash, P. C. (2020). Adaptive agronomic practices for sustaining food production. In *Adaptive Agricultural Practices* (pp. 11-43). Springer, Cham.

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GEOG-6115 **Remote Sensing** **3(2-1)**

It describes about knowledge of Remote Sensing (RS) and its practical implementation. To produce students, that has applicable knowledge about basic tools of GIS. The course aims to equip students with an understanding of GIS, evolution and applications of spatial data through Geo-spatial technologies. Remote sensing is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area. Special cameras collect remotely sensed images of the Earth, which help researchers "sense" things about the Earth. This study introduces knowledge of recording earth's surface features from space-borne platforms and different ways in which images can be analyzed. It will enable students to develop an understanding of common remote sensing products such as, earth resources satellite images, aerial photographs etc to develop a comprehension regarding ground-truthing aided by GPS.

Course Contents:

1. Introduction
2. History and Development
3. Concepts and Foundation of Remote Sensing and Electromagnetic spectrum
4. Visible Spectrum, Colour Theory
5. Atmospheric Attenuation
6. Types of Remote Sensing Systems
7. Type of Sensors
8. RBV, MSS, TM,HRV, HRPT/APT/AVHRR, MODIS (Terra and Aqua) non-imaging systems (RADAR)
9. Types of Satellites
10. Telecommunication, Spy, Scientific etc.)
11. Platforms (Orbits)
12. Ground Receiving Stations (Reception of Data)
13. Image Processing
14. Global Positioning System (GPS)
15. Applications of Remote Sensing
16. Remote Sensing in Pakistan: Potential and Prospects.

Recommended Texts:

1. ITC (2004). *Principles of remote sensing.*Netherlands: ITC Educational Textbook Series.
2. Campbell, J. B. &Wynne, R. H. (2011). *Introduction to remote sensing*. New York: Guilford Press.

Suggested Readings:

1. Iliffe, J. & Lott, R. (2008). *Datums and Map Projections for remote sensing, GIS, and Surveying* (2nd ed.). Manchester: Whittles Publishing.
2. Jensen, J. (2005). *Introductory remote sensing*: *Principles and Concepts*.New York: Freeman & Co.
3. Jensen, J. R. (2011). *Remote sensing of the environment: an earth resource perspective*. New Jersey: Prentice Hall.

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STAT-5102 **Applied Statistics** **3(3-0)**

This course provides a comprehensive introduction to key concepts and techniques in the fields of sampling theory, index numbers, and time series analysis. Students will develop a strong foundation in statistical methods essential for making informed decisions in various fields, including economics, finance, social sciences, and more. Understand the principles of sampling and different sampling methods. Study the construction and interpretation of index numbers. Gain insights into the use of index numbers in economics, business, and policy-making. Compute and compare various index numbers, such as Laspeyres, Paasche, and Fisher. Examine the concepts of time series data and their applications.

Contents

1. Importance of sampling: Sample versus population
2. Census and survey problem, questionnaire development.
3. Concepts of statistic and population parameter.
4. Random and nonrandom sampling
5. Sampling and Non-Sampling Errors
6. Sampling techniques: Simple Random, Stratified, Cluster and Systematic random sampling.
7. Index numbers: construction and uses of index numbers
8. Un-weighted index numbers (simple aggregative index, average of relative price index numbers).
9. Weighted index numbers (Laspayers, Paaches and Fishers ideal index numbers). Consumer price index (CPI) and Sensitive Price Indicators.
10. Time Series Analysis: Examine the concepts of time series data and their applications
11. Develop skills in data visualization, including time plots and seasonal decomposition
12. Perform time series forecasting using methods such as moving averages and exponential smoothing

Recommended Books

1. Chaudhary, S.M. (2014). *Introduction to statistical theory* (8th Ed.). Lahore: Ilmi Kitab Khana.
2. Clark, G.M. and Cooke, D. (2009). *A basic course of statistics* (5th Ed.). Wiley.

Suggested Books

1. Cochran, W. G. (1977). *Sampling techniques.* (3rd Ed.). New York: John Wiley & Sons.
2. Walpole, R.E., Myers, R. H. & Myers, S. L. (1998). *Probability and statistics for engineers and scientist* (6th Ed.) New York: Prentice Hall.

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SEMESTER-V

CLCH-6111 Climate Resilient Crop Management 3(2-1)

To familiarize the students with the core concept of climate-resilient agriculture as well as its importance for sustainable crop production. Explore innovative crop management strategies to enhance resilience to climate variability and change. To evaluate the impact of climate stressors on crop growth, development and yield. By the end of this course, students will be able to define climate-resilient crop management and explain its components. The will be able to identify key climate stressors affecting crop productivity and quality. They can implement adaptive crop management practices to mitigate climate risks.

CONTENTS

Theory

1. Introduction to climate-resilient crop management: Definition and principles
2. Role of adaptive strategies in climate-smart agriculture
3. Climate stressors on crop production: Effects of temperature, CO_2 concentration, water stress, and extreme weather events on crops, Impacts on germination, crop growth stages, flowering, and fruit development
4. Crop diversification and rotation: Importance of crop diversity and rotation for resilience to climate variability, Intercropping, alternate crops, cover cropping, and agroforestry systems
5. Climate efficient nutrient management techniques
6. Water management and irrigation techniques: Water-saving irrigation methods (drip irrigation, rainwater harvesting), soil moisture conservation and drought-tolerant crop varieties
7. Integrated pest and disease management: Climate change impacts on pest and disease dynamics, Biological control, integrated pest management (IPM), and resistant crop varieties

Practical

1. Field demonstrations of climate-resilient practices
2. Implementing irrigation scheduling and soil conservation techniques
3. Crop monitoring and data analysis: Collecting and analyzing data on crop performance under different climate scenarios
4. Using crop modeling tools to simulate yield changes and adaptation strategies

Recommended Texts

1. Raj, A., & Jhariya, M. K. (2023). Carbon Sequestration in Agroforestry and Horticulture Based Farming Systems: Mitigating Climate Change and Advancing Food and Nutrition Security. In *Emerging Solutions in Sustainable Food and Nutrition Security* (pp. 143-182). Cham: Springer International Publishing.
2. Sengar, R. S., & Sengar, K. (Eds.). (2014). *Climate change effect on crop productivity.* CRC press.
3. Lipper, L., McCarthy, N., Zilberman, D., Asfaw, S., & Branca, G. (2017). *Climate smart agriculture: building resilience to climate change* (p. 630). Springer Nature.

Suggested Readings

1. Tittonell, P. (2023). *A Systems Approach to Agroecology*. Springer.Gliessman,
2. S., Friedmann, H., & H Howard, P. (2019). Agroecology and food sovereignty.
3. Jácome, A. G. (2022). *Traditional Mexican agriculture: A basis for sustainable agroecological systems*. CRC Press.

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SAES-6816 **Environmental Pollution and Management** **3(3-0)**

The aim of this course is to teach students about soil, water and air pollution and impact on soil, plants and human health. The students should be able to know about the sources and causes of pollution and their remedies. The aim of this course is basically to develop understanding of students that why pollution prevention or control is needed to preserve precious environmental resources and to improve the environmental quality. The students will also able to learn that how the amount of damage to a particular medium (air, water, land) varies according to the type of pollutant, the amount of pollutant disposed of, and the distance from the source of pollution. The course will enable the students to perceive knowledge that how pollution prevention techniques reduces or eliminates waste created at the source, avoiding the generation of a waste, protects the environment by reducing the risk of toxic releases.

CONTENTS

Theory

1. Introduction to soil, water and air pollution
2. Sources and causes of pollution
3. Types of pollutants: inorganic, organic and radioactive
4. Fate of pollutants: adsorption, precipitation, degradation, movement and plant uptake
5. Degradation of pollutants: chemical, biological and light
6. Factors affecting movement of pollutants in soil
7. Impact of pollutants on soil, plant, animal and human health
8. Water pollution: drinking and irrigation; BOD, COD and eutrophication
9. Atmospheric pollutants; greenhouse gases
10. Strategies for pollution control
11. Management and control: control measure at source, soil and water treatment, public awareness
12. Legislation and socio-economic issues of environmental pollution

Recommended Texts

1. Ashfar and Saleem. Environmental Pollution and Agriculture. (Pak Book Empire, Lahore, 2010).
2. Asthana and Asthana. Environment Problems & Solutions. (S. Chand & Co. Ltd. New Delhi, India, 2003).

Suggested Readings

1. Cunningham, Cunningham and Saigo. (9th ed). Environmental Science: A global Concern. (McGraw Hill, NY, USA, 2007).
2. Harrison. (4th ed.). Pollution: Causes, Effects and Control. (The Royal Society of Chemistry, Cambridge, UK, 2001).

Pakistan Environmental Protection Act, Govt. of Pakistan, 1997).

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CLCH-6112 Sustainability and Climate Solutions 3(2-1)

To make students to understand the concept of sustainability and its relationship to climate change mitigation and adaptation. To explore innovative solutions and technologies for promoting sustainability in the context of climate challenges and analyze case studies of successful sustainability initiatives and their impact on environmental and social systems. By the end of this course, students will be able to define sustainability and explain its relevance to addressing climate change. They can identify key climate solutions and technologies for achieving sustainable development goals and can evaluate the economic, environmental, and social implications of climate solutions. Apply interdisciplinary approaches to develop and implement sustainable climate strategies.

CONTENTS

Theory

1. Introduction to sustainability and climate solutions: Definition and principles
2. Overview of climate challenges and the need for sustainable solutions
3. Sustainable energy systems: Renewable energy technologies (solar, wind, hydro, geothermal) and their role in carbon foot printing
4. Green infrastructure and urban planning: Sustainable urban design, green buildings, and low-carbon transportation systems, Urban resilience strategies for adapting to climate impacts (heat waves, flooding)
5. Circular economy and waste management: Principles of circular economy and resource conservation, Waste reduction, recycling, and sustainable consumption patterns
6. Policy and governance for climate solutions
7. Role of stakeholders (government, businesses, NGOs) in promoting sustainability

Practical

1. Field and institutional visits: Visiting sustainable energy installations, eco-friendly buildings, and green infrastructure projects
2. Case studies: Analyzing real-world examples of successful climate solutions and their impact
3. Sustainability project design: Developing and presenting proposals for sustainable climate projects, Collaborative group projects on sustainability solutions for specific challenges

Recommended Texts

1. King, B. (2017). *The New Carbon Architecture: Building to Cool the Climate*. New Society Publishers.
2. Dresner, S. (2012). *The principles of sustainability*. Routledge.
3. Kumareswaran, K., & Jayasinghe, G. Y. (2023). *Green Infrastructure and Urban Climate Resilience*. Cham: Springer.
4. Jain, A. K. (2023). *Climate Resilient, Green and Low Carbon Built Environment*. Springer Nature.

Suggested Readings

1. Hawken, P. (Ed.). (2017). *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*. Penguin Books.
2. Kolbert, E. (2015). *The Sixth Extinction: An Unnatural History*. Picador.
3. MacKay, D. J. C. (2009). *Sustainable Energy - Without the Hot Air*. UIT Cambridge Ltd.
4. Barnes, P. (2007). *Climate Solutions: A Citizen's Guide*. Chelsea Green Publishing.

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CLCH-6113 Climate Change Risks and Food Security 3(2-1)

To enable students with understanding of the risks and challenges projected by climate change to local food security. Explore the complex interactions between climate variability, agriculture, and food systems. By the end of this course, students will be able to explain the concepts of food security and the factors influencing food availability and access. They will be enabled to identify climate change risks to agricultural productivity, food production systems, and supply chains and assess the vulnerability of different regions and populations to climate-related food insecurity.

CONTENTS

Theory

1. Introduction to climate change and food security: Definitions, food systems, and global hunger
2. Components of food security
3. Overview of climate change impacts on food production: Effects of temperature extremes, droughts, floods, and storms on crops and livestock, Crop failures, yield reductions, and disruptions in food supply chains
4. Adaptation and mitigation strategies for climate-resilient food supply chains
5. Climate Change and Nutrition: Impact of climate variability on food quality, nutritional value, and dietary diversity, Addressing malnutrition and food insecurity through climate-resilient food systems
6. Food storage and supply system in Pakistan
7. Role of governments, NGOs, and international organizations in addressing climate-related food security
8. Policy frameworks (Sustainable agriculture policies, disaster risk reduction etc.) for enhancing resilience

Practical

1. Food security assessment procedures
2. National institutional visits working on food security
3. Conducting household surveys and nutritional assessments to evaluate food security status
4. Examining case studies of climate adaptation projects and their impact on local food systems

Recommended Texts

1. Lobell, D. B., & Burke, M. (Eds.). (2009). Climate change and food security: adapting agriculture to a warmer world (Vol. 37). Springer Science & Business Media.
2. Pritchard, B., Ortiz, R., & Shekar, M. (Eds.). (2016). Routledge handbook of food and nutrition security. London, UK: Routledge.
3. Marinova, D., & Bogueva, D. (2022). Food in a planetary emergency (pp. 1-232). Singapore, Springer.

Suggested Readings

1. Lengnick, L. (2014). Resilient agriculture: Cultivating food systems for a changing climate. New Society Publishers.
2. Marcotullio, P., Cooper, R., & Lebel, L. (2014). Climate and urbanization. Climate in Asia and the Pacific: Security, Society and Sustainability, 59-127.
3. Hassan, A., Khan, M. K. I., Fordos, S., Hassan, S. A., Khalid, S., & Hasan, A. (2023). Food Safety and Quality Assurance in the Supply Chain of Pakistan. In Biology and Life Sciences Forum (Vol. 26, No. 1, p. 111). MDPI.

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CLCH-6114 Carbon Sequestration and Environmental Footprints 3(2-1)

To educate students about the concept of carbon sequestration and its role in mitigating climate change and explore various methods and technologies for enhancing carbon storage in terrestrial and aquatic ecosystems. To analyze environmental footprints and their implications for sustainability and resource management. By the end of this course, students will be able to define carbon sequestration and explain its importance in climate change mitigation and to identify natural and anthropogenic processes for capturing and storing carbon in ecosystems. They can apply carbon accounting techniques and sustainability metrics to assess environmental impacts.

CONTENTS

Theory

1. Introduction to carbon sequestration: Carbon cycle and sources of atmospheric carbon dioxide (CO_2)
2. Importance of carbon sequestration in reducing greenhouse gas emissions
3. Methods of carbon sequestration: Afforestation and reforestation, Soil carbon storage techniques
4. Blue carbon and aquatic ecosystems: Role of coastal wetlands in carbon sequestration, carbon storage in marine sediments and deep ocean environments
5. Environmental footprints and sustainability metrics: Concept of environmental footprints (carbon, water, ecological) and their calculation, life cycle assessment and carbon accounting methods for assessing environmental impacts
6. Carbon markets: Overview of carbon trading, carbon offset projects, and carbon pricing mechanisms
7. Policy instruments: Policy frameworks (e.g., REDD+, carbon tax) for promoting carbon sequestration and emission reductions

Practical

1. Carbon sequestration measurements: Field measurements of carbon stocks in forests, soils, and wetlands, Laboratory analysis of soil carbon content and organic matter decomposition
2. Environmental footprint analysis: Calculating carbon footprints for different products and activities, using sustainability assessment tools to compare environmental impacts of alternative practices

Recommended Texts

1. Smit, B., Reimer, J. A., Oldenburg, C. M., & Bourg, I. C. (2014). Introduction to carbon capture and sequestration (Vol. 1). World Scientific.
2. Lorenz, K., & Dechert, R. (Eds.). (2010). Carbon Sequestration in Forest Ecosystems. Springer.
3. Macreadie, P. I., Costa, M. D., Atwood, T. B., Friess, D. A., Kelleway, J. J., Kennedy, H. & Duarte, C. M. (2021). Blue carbon as a natural climate solution. Nature Reviews Earth & Environment, 2(12), 826-839.

Suggested Readings

1. Muthu, S. S. (2016). Environmental Footprints and Eco-design of Products and Processes. Springer.
2. Van Slyke, C. (Ed.). (2008). Information Communication Technologies: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications (Vol. 2). IGI Global.
3. Ussiri, D. A., & Lal, R. (2017). Carbon sequestration for climate change mitigation and adaptation (pp. 287-325). Cham, Switzerland: Springer International Publishing.

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CLCH-6115 Human Response and Climate Change 3(3-0)

To teach the students about psychological, social, and behavioral dimensions of human responses to climate change. Explore individual and collective responses to climate impacts and adaptation strategies and also analyze the role of communication, education, and policy in influencing human behavior towards climate action. To educate them to develop critical thinking skills in assessing and addressing human challenges and opportunities in response to climate change. By the end of this course, students will be able to explain the psychological and emotional responses of individuals and communities to climate change. They will be able to evaluate the effectiveness of communication and education campaigns in promoting climate awareness and behavior change and propose policy interventions and strategies to foster sustainable human responses to climate challenges.

CONTENTS

Theory

1. Psychological and emotional responses to climate change: Climate anxiety, eco-grief, and stress related to environmental degradation
2. Coping mechanisms and resilience-building strategies for climate-related distress
3. Social and cultural dimensions of climate responses: Social norms, values, and beliefs influencing climate behaviors, Equity, justice, and human rights considerations in climate adaptation and mitigation
4. Communication and climate engagement: Role of media, storytelling, and narrative framing in shaping public perceptions of climate change, Effective strategies for climate communication and engagement across diverse audiences
5. Community responses and climate action: Grassroots initiatives, community-based adaptation, and resilience-building projects
6. Collaborative approaches to climate governance and decision-making at local and global scales
7. Policy and governance for climate resilience: Policy tools and regulations to incentivize sustainable behaviors and practices
8. Behavioral economics and nudges for promoting climate-friendly choices and lifestyles

Recommended Texts

1. Hulme, M. (2009). Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity. Cambridge University Press.
2. To, W. O. B. A. W. Don't Even Think About It: Why Our Brains Are Wired To Ignore Climate Change.Barnes, J., & Dove, M. R. (Eds.). (2015). Climate Cultures: Anthropological Perspectives on Climate Change. Yale University Press.
3. Armstrong, A. K., Krasny, M. E., & Schuldt, J. P. (2018). Communicating climate change: A guide for educators (p. 144). Cornell University Press.

Suggested Readings

4. Dunlap, R. E., & Brulle, R. J. (2015). Climate Change and Society: Sociological Perspectives. Oxford University Press.
5. Lamb, H. H. (2013). Weather, Climate and Human Affairs (Routledge Revivals): A Book of Essays and Other Papers. Routledge.
6. Bulkeley, H. (2013). Cities and climate change. Routledge.
7. Scranton, R. (2015). Learning to Die in the Anthropocene: Reflections on the End of a Civilization. City Lights Publishers.

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SEMESTER-VI

CLCH-6116 Climate Change Modelling, Impacts and Adaptation 3(2-1)

To enable students with the understanding of climate change modelling techniques and their applications for predicting future climate scenarios. Explore the impacts of climate change on natural and human systems, including ecosystems, agriculture, and water resources. To educate them about adaptation strategies and resilience-building measures to mitigate the impacts of climate change. By the end of this course, students will be able to identify key climate change impacts on various sectors, including agriculture, water management, and public health. They can evaluate adaptation strategies and policies to address climate risks and enhance resilience, and apply climate modelling tools and scenario analysis to assess vulnerability and develop adaptation plans.

CONTENTS

Theory

1. Climate change modelling and simulation: Types of climate models
2. Applications of climate change models
3. Uncertainty and limitations in climate projections
4. Impacts of climate change on natural systems: Changes in temperature, elevated CO_2, precipitation patterns, and extreme weather events
5. Implications for biodiversity, ecosystems, and ecosystem services
6. Impacts of climate change on human systems: Effects on agriculture, food security, and water resources
7. Adaptation strategies and resilience building: Nature-based solutions (e.g., ecosystem restoration, green infrastructure), climate-smart agriculture, water management, and urban planning

Practical

1. Measurement of environmental variables from observatories
2. Climate data analysis and scenario modelling: Using climate datasets (temperature, precipitation) to analyze historical trends and future projections, scenario planning and impact assessments using climate modelling software
3. Vulnerability assessments and adaptation planning: Conducting vulnerability assessments for specific regions or sectors, developing adaptation strategies and prioritizing resilience measures

Recommended Texts

1. Neelin, J. D. (2010). Climate change and climate modeling. Cambridge University Press.
2. Adger, W. N., Lorenzoni, I., & O'Brien, K. L. (Eds.). (2009). Adapting to Climate Change: Thresholds, Values, Governance. Cambridge University Press.
3. Schmidt-Thomé, P., & Klein, J. (Eds.). (2013). Climate change adaptation in practice: from strategy development to implementation. John Wiley & Sons.

Suggested Readings

1. Randall, D. A., Wood, R. A., Bony, S., Colman, R., Fichefet, T., Fyfe, J. & Taylor, K. E. (2007). Climate models and their evaluation. In Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC (FAR) (pp. 589-662). Cambridge University Press.
2. Asseng, S., Zhu, Y., Wang, E., & Zhang, W. (2015). Crop modeling for climate change impact and adaptation. In Crop physiology (pp. 505-546). Academic Press.

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CLCH-6117 Renewable Energy and Climate 3(2-1)

To familiarize the students with the role of renewable energy in mitigating climate change and reducing greenhouse gas emissions. Develop understanding of different types of renewable energy technologies, their benefits, and challenges; and analyze the environmental, social and economic impacts of renewable energy deployment. To develop, practical skills in assessing renewable energy resources and designing sustainable energy systems. By the end of this course, students will be able to explain the principles of renewable energy generation and its significance for climate action. The can evaluate the environmental and socio-economic impacts of renewable energy deployment.

CONTENTS

Theory

1. Introduction to renewable energy and climate change
2. Role of renewable energy in reducing carbon emissions and transitioning to a low-carbon economy
3. Global and regional trends in renewable energy deployment and policies
4. Solar energy technologies: Photovoltaic (PV) systems, concentrated solar power (CSP), and solar thermal applications, Solar resource assessment and integration into the electricity grid
5. Wind energy technologies: Onshore and offshore wind farms, wind turbine technology, and wind resource assessment, challenges and opportunities for wind energy expansion and integration
6. Hydropower and other renewable energy sources: Types of hydropower systems (dam, run-of-river, pumped storage) and their impacts
7. Biomass energy, geothermal energy, and emerging renewable technologies
8. Environmental and social impacts of renewable energy: Life cycle assessment of renewable energy systems, Impacts on land use, biodiversity, and local communities

Practical

1. Renewable energy resource assessment: Using GIS tools to analyze solar and wind potential in different regions
2. Collecting and analyzing data from renewable energy monitoring stations,
3. Design and simulation of renewable energy systems: Hands-on activities with solar panels, wind turbines, and energy storage systems
4. Energy modeling and optimization for grid integration and off-grid applications

Recommended Texts

1. Quaschning, V. (2014). *Understanding renewable energy systems*. Routledge.
2. Twidell, J. (2021). *Renewable energy resources*. Routledge.
3. Boyle, G. (1996). Renewable Energy: power for a sustainable future. *Journal of energy literature*, *2*, 106-107.
4. Manwell, J. F., McGowan, J. G., & Rogers, A. L. (2010). *Wind energy explained: theory, design and application*.
5. Kalogirou, S. (2013). *Solar Energy Engineering: Processes and Systems* (2nd ed.). Academic Press.

Suggested Readings

1. Klass, D. L. (1998). *Biomass for Renewable Energy, Fuels, and Chemicals*. Academic Press.
2. Glassley, W. E. (2015). *Geothermal Energy: Renewable Energy and the Environment* (2nd ed.). CRC Press.
3. Bush, M. J. (2019). *Climate change and renewable energy: How to end the climate crisis*. Springer Nature.
4. Quaschning, V. V. (2019). *Renewable energy and climate change*. John Wiley & Sons.

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CLCH-6118 **Climate and Human Health** **3(2-1)**

To equip students with the knowledge related to impacts of climate change on human health, including direct and indirect effects. To familiarize them with the pathways through which climate variability and extreme weather events influence health outcomes. To develop practical skills in assessing climate-health interactions and designing adaptation measures. By the end of this course, students will be able to understand the connections between climate change and human health, including vulnerabilities and adaptation strategies. To enable them to know about climate-sensitive health impacts, such as heat-related illnesses, vector-borne diseases, and air pollution with reference to public health interventions and policies in addressing climate-related health risks.

CONTENTS

Theory

1. Climate change and health impacts: Overview of climate-sensitive health outcomes (heat stress, respiratory diseases, infectious diseases)
2. Vulnerable populations and equity considerations in climate-health interactions
3. Extreme weather events and health risks: Effects of heatwaves, floods, hurricanes, and wildfires on public health, Mental health impacts of climate-related disasters and displacement
4. Water pollution and human health
5. Health hazards due to UV radiations
6. Air quality, pollution and respiratory health: Links between climate change, air pollution, smog and respiratory illnesses, Health benefits of clean energy transitions and air quality improvement measures
7. Vector-borne diseases and climate change: Spread of vector-borne illnesses (e.g., malaria, dengue fever) in response to changing climate conditions, Integrated vector management strategies for disease prevention
8. Adaptation strategies and public health resilience: Early warning systems, heat action plans, and emergency preparedness measures
9. Community engagement and capacity-building for climate-resilient health systems

Practical

1. Epidemiological data analysis: Analyzing health data sets to study climate-health relationships
2. Mapping disease patterns and climate variables using geographic information systems (GIS)
3. Health impact assessments and risk management: Conducting health impact assessments for climate adaptation projects
4. Developing adaptation strategies and policies to reduce climate-related health risks

Recommended Texts

1. Levy, B. S., & Patz, J. A. (2015). *Climate Change and Public Health* (2nd ed.). Oxford University Press.
2. Lemery, J., Knowlton, K., & Sorensen, C. (Eds.). (2021). *Global climate change and human health: from science to practice*. John Wiley & Sons.
3. Lemery, J., Knowlton, K., & Sorensen, C. (Eds.). (2021). *Global climate change and human health: from science to practice*. John Wiley & Sons.Butler, C. D. (2008). *Human Health and Global Climate Change: A Review of Potential Impacts and Adaptations*. Routledge.

Suggested Readings

1. Fears, R., Canales-Holzeis, C., Caussy, D., Harper, S. L., Hoe, V. C. W., McNeil, J. N. & Haines, A. (2024). Climate action for health: Inter-regional engagement to share knowledge to guide mitigation and adaptation actions. *Global Policy*, *15*, 75-96.
2. Brunekreef, B., & Holgate, S. T. (2002). Air pollution and health. *The lancet*, *360*(9341), 1233-1242.
3. Butler, C. D., Ewald, B., McGain, F., Kiang, K., & Sanson, A. (2022). Climate change and human health. *Sustainability and the new economics: Synthesising ecological economics and modern monetary theory*, 51-68.

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CLCH-6119 Research Methodology and Scientific Writing 3(2-1)

This is a graduate level course in Department of Agronomy. The aim of the course is to introduce the students about the research methodology and planning a research experiment in the field of agronomy. This course will introduce the method of collecting data and analyze the data and develop a skill to presentation in tabulated or graphical form. This course enhances the capability of students to write good scientific papers. The course emphasizes quality of writing and dissemination with a view to improve readability, maximize the contribution of the research done and improve the opportunities for publishing. It also concerns the quantity of scientific production by initially addressing the issue of increasing productivity through peer-guidance, best practice in scientific writing.

Contents

Theory

1 Concept of research,
2 Scientific method and experiment
3 Planning and execution of trials
4 Experimental designs and layout
5 Research trial observations
6 Collection, processing and analysis of data
7 Measures of experimental variability
8 Interpretation and summarization of results
9 Types of scientific writing and developing a research proposal.

Practical

1 Writing of research proposal
2 Layout of field experiments
3 Collection, tabulation and analysis of data
4 Presentation of data in tables, curves, histograms, etc.
5 Writing of scientific paper/report.

Recommended Texts

1 Heard S.B. (2016).*The Scientist's Guide to Writing: How to Write More Easily and Effectively Throughout Your Scientific Career*, New Jersey: Princeton University Press.
2 Garson, G.D. & Sarsfield, R. (2018). Research Designs. New York: Statistical Association Publishers.

Suggested Readings

1. Mack, C.A (2018).How to Write a God Scientific Paper, Bellingham: SPIE Publishers.
2. Khalil, S K. & Shah, P. (2007).Scientific Writing and Presentation, HEC Manaograph; Islamabad.
3. Martha, D. (2005).Scientific Papers and Presentations, San Deigo, California: Academic Press.

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CLCH-6120 Industrialization and Climate Change 3(2-1)

To equip the students with the historical and contemporary relationship between industrialization and climate change. To explore the impacts of industrial activities on greenhouse gas emissions and global warming; and to analyze strategies for decarbonizing industrial sectors and transitioning towards sustainable production to develop skills regarding industrial emissions, carbon footprinting, and climate-friendly technologies. By the end of this course, students will be able to explain the role of industrialization in contributing to climate change through fossil fuel combustion and other processes. To identify major industrial sectors responsible for greenhouse gas emissions and environmental impacts with respect to technologies and policies for reducing carbon intensity and promoting cleaner industrial practices.

CONTENTS

Theory

1. Historical perspectives on industrialization and climate change: Industrial revolution and the rise of fossil fuel-based economies
2. Evolution of industrial sectors and their environmental impacts
3. Industrial emissions and greenhouse gas sources: Carbon dioxide (CO_2) emissions from energy-intensive industries (e.g., manufacturing, transportation), Methane (CH_4) and nitrous oxide (N_2O) emissions from industrial processes and waste management
4. Decarbonizing industrial sectors: Energy efficiency measures and renewable energy integration in industrial operations, Carbon capture and storage technologies for mitigating emissions from heavy industries
5. Sustainable production and circular economy: Principles of eco-design, resource efficiency, and waste reduction in industrial settings, transitioning towards a circular economy model for industrial sustainability
6. National and international policies to promote low-carbon industrial development
7. Public-private partnerships for advancing clean technologies and green industrial practices

Practical

1. Industrial visits: Calculating carbon emissions and conducting carbon audits for industrial processes
2. Assessing the environmental impact of specific industrial products or sectors
3. Hands-on activities with carbon capture and recycling technologies
4. Visits to green based industries in the country

Recommended Texts

1. Socolow, R. (Ed.). (1994). *Industrial ecology and global change* (Vol. 5). Cambridge University Press.
2. Graedel, T. E., & Allenby, B. R. (2010). Industrial ecology and sustainable engineering.
3. Ameta, S. C., & Ameta, R. (Eds.). (2023). *Green Chemistry: Fundamentals and Applications*. CRC press.
4. Zavyalova, E. B., & Popkova, E. G. (Eds.). (2021). *Industry 4.0: exploring the consequences of climate change*. Springer Nature.

Suggested Readings

1. Hussain, C. M., Petrillo, A., & Islam, S. U. concepts in smart societies.
2. Vila-Traver, J., Aguilera, E., Infante-Amate, J., & de Molina, M. G. (2021). Climate change and industrialization as the main drivers of Spanish agriculture water stress. *Science of the Total Environment*, *760*, 143399.
3. El-Haggar, S., & Samaha, A. (2019). *Roadmap for global sustainability-rise of the green communities* (pp. 1-215). Berlin/Heidelberg, Germany: Springer International Publishing.
4. Das, R. (2014). Has industrialization benefited no one? Climate change and the non-identity problem. *Ethical Theory and Moral Practice*, *17*, 747-759.

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CLCH-6121 Climate Change Mitigation Technologies 3(2-1)

To equip students with principles and applications of climate change mitigation technologies. To explore a range of technologies and strategies for reducing greenhouse gas emissions and analyze the effectiveness and scalability of mitigation technologies across different sectors. By the end of this course, students will be able to explain key climate change mitigation technologies and their underlying principles. To identify technological solutions for reducing emissions from energy, transportation, industry and agriculture. To evaluate the environmental, economic, and social impacts of mitigation technologies by apply quantitative methods.

CONTENTS

Theory

1. Overview of climate change KPIs
2. Principles of carbon sequestration, emission reduction, and carbon offsetting
3. Energy sector mitigation technologies: Renewable energy technologies (solar, wind, hydro, geothermal)
4. Transportation and mobility solutions: Electric vehicles, hydrogen fuel cells, and alternative fuels, sustainable urban planning and transportation policies
5. Industrial emission reduction: Carbon capture and storage technologies for heavy industries, Clean manufacturing processes and circular economy approaches
6. Agriculture and land use practices: Climate-smart agriculture techniques (e.g., precision farming, agroforestry), Soil carbon sequestration and sustainable land management practices

Practical

1. Evaluating the performance and efficiency of renewable energy systems
2. Conducting cost-benefit analyses for implementing mitigation technologies
3. Carbon footprint calculations and carbon trading simulation

Recommended Texts

1. Singh, V. (2024). Climate Change Mitigation. In *Textbook of Environment and Ecology* (pp. 309-325). Singapore: Springer Nature Singapore.
2. Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Agrawala, S., Bashmakov, I. A., Blanco, G. & Zwickel, T. (2014). Summary for policy makers.
3. Boyle, G. (1996). Renewable Energy: power for a sustainable future. *Journal of energy literature*, *2*, 106-107.
4. Al-Fattah, S. M., Barghouty, M. F., & Dabbousi, B. O. (2011). *Carbon capture and storage: Technologies, policies, economics, and implementation strategies*. CRC press.

Suggested Readings

1. Roychowdhury, R., Choudhury, S., Hasanuzzaman, M., & Srivastava, S. (Eds.). (2020). Sustainable agriculture in the era of climate change.
2. Behera, B., Haldar, A., & Sethi, N. (2024). Agriculture, food security, and climate change in South Asia: a new perspective on sustainable development. *Environment, Development and Sustainability*, *26*(9), 22319-22344.
3. Chang, V., Sharma, S., & Li, C. S. (2020). Smart cities in the 21st century. *Technological Forecasting and Social Change*, *153*, 119447.

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URCG-5111 **Translation of the Holy Quran - III** **Non-Credit**

Topic	Details
Semester/Level	In some discipline 5th semester and in some discipline 6th Semester/ BS (5th Semester intake) 1st / 2nd
Objectives	• To introduce ethics and highlight its importance, need and relevance for individual and collective life. • To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc. • To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc. • To inculcate ethical and moral values in our youth. • To develop a balanced dynamic and wholesome personality. • To introduce the students to Quranic Arabic grammar in practical manner.
Course Contents:	○ اخلاق (تعارف،ضرورت واہمیت ،اقسام،معنویت) اخلاق حسنہ : • برائی کو نیکی سے مٹانا • نیکی کے کاموں میں مسابقت • لوگوں کے درمیان صلح • عدل وانصاف • سچائی • ایثار • سلیم قلب • مہمان نوازی • لغویات سے اعراض • عاجزی و انکساری • نگاہ اور آوازکو پست رکھنا • چال میں میانہ روی • شرمگاہوں کی حفاظت • صبر • شکر • امور میں میانہ روی اخلاق سئیہ : • ظلم اور زیادتی • غرور و تکبر • نفسانی خواہشات کی پیروی • بدگمانی • جھوٹ • چغلی اور تہمت • تمسخر اور شیخی خوری • لہو و لعب • برے ناموں سے پکارنا • احسان جتانا اور تکلیف دینا • فضول خرچی اور حد سے بڑھنا • حسد اور تنگ دل • بے پردگی
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of Chapters and	▪ منتخب آیات مع ترجمہ وتجوید ▪ البقرہ (۱۱۲، ۲۳۵، ۸۳، ۱۸۲، ۱۷۲، ۱۵۲، ۱۷۲، ۵۲، ۱۵۳، ۱۷۷، ۲۵۰، ۱۲۵،

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verse Numbers:	٢٢٢، ٢٧، ٧٧، ١٨٢، ١٣٨، ١٨٧، ١٠٩، ٢٦٣، ٢٦٣، ٢٦٢، ٢١٢، ٦٧، ٢٣١، ١٠، ٣٣، ١٢٣، ٢٥٨، ٢٧، ٧١، ٨٣، ٢٢٦، ١٩٥، ٧٦) ■ آل عمران (١٥٣، ١٣، ٢٣، ١٨٥، ١٣٢، ١٣٨، ١٣٣، ١٣٥، ١٧، ٢٠٠، ١٢٥، ١٣٣، ١١٣، ١٠٣، ١٠٤، ٢٦، ٧٨، ١٣١، ١٣٧، ١٥٩) ■ النساء (١٣٥، ٢٣، ٢٢، ١٠٨، ١٠٧، ١٠٥، ٥٣، ٢٠، ٢٧، ١٧٣، ٣٦، ٢٥، ٢٣، ٣٧، ٥٧، ٢٣) ■ المائدة (٥٨، ٥٧، ٩٣، ١٣، ٦، ٣١، ١٩) ■ النحل (١٢٦، ٩٠، ١٠٥، ١١٣، ٣٠، ١٢٦، ١٢٥) ■ الرعد (٢٥، ٢٠، ٢٣، ٢٢، ٦) ■ الاعراف (٣١، ٦٦، ٥١، ١٣٦، ٣٠، ٣، ٢٠، ١٣٣، ١٩٩، ٩٥، ٨١) ■ القصص (٥٣، ٨٣) ■ فصلت (٣٣) ■ الانعام (٣٢، ٧٠، ٧٠، ١٣٠، ١٥٥، ١٦٠) ■ النمل (٩٠، ٣٦) ■ الحج (٣٠، ٥٨، ٦٠، ٨٨، ٧٧) ■ الحجرات (٩، ١١، ٦، ١١، ٣، ١٢، ١٥، ١٠) ■ الاحزاب (٢٣، ٥٠، ٥٨، ٥٨، ٥٢، ٥٥، ٥٩، ٣٥، ٢٣، ٣٥) ■ الحشر (٩) ■ طه (٧٢) ■ الانعام (١٦٣، ١٣١، ١١٦، ١٥١، ٦٣، ١٢٧) ■ ق (٣٣) ■ الانفال (٢٧، ٣٦، ٦١) ■ الفتح (١٥) ■ يونس (١٠، ١٩، ١٢، ٦٦، ٢٢، ٢٢) ■ الفرقان (٦٣، ٢١، ٦٧، ٦٣) ■ النور (٢٣، ٦، ٣، ٣٠، ٣١، ٣٣، ٣٣، ٦١، ٣١، ٢٢) ■ لقمان (٦، ٣٣، ١٩، ٣٢، ١٨) ■ الاسراء(٣٧، ١١٠، ٥، ٣٧) ■ المزمل (١٨) ■ المدثر (٦، ٣) ■ المدثر (٣٧) ■ فاطر (٣٢) ■ الفتح (٢٩) ■ البلد (١٧) ■ الزمر (٣، ١٠) ■ الحجر (٨٥) ■ النجم (٣١) ■ الرحمٰن (٦٠) ■ هود (٨، ١٠٢، ٣) ■ الكهف (٢، ٥٦) ■ الشورى (٣٧) ■ غافر (٢٨، ٢٧) ■ الحديد (٢٠، ٢٠) ■ مريم (٥٩) ■ النازعات (٣١) ■ التوبہ (٦٥، ٦٣، ٧٧) ■ الهمزه (١)

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SEMESTER-VII

CLCH-6122 Climate Data Analysis and Visualization 3(2-1)

To develop proficiency in handling and analyzing climate data using statistical and visualization techniques. To understand the sources, formats, and quality control of climate data. To learn to interpret climate patterns, trends, and variability through data analysis. Gain practical skills in creating meaningful visualizations to communicate climate information effectively. By the end of this course, students will be able to retrieve, preprocess, and manage climate datasets from various sources. To apply statistical methods to analyze climate variables (e.g., temperature, precipitation, humidity) and interpret climate trends, anomalies, and extreme events using data visualization tools. Create informative and engaging climate maps, graphs, and charts for scientific communication.

CONTENTS

Theory

8. Climate data sources and formats: Types of climate data (observational, satellite, model output), data acquisition, metadata, and quality control procedures
9. Statistical analysis of climate variables: Descriptive statistics (mean, median, variance) for climate datasets, time series analysis, trend detection, and hypothesis testing
10. Climate patterns and variability: El Niño-Southern Oscillation (ENSO), La Niña, North Atlantic Oscillation (NAO), and other climate indices
11. Spatial analysis techniques
12. Data visualization techniques: Graphical representations of climate data (line plots, scatter plots, histograms), Geographic information system (GIS) mapping for climate spatial analysis
13. Climate change detection and attribution: Detection of climate change signals in observational datasets
14. Attribution of climate trends to natural variability vs. human-induced factors

Practical

1. Climate data retrieval and preprocessing: Accessing climate databases and APIs (e.g., NOAA, NASA), cleaning and formatting climate datasets for analysis
2. Climate data analysis and visualization projects: Conducting hands-on data analysis tasks using statistical software, developing climate visualizations and interactive dashboards for research presentations

Recommended Texts

1. Deacon, J., Fan, A., Fannin, B., Levine, J., Quigley, K., & Yu, P. (2020). Introduction to data visualization. In *Casualty Actuarial Society E-Forum, Summer 2020* (p. 44).
2. Von Storch, H., & Zwiers, F. W. (2002). *Statistical analysis in climate research*. Cambridge university press.
3. Hannachi, A. (2021). *Patterns identification and data mining in weather and climate* (Vol. 10). Berlin/Heidelberg, Germany: Springer.
4. Maslin, M. (2014). *Climate Change: A Very Short Introduction* (3rd ed.). Oxford University Press.
5. Farmer, G. T., & Cook, J. (2013). *Climate Change Science: A Modern Synthesis*. Springer.

Suggested Readings

1. Von Storch, H., & Navarra, A. (Eds.). (1999). *Analysis of climate variability: applications of statistical techniques*. Springer Science & Business Media.
2. Estrellado, R. A., Freer, E., Rosenberg, J. M., & Velásquez, I. C. (2020). *Data science in education using R*. Routledge.

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CLCH-6123 Climate Change Resilience and Adaptation 3(2-1)

To understand the concepts of climate change resilience and adaptation. To explore strategies and measures for enhancing resilience to climate impacts and analyzes case studies and best practices in climate adaptation across different sectors. By the end of this course, students will be able to define climate change resilience and adaptation and their importance in addressing climate risks. To identify climate change impacts on natural and human systems and assess vulnerability. To evaluate adaptation strategies and approaches in various sectors (e.g., agriculture, water resources, urban planning).

CONTENTS

Theory

1. Introduction to climate change resilience and adaptation: Definitions, frameworks, and principles
2. Linkages between climate resilience, adaptation, and sustainability
3. Climate change impacts and vulnerability assessment: Impacts of climate change on ecosystems, water resources, agriculture, and communities
4. Methods for assessing vulnerability and adaptive capacity
5. Adaptation strategies and measures: Nature-based solutions (e.g., ecosystem restoration, green infrastructure), climate-smart agriculture, water management, and disaster risk reduction,
6. Sectoral adaptation planning: Urban resilience and climate-responsive design in cities, coastal zone management and adaptation to sea-level rise
7. Community engagement and adaptation governance: Stakeholder engagement and participatory approaches in adaptation planning, Policy frameworks and funding mechanisms for climate resilience projects

Practical

1. Using climate models and data to assess future climate scenarios
2. Identifying adaptation options and prioritizing actions based on risk assessments
3. Adaptation plan development and simulation: Collaborative design of adaptation plans for hypothetical scenarios

Recommended Texts

1. Galappaththi, E. K. (2020). *Opportunities for adaptation to climate change: a comparative analysis of Indigenous fisheries systems in the Canadian Arctic and Eastern Sri Lanka.* McGill University (Canada).
2. Zolnikov, T. R. (Ed.). (2019). *Global adaptation and resilience to climate change*. Springer International Publishing.
3. Pelling, M. (2010). *Adaptation to climate change: from resilience to transformation.* Routledge.Keenan, J. M. (2019). *Climate Adaptation Finance and Investment in California.* Routledge.
4. Schipper, E. L. F., & Ayers, J. (2014). *Community-Based Adaptation to Climate Change: Scaling It Up*. Routledge.

Suggested Reading

1. Bleischwitz, R., Hoff, H., Spataru, C., Van der Voet, E., & VanDeveer, S. D. (Eds.). (2018). *Routledge handbook of the resource nexus* (p. 536). Abingdon, Oxfordshire: Routledge.
2. Loder, A. (2020). *Small-scale urban greening: Creating places of health, creativity, and ecological sustainability*. Routledge.
3. Chandler, D., & Coaffee, J. (2016). *The Routledge handbook of international resilience.* Routledge.

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CLCH-6124 Climate Change Impacts on Terrestrial and Aquatic Animals 3(2-1)

To understand how climate change affects terrestrial and aquatic animal species and explore the ecological impacts of climate change on animal populations, communities and ecosystems through adaptatiojn strategies and responses of animals to changing environmental conditions. By the end of this course, students will be able to describe the direct and indirect effects of climate change on terrestrial and aquatic animals. Identify key ecological processes and interactions influenced by climate variability. Evaluate adaptive behaviors, physiological responses, and phenological changes in animal species. Apply field and laboratory techniques to assess climate-related impacts on animal populations.

CONTENTS

Theory

1. Introduction to climate change impacts on animals: Overview of climate-related stressors affecting terrestrial and aquatic fauna
2. Impacts of climate change on species distribution, phenology, and habitat suitability
3. Ecological consequences of climate change: Effects on animal physiology, metabolism, and reproductive cycles
4. Cascading effects on food webs, trophic interactions, and ecosystem dynamics
5. Adaptation and resilience in animal species: Behavioral adaptations (migration, hibernation, diapause) in response to changing seasons, Physiological adaptations to temperature extremes, water availability, and habitat loss
6. Climate impacts on migratory birds, amphibians, fish, and marine mammals
7. Conservation and management strategies: Habitat restoration, protected area design, and climate-informed conservation planning, integrating climate change considerations into wildlife management and policy frameworks

Practical

1. Field surveys and observations
2. Monitoring changes in species abundance, distribution, and phenology
3. Analyzing climate data and animal monitoring records using statistical methods
4. Mapping habitat changes and species responses to climate variables

Recommended Texts

1. Newman, J. A. (2011). *Climate change biology*. Cabi.Elton, C. S. (2001). *Animal ecology*. University of Chicago Press.
2. Bonan, G. (2019). *Climate change and terrestrial ecosystem modeling*. Cambridge University Press.
3. Møller, A. P., Fiedler, W., & Berthold, P. (Eds.). (2010). *Effects of Climate Change on Birds*. Oxford University Press.
4. Arias, A.H., & Menendez, M.C. (Eds.). (2013). Marine Ecology in a Changing World (1st ed.). CRC Press. https://doi.org/10.1201/b16334

Suggested Readings

1. Lovejoy, T. E., & Hannah, L. (Eds.). (2019). Climate Change and Biodiversity. Yale University Press.
2. Doney, S. C., Ruckelshaus, M., Emmett Duffy, J., Barry, J. P., Chan, F., English, C. A. & Talley, L. D. (2012). Climate change impacts on marine ecosystems. Annual review of marine science, 4(1), 11-37.
3. Schumann, N., Gales, N. J., Harcourt, R. G., & Arnould, J. P. (2013). Impacts of climate change on Australian marine mammals. Australian Journal of Zoology, 61(2), 146-159.

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CLCH-6125 AI Solutions for Climate Change Issues 3(2-1)

To understand the role of artificial intelligence (AI) in addressing climate change challenges. To explore AI applications for climate modeling, mitigation, adaptation, and monitoring through case studies and examples of AI-driven solutions for climate-related issues. To develop practical skills in using AI tools and techniques for climate analysis and decision-making. Introduction to Artificial Intelligence or Machine Learning Basic Programming Skills. By the end of this course, students will be able to explain the concepts and principles of AI and machine learning relevant to climate change. To identify AI applications in climate science, renewable energy optimization, carbon capture, and environmental monitoring and evaluate the potential and limitations of AI technologies for addressing complex climate issues. They can apply AI algorithms and tools to analyze climate data, simulate scenarios, and develop predictive models.

CONTENTS

Theory

1. Introduction to AI and climate change: Overview of AI techniques (machine learning, deep learning) for climate applications
2. Role of AI in climate modeling, weather prediction, and climate risk assessment
3. AI Solutions for climate mitigation and adaptation: Optimization of renewable energy systems using AI algorithms
4. AI-driven strategies for carbon capture, utilization, and sequestration
5. Climate monitoring and environmental sensing: Use of AI in satellite imagery analysis, remote sensing, and real-time environmental monitoring
6. AI-based tools for biodiversity conservation, habitat mapping, and ecological forecasting
7. AI-supported decision support systems for climate policy formulation and adaptation planning
8. Ethical considerations and challenges of AI deployment in climate governance

Practical

1. Hands-on trainings of AI Tools and Software
2. Implementing AI models for climate-related applications
3. Climate data analysis and ai applications: Using AI algorithms to analyze climate datasets, identify patterns, and make predictions
4. Developing AI-based solutions for specific climate change scenarios

Recommended Texts

1. Goundar, S., Purwar, A., & Singh, A. (Eds.). (2022). Applications of artificial intelligence, big data and internet of things in sustainable development. CRC Press.
2. Fielding, A. (Ed.). (1999). Machine learning methods for ecological applications. Springer Science & Business Media. Xing, Y., & Vuc, T. N. X. (2018). Deep Learning for the Earth Sciences: Using MATLAB. Springer,
3. Hsieh, W. W. (2009). Machine Learning Methods in the Environmental Sciences: Neural Networks and Kernels. Spain: Cambridge University Press.Monteleoni, C., Schmidt, G. A., & Mandli, K. T. (Eds.). (2013). Climate Informatics: Applications of Machine Learning in Climate Science. CRC Press.

Suggested Readings

1. Kraljevski, I., Ju, Y. C., Ivanov, D., Tschöpe, C., & Wolff, M. (2023). How to Do Machine Learning with Small Data?--A Review from an Industrial Perspective. arXiv preprint arXiv:2311.07126.
2. Chen, L., Chen, Z. & Zhang, Y. (2023). Artificial intelligence-based solutions for climate change: a review. Environ Chem Lett 21, 2525–2557

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CLCH-6126 Water and Environmental Governance 3(2-1)

To understand the concepts of water governance and environmental governance and explore the interplay between water management, environmental policies, and governance frameworks. To analyze the role of institutions, stakeholders, and decision-making processes in water resource management. By the end of this course, students will be able to define water governance and environmental governance and their significance in sustainable development and identify key principles and frameworks of water resource management and environmental policy with respect to governance structures.

CONTENTS

Theory

1. Introduction to water governance: Definitions of water governance, stakeholder engagement, and policy integration
2. Principles of integrated water resources management
3. Environmental governance frameworks: Overview of environmental policies, regulations, and international agreements, role of government agencies, NGOs, and community organizations in environmental governance
4. Institutional arrangements for water management: Water governance models (centralized vs. decentralized), basin-level governance
5. Stakeholder engagement and decision-making processes: Participatory approaches in water governance (e.g., public consultations, multi-stakeholder platforms)
6. Water scarcity and climate change
7. National and international conflict in water allocation and management under changing climate scenario
8. Water policy analysis and implementation: Policy tools for water conservation, pollution control, and ecosystem restoration, assessing water policy effectiveness and monitoring compliance with environmental regulations

Practical

1. Visits to water conservation and reservoirs
2. Demonstration of ground water recharge
3. Demonstration of waste water treatment and utilization
4. Indus basin water distribution system: limitation and advantages

Recommended Texts

1. Mirumachi, N. (Ed.). (2013). Water Governance for Sustainable Development: Approaches and Lessons from Developing and Transitional Countries. Routledge.
2. Perret, S., Farolfi, S., & Hassan, R. M. (Eds.). (2006). Water governance for sustainable development. Editions Quae.
3. Mol, A. P. J., & Buttel, F. H. (Eds.). (2002). Environmental Governance: Institutions, Policies and Actions. Springer.

Suggested Readings

1. van der Heijden, J., & Frantzeskaki, N. (Eds.). (2019). Governance for Urban Sustainability and Resilience. Palgrave Macmillan.
2. Ripley, A. C. (2011). The human right to water and its application in the Occupied Palestinian Territories. Routledge.
3. Allan, J., Wagner, L., Templeton, J., & Kosolapova, E. (2024). State of global environmental governance 2023.

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CLCH-6127 Agroforestry and Climate Resilience 3(3-0)

This course aims to provide students with an understanding of agroforestry systems and their role in climate resilience. Students will learn how agroforestry supports biodiversity, carbon sequestration, and sustainable land use. By the end of the course, they will be able to evaluate agroforestry practices for soil and water conservation, assess socioeconomic benefits, and propose solutions for mitigating climate challenges.

CONTENT

1. Basics of agroforestry and its importance.
2. Types of agroforestry systems like silvopastoral and agrosilvicultural.
3. Agroforestry's role in tackling climate change.
4. How agroforestry supports biodiversity and wildlife.
5. Managing soil and water through agroforestry practices.
6. Benefits of agroforestry for farmers and communities.
7. Agroforestry techniques for dry and arid areas.
8. Using agroforestry to reduce impacts of floods and droughts.
9. Linking agroforestry with sustainable land use.

Recommended Texts

1. P Nair, P. K. R., & Garrity, D. (Eds.). (2012). Agroforestry: The Future of Global Land Use. Dordrecht: Springer.
2. Young, A. (1997). Agroforestry for Soil Management (2nd ed.). Wallingford, UK: CABI.
3. Kumar, B. M., & Nair, P. K. R. (Eds.). (2011). Carbon Sequestration Potential of Agroforestry Systems: Opportunities and Challenges. Dordrecht: Springer.

Suggested Readings

1. Lundgren, B. O., & Raintree, J. B. (1982). Sustained Agroforestry. Nairobi: ICRAF.
2. Leakey, R. (2017). Multifunctional Agriculture: Achieving Sustainable Development in Africa. Wallingford, UK: CABI. olicies and programs to promote agroforestry.

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URCG-5111 **Translation of the Holy Quran - IV** **Non-Credit**

Topic	Details
Semester/Level	In some discipline 7th semester and in some discipline 8th Semester/ BS (5th Semester intake) 3rd / 4th
Objectives	• To familiarize the students with commandments of trade and inheritance mentioned in the Quranic text (with the help of Urdu translation). • Students • To introduce the students to scientific facts and miracles of the Holy Quran and Quranic stress on deep study of Allah's explored universe. • To motivate the students for reading and exploring the last Holy Book revealed by Almighty Allah. • Through memorization students will develop their relation with last revelation.
Course Contents:	○ تجارت اور وراثت: • مال کی تقسیم • نادان کا مال • عوام الناس کا مال • عورتوں کا مال • یتیموں کا مال • کفار کا مال • جائز مال • معاہدے • رہن • قرض ○ سائنسی حقائق: • تخلیق کائنات • اجرام فلکی • شجر و حجر • زمین و آسمان کے اسرار • ہوائیں اور طوفان • بہائم اور مویشی • حشرات الارض • پہاڑ اور سمندر
Grammar :	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of Chapters and verse Numbers:	▪ منتخب آیات مع ترجمہ وتجوید ▪ البقرہ (۲۶۱، ۲۲۱۵، ۲۶۵، ۲۱۹، ۲۶۳، ۲۷۵، ۱۸، ۲۶۵، ۱۷۷، ۲۶۵، ۱۶، ۲۷۵، ۲۸۲، ۲۶۲، ۲۷۳، ۲۷۱، ۸۳، ۱۷۷، ۲۱۵، ۲۷۶، ۲۷۸، ۱۶، ۲۷، ۲۲۳، ۲۹، ۲۵۵، ۱۶۳، ۲۶۶، ۱۶۳، ۱۶۳، ۵۰، ۶۰، ۱۶۳، ۵۷، ۲۱۰، ۱۹، ۲۶، ۷۱، ۹۲، ۹۳) ▪ آل عمران (۱۱۷، ۱۳۳، ۱۳۰، ۱۹۰، ۲۷، ۵۹) ▪ النساء (۲۹، ۲، ۲۹، ۱۶۱) ▪ المائدہ (۸۹، ۹۵، ۷۵، ۶۹، ۶۰) ▪ التوبہ (۹۸، ۲۳، ۶۹، ۲۳، ۲۳، ۶۰، ۳) ▪ الاعراف (۱۷۲، ۱۸۵، ۵۷، ۵۸، ۱۶۳، ۱۶۳، ۱۶۰، ۴۰، ۱۳۳، ۱۷۶، ۱۶۶) ▪ الرعد (۱۷، ۳) ▪ الطور (۳۳) ▪ الانعام (۵۹، ۶۳، ۱۳۱، ۱۳۶، ۳۸) ▪ الانفال (۲۸، ۳۶، ۳۱) ▪ الکہف (۵۱، ۱۰۹، ۳۷، ۳۲، ۳۵، ۱۷، ۳۵) ▪ الجاثیہ (۵)

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	▪ فاطر (٢٧، ١٢، ١٣) ▪ العنكبوت (٢٠، ٦٣، ٣١) ▪ الروم (٥٠) ▪ الاسراء (٧٠، ٩٩) ▪ الرعد (٢) ▪ السبا(١٠، ٣، ٢٢) ▪ يونس (٨٨، ١٠١، ٢٣، ٢٣، ٥، ٢٢) ▪ يوسف (٩٣، ١٣) ▪ الفرقان (٦٢، ٥٣) ▪ لقمان (٢٩، ١٦) ▪ طه (١١٣، ٥٣) ▪ النحل (٧٥، ١١، ٦١، ٣٩، ٧٩، ٦٨، ٦٨، ١١٥، ٨، ٨) ▪ النمل (٦٣، ٦٣، ٨٨، ٦٠، ٨٢، ١٦، ١٧، ١٨) ▪ السجده (٢٧) ▪ الحديد (٦) ▪ هود (٣٣، ٦) ▪ يسين (٣٧، ٣١) ▪ الروم (٣٩، ٣٩، ٥٠، ١٩، ٢٣، ٣٦) ▪ فصلت (٣٩، ٣٩) ▪ الحج (٦١، ٦٥، ٢٢، ٧٣) ▪ الحجر (١٩، ٢٢) ▪ الانبياء (٣١، ٣٠، ٣٧) ▪ الزاريات (٣٧) ▪ الزلزله (١) ▪ القصص (٧٦، ٧٩، ٨٠، ٨١، ٨٢) ▪ النور (٣٧، ٢٢، ٢٢، ٣٠، ٣٥، ٣٣) ▪ الجمعه (١١، ٦٢، ١٠، ١١، ٥) ▪ القمر (٧) ▪ الواقعه (٦٩) ▪ الفاطر (٢٠، ١٣) ▪ الملک (١٩) ▪ الصف (١٠) ▪ الجن (١٣) ▪ الشورى (٢٨) ▪ الزخرف (١١) ▪ الفيل (١)	

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SEMESTER-VIII

CLCH-6128 **Research project / Internship** **3(0-3)**

Internship opportunities can provide students with unique exposure to research in other environments, including private industries, federal agencies, other countries, or other universities. Because of their value to the graduate student experience, the Department of Agronomy offers this course. It is intended to apprise students of the basics of how to design and conduct research, data analysis as well as technical report writing and presentation. Further, it covers a wide spectrum of experiments designed for students at undergraduate level. The experiments are selected to provide insight into the basic principles and techniques of Agronomy. At the end of the semester, a study tour is arranged of provincial and federal research institutes to acquaint the students with recent research activities going on there. Pesticide companies' visits are also arranged time to time for this course during the semester. The core objective of this course is to train the students in such a way that at the completion of this course students may design their future research proposals.

Course Contents

1. Proposal development, on spot field training
2. Report writing and project presentation. (Format as per thesis manual of the university concerned).

Recommended Texts

1. Ghafoor, A. (2016). *Manual for synopsis and thesis preparation*. Faisalabad, University of Agriculture Press.
2. Relevant latest literature on target issues.

Suggested Readings

1. Reviews, research articles
2. Illustrated Manuals, Compendiums
3. Pocket books

CLCH-6129 **Capstone Project** **3(0-3)**

A capstone project is typically a final project that allows students to showcase the knowledge and skills they have gained throughout their academic program and apply them to real-world problems and issues.

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