COURSE CONTENTS OF COMPULSORY/GENERAL FACULTY COURSES FOR BS (4TH SEMESTER) PROGRAM IN BOTANY

Year	Semester	Course Code	Course Title	Credit Hrs.
Year-II	4th	GEN-4401	Fundamentals of Sociology	2(2-0)
		GEN-4402	Civics & Community Engagement	2(2-0)
		GEN-4403	Ideology& Constitution of Pakistan	2(2-0)
		BOT-4404	Cell Biology, Genetics & Evolution	3(2-1)
		CHM-4405	Organic Chemistry	4(3-1)
		ZOO-4406	Animal Form and Function-I	4(3-1)
		Total credit hours.		**17**

GEN-4401 Fundamentals of Sociology 2(2-0)

Course Objectives:

To familiarize the students with fundamental concepts, theories, and methods of sociology

Course Contents:

Unit I: Introduction to Sociology

- Defining sociology and its significance
- The sociological perspective and imagination

Unit II: Foundations of Sociological Thinking

- Major sociological theories: functionalism, conflict theory, symbolic interactionism
- Sociological research methods: quantitative and qualitative approaches

Unit III: Culture and Socialization

- Definition of culture and cultural relativism
- Elements of culture: norms, values, symbols
- Agents of socialization: family, peers, media

Unit IV: Social Structure and Institutions

- Social structure: status, roles, social groups
- Institutions: family, education, religion, economy, politics
- Social roles and role conflict

Unit V: Social Stratification and Inequality

- Social classes and socioeconomic inequality
- Race, ethnicity, and gender as sources of inequality
- Social mobility and its determinants

Unit VI: Deviance and Crime

- Theories of deviance: strain theory, labeling theory, control theory
- Types of deviant behavior: crime, delinquency
- Social control and the criminal justice system

Unit VII: Social Change and Globalization

- Social change theories: modernization, conflict, globalization
- Impact of technology, communication, and migration
- Social movements and their role in change

Unit VIII: Social Institutions and Issues in Society

- Marriage and family dynamics
- Education and its functions
- Religion and its role in society

- Health and healthcare disparities

Unit IX: Sociology in Everyday Life

- Applying sociological concepts to real-life situations
- Understanding social issues and making informed decisions

Recommended Books:

1. Sociology: A Brief Introduction" by Richard T. Schaefer
2. Sociology: The Essentials" by Margaret L. Andersen and Howard F. Taylor
3. Introduction to Sociology" by Anthony Giddens, Mitchell Duneier, Richard P. Appelbaum, and Deborah Carr
4. The Sociological Imagination" by C. Wright Mills
5. Social Research Methods" by Alan Bryman
6. The Presentation of Self in Everyday Life" by Erving Goffman

GEN-4402 Civics & Community Engagement 2(2-0)

Course Objectives:

To explore the fundamental concepts of civics, citizenship, and community engagement.

Course Contents:

Module 1: Introduction to Civics and Citizenship

- Definition and importance of civics education
- Roles and responsibilities of citizens in a democracy
- Historical evolution of citizenship concepts

Module 2: Democratic Governance and Political Participation

- Types of democracies and principles of democratic governance
- Electoral systems and political parties
- Voter education and political participation

Module 3: The Constitution and Rule of Law

- Basics of constitutional law and its significance
- Separation of powers and checks and balances.
- Protecting individual rights and civil liberties

Module 4: Public Policy and Civic Engagement

- Understanding public policy and its impact
- Role of advocacy and lobbying in shaping policies
- Civic engagement strategies for policy change

Module 5: Civil Society and Non-Governmental Organizations (NGOs)

- Defining civil society and its functions
- Role of NGOs in promoting social justice and development
- Collaborations between NGOs, governments, and businesses

Module 6: Media Literacy and Civic Education

- Importance of media literacy in an information-driven society
- Analyzing media bias and misinformation
- Utilizing media for civic education and awareness

Module 7: Social Justice and Human Rights

- Concepts of social justice and equity
- Promoting human rights and addressing discrimination
- Intersectionality and the impact of multiple identities

Module 8: Community Engagement and Service Learning

- Principles of community engagement and service learning
- Collaborative problem-solving and community needs assessment.
- Implementing sustainable community development projects

Module 9: Ethical Leadership and Decision-Making

- Characteristics of ethical leaders
- Ethical decision-making frameworks
- Applying ethics to community engagement and activism

Module 10: Global Citizenship and Sustainability

- Understanding global citizenship and interconnectedness

- Addressing global challenges (climate change, poverty)
- Sustainable development and responsible global citizenship

Recommended Books:

1. Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education
2. Civic Engagement in American Democracy" by David J. Houston and Mark Carl Rom
3. The Civic Web: Young People, the Internet, and Civic Participation" by Shakuntala Banaji
4. Becoming a Citizen Activist: Stories, Strategies, and Advice for Changing Our World" by Nick Licata
5. Citizens, Politics, and Social Communication: Information and Influence in an Election Campaign" by Dietram A. Scheufele.

GEN-4403 Ideology & Constitution of Pakistan 2(2-0)

Introduction / Objectives

Objectives

- To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan.
- To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

1. **Historical Perspective**

a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
b. Factors leading to Muslim separatism.
c. People and Land
i. Indus Civilization
ii. Muslim advent
iii. Location and Geo-Physical features.

2. **Government and Politics in Pakistan**

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

3. **Contemporary Pakistan**

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

Recommended Books:

1. Burki, Shahid Javed. *State & Society in Pakistan,* the MacMillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development.* Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Bangladesh.,* Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota,* Lahore: Idara-e- Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan,* Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development.* Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh.* Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan,* Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research,1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan.* Boston: Houghton Mifflin, 1967.

12. Aziz, K.K. *Party, Politics in Pakistan,* Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, Pakistan under Martial Law, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective.* Islamabad: National Commission on Historical and Cultural Research, 1993.

BOT-4404 Cell Biology, Genetics & Evolution 3(2-1)

Aims and Objectives

To understand

1. Structure and functions of cell.
2. Nature of genetic material and hereditary process.
3. Familiarization with evolutionary processes.

Course Contents

a) Cell biology

1. Structures and Functions of Biomolecules
   Carbohydrates, Lipids, Proteins, Nucleic Acids
2. Cell: Physico-chemical nature of plasma membrane and cytoplasm.
3. Ultrastructure of plant cell with a brief description and functions of the following organelles
   Cell wall, Endoplasmic reticulum, Plastids, Mitochondria, Ribosomes, Dictyosomes, Vacuole, Microbodies (Glyoxysomes and Peroxisomes)
4. Nucleus: Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, karyotype analysis
5. Reproduction in somatic and embryogenic cell, mitosis and meiosis, cell cycle
6. Chromosomal aberrations; Changes in the number of chromosomes. Aneuploidy and euploidy. Changes in the structure of chromosomes, deficiency, duplication, inversion and translocation.

b) Genetics

1. Introduction, scope and brief history of genetics. Mendelian inheritance; Laws of segregation and independent assortment, back cross, test cross, dominance and incomplete dominance.

2. Sex linked inheritance, sex linkage in Drosophila and man (colour blindness), XO, XY, WZ mechanisms, sex limited and sex-linked characters, sex determination.

3. Linkage and crossing over: definition, linkage groups, construction of linkage maps, detection of linkage.

4. Molecular genetics; DNA replication. Nature of gene, genetic code, transcription, translation, protein synthesis, regulation of gene expression (e.g., *lac* operon).

5. Transmission of genetic material in Bacteria: Conjugation and gene recombination in *E. coli,* transduction and transformation.

6. Principles of genetic engineering / biotechnology; Basic genetic engineering techniques.

7. Application of genetics in plant improvement: Induction of genetic variability (gene mutation, recombination), physical and chemical mutagens, selection, hybridization and plant breeding techniques. Development and release of new varieties.

8. Introduction to germplasm conservation

c) Evolution

The nature of evolutionary forces, adaptive radiation, differential reproductive potential, first plant cell, origin of organized structures, early aquatic and terrestrial ecosystem, first vascular plant.

Practical

Study of cell structure using compound microscope and elucidation of ultrastructure from electron microphotographs

1. Measurement of cell size.
2. Study of mitosis and meiosis by smear/squash method and from prepared slides.
3. Study of chromosome morphology and variation in chromosome numbers.
4. Extraction and estimation of carbohydrate, protein, RNA and DNA from plant sources

Genetics

1. Genetical problems related to the transmission and distribution of genetic material.
2. Identification of DNA in plant material. Carmine/orcein staining.

3. Study of salivary gland chromosomes of Drosophila.

Recommended Books:

1. Hoelzel, A. R. 2001. Conservation Genetics. Kluwer Academic Publishers.
2. Dyonsager, V.R. (1986). Cytology and Genetics. Tata and McGraw Hill Publication Co. Ltd, New Delhi.
3. Lodish. H. 2001. Molecular Cell Biology. W. H. Freeman and Co.
4. Sinha, U. and Sinha, S. (1988). Cytogenesis Plant Breeding and Evolution, Vini Educational Books, New Delhi.
5. Strickberger, M.V. (1988), Genetics, MacMillan Press Ltd., London.
6. Carroll, S.B., Grenier, J.K. and Welnerbee, S.d. 2001. From DNA to Diversity - Molecular Genetics and the Evolution of Animal Design. Blackwell Science.
7. Lewin, R, 1997. Principles of Human Evolution. Blackwell Science.
8. Strickberger, M. W. 2000 Evolution. Jones & Bartlet Publishers Canada
9. Ingrouille M. J. & B. Eddie. 2006. Plant Diversity and Evolution. Cambridge University Press.

CHM-4405 Organic Chemistry 4(3-1)

1. Introduction to Chemical Bonding

Attainment of a stable configuration, types of bonds (ionic bonds, covalent bonds, coordinate bonds), oxidation number and formal oxidation number. The localized bonding approach (Introduction to valence bond theory and hybridization. The delocalized bonding approach (MOT applied to homonuclear diatomic molecules).

2. Acids and Bases

Concepts of acids and bases (Arrhenius, Lowry-Bronsted, Lewis and SHAB concept), relative strength of acids and bases. pH, pKa, pKb and buffer solutions and their significance. Theory of Indicators, solubility, solubility product, common ion effect and their applications.

3. Chemistry of p-block Elements

General characteristics of the following group of p-block elements with reference to the aspects given against each:

Boron and Aluminum

Gradation of the characteristic properties within the group. Structures, properties and applications of electron deficient molecules such as boron hydrides and aluminum hydrides.

Carbon and Silicon

Gradation of the characteristic properties within the group). Production of pure silicon for solar energy and silicon chips. Structural aspects of ortho and metasilicates and their industrial applications.

Nitrogen and Phosphorus

Gradation of the characteristic properties within the group. Oxides of nitrogen (NO and NO2) and their role in air pollution, oxyacids (HNO2 and HNO3) of nitrogen. Industrial preparation of urea and superphosphate fertilizers.

Oxygen and Sulfur 26 Gradation of the characteristic properties within the group. Role of sulphur dioxide in air pollution. Thionic acids (H2SO3 and H2SO4) and uses hypo in photography.

The Halogens

Gradation of the characteristic properties within the group, anomalous behavior of fluorine. Preparation of oxyacids of halogens (HClO3 and HClO4) and their uses. Interhalogens, pseudohalogens.

The Noble Gases

Preparation, properties and uses of xenon fluorides; Commercial uses of noble gases.

4. **Chemistry of d-block Elements**

Electronic configuration and general characteristics of d-block elements. Industrial applications of transition metals. Werner's concept and nomenclature of coordination compounds.

5. **Introduction to Modern Materials**

Liquid crystals, engineering ceramics, fiber glass and thin films.

Practicals

1. Laboratory Ethics and safety measures

Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations

2. Qualitative analysis

Analysis of four ions (two anions and two cations) from mixture of salts
3. Quantitative analysis
a. Acid-Base Titrations (minimum 02)
b. Redox Titrations (minimum 02)
c. Complexometric Titrations (minimum 02)
4. Inorganic Preparations
a. Preparation of Ferrous sulphate
b. Preparation of Ferric alum
c. Preparation of Barium sulfate

Recommended Books

1. Huheey, J. E., Keiter, E. A. and Keiter, R. L., "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Harper and Row, New York, 2001
2. Cotton, F. A., Wilkinson, G. and Gaus, P. L., "Basic Inorganic Chemistry", 3rd Ed., Wiley, New York, 1995.
3. Clyde Day, M. & Selbin, J., "Theoretical Inorganic Chemistry", 2nd Ed., Van Nustrand Reinhold, 1969.
4. Lee, J.D., "Concise Inorganic Chemistry", Chapman and Hall, 5th Edition, 1996.
5. Shriver, D. F., Atkins, P. W. and Langford, C. H., "Inorganic Chemistry", Oxford University Press, 2nd Edition, 1994.
6. Cartmell E. and Fowles G. W. A. "Valency and Molecular Structure" Adlard and Sons Limited 3rd Edition (1966)
7. Douglas B., McDaniel D. and Alexander J. "Concepts and Models of Inorganic Chemistry" John Wiley & Sons, Inc. 3rd Edition (1994)
8. Harvey K. B. and Porter G. B. "Introduction to Inorganic Physical Chemistry" Addison-Wesley Publishing Company, Inc. (1963)
9. Hill J. W. and Petrucci R. H. "General Chemistry" Prentice-Hall, Inc. (1996)
10. Marr G. and Rockett B. W. "Practical Inorganic Chemistry" Van Nostrand Reinhold Company. (1972)
11. Miessler G. L. and Tarr Donald A. "Inorganic Chemistry" Prentice-Hall International, Inc. Prentice-Hall International Edition (1991)
12. Moody B. "Comparative Inorganic Chemistry" Routledge, Chapman and Hall, Inc. 3rd Edition (1991)
13. Kennedy, Friedlander, "Nuclear and Radiochemistry" (latest edition).
Bassette, J., Denney, G. H. and Mendham, J., "Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis" English Language Book Society, 4th Edition, 1981.
Vogel, A. I., "A Textbook of Micro and Semi-micro–Qualitative Inorganic Analysis" Longman Green & Co. 1995.

ZOO-4406 Animal Form and Function-I 4(3-1)

Course Objectives:

The Objectives of the courses are:

1. To teach about animals' diversity adapted in different strategies for performance of their similar functions through modifications in body parts in past and present times.
2. To impart understanding of diverse strategic structural adaptations in each of the functional systems of nutrition, excretion, osmoregulation and reproduction and development for effective survival in their specific conditions.
3. To understand the organ systems, their specialization and coordination with each other and constantly changing internal and external environment, inside and outside the animal's body.
4. To embrace the phenomena in basic structure of each system that determines its particular function.

Course Learning Outcomes:

1. **Acquire** the concept that for the performance of a function, for example exchange of respiratory gases the different forms are adapted in t environments e.g., gills in aquatic and lungs in terrestrial environment.
2. **Understand** that diverse forms adapted to perform the same functions are because of the different past and present conditions.

3. **Solve** of emergence of diversity of forms for the performance of similar function.
4. **Analyze** the requirements of diverse forms for the performance of similar functions in their past and present needs.
5. **Evaluate** the adaptations in forms for its efficiency in managing the function in differing situations in the past and present times.
6. **Demonstrate** that a form is successfully adapted to perform a function adequately and successfully.

Course Outline:

1. **Nutrition and Digestion:**
   a. Evolution of nutrition; the metabolic fates of nutrients in heterotrophs; digestion
   b. Animal strategies for getting and using food, diversity in digestive structures of invertebrates.
   c. The mammalian digestive system: gastrointestinal motility and its control
   d. Oral cavity, pharynx and esophagus, stomach, small intestine: main site of digestion; large intestine; role of the pancreas in digestion; and role of the liver and gallbladder in digestion.
2. **Temperature and Body Fluid Regulation:**
   a. Homeostasis and Temperature Regulation; The Impact of Temperature on Animal Life; Heat Gains and Losses; Some Solutions to Temperature Fluctuations; Temperature Regulation in Invertebrates, Fishes, Amphibians, Reptiles, Birds and Mammals.
   Heat Production in Birds and Mammals
   b. Control of Water and Solutes (Osmoregulation and Excretion);
   Invertebrate and Vertebrate
   c. Excretory Systems: How Vertebrates Achieve Osmoregulation; Vertebrate Kidney Variations; Mechanism in Metanephric Kidney
   Functions. Reproduction and Development
3. **Reproduction:**
   a. Asexual reproduction in invertebrates; advantages and disadvantages of asexual reproduction.
   b. Sexual reproduction in invertebrates; advantages and disadvantages of sexual reproduction; sexual reproduction in vertebrates; reproductive strategies; examples of reproduction among various vertebrate classes.
   c. The human male reproductive system: spermatogenesis, transport and hormonal control, reproductive function.
   d. The human female reproductive system: folliculogenesis, transport and hormonal control, reproductive function; hormonal regulation in gestation; prenatal development and birth: the placenta; milk production and lactation.

4. **Descriptive Embryology:**
   a. Fertilization; embryonic development: cleavage, and egg types; the primary germ layers and their derivatives.
   b. Echinoderm embryology.
   c. Vertebrate embryology: the chordate body plan,
   d. Amphibian embryology, development in terrestrial environments,
   e. Avian embryology, and the fate of mesoderm.

Practicals:

1. Study of excretory system in an invertebrate and a vertebrate representative (Model).
2. Study of digestive system in invertebrate and a vertebrate representative (Dissection).
3. Dissection and study of male and female reproductive system in vertebrates and invertebrates.
4. Study of stages in the development of an Echinoderm.
5. Study of early stages in the development of a frog, chick and a mammal.

Note: Prepared slides and preserved specimen and/or projection slides and/or CD ROM computer projections may be used.

Books Recommended

1. Pechenik, J.A. 2013. Biology of Invertebrates, 4th Ed. (International), Singapore: McGraw-Hill.
2. Arthur, M. M. 2010. Vertebrate Embryology.
3. Hickman, C.P., Roberts, L.S., Larson, A. 2004. Integrated Principles of Zoology, 11th Ed. (International), Singapore: McGraw-Hill.
4. Miller, S.A., Harley, J.B. 2002. Zoology, 5th, 6th, 7th, 8th, 9th, 10th & 11th Ed. (International), Singapore: McGraw-Hill.
5. Campbell, N.A. 2002. Biology, 6th Ed. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
6. Kent, G.C., Miller, S. 2001. Comparative Anatomy of Vertebrates. New York: McGraw-Hill.
7. Hickman, C.P., Kats, H.L. 2000. Laboratory Studies in Integrated Principles of Zoology. Singapore: McGraw-Hill.