ہائیر ایجوکیشن کمیشن

HIGHER EDUCATION COMMISSION

Government of Pakistan, Islamabad

(Curriculum Division)

ENDORSEMENT OF THE COURSE DESIGN COMMITTEE

A meeting of a course design committee was held on **October 24, 2025** in the Higher Education Commission, Islamabad to design a three-credits course of **"Natural Sciences"** as part of the general education component of the HEC Undergraduate Education Policy (V 1.1).

Following members of the committee attended the meeting and developed the draft of the course:

1. Dr. Anisa Qamar, Professor & Chairperson, Department of Physics, University of Peshawar, Peshawar.
2. Dr. Arfana Mallah, Professor & Director, Dr. M. A. Kazi Institute of Chemistry, University of Sindh, Jamshoro.
3. Dr. Hooria Younas, Associate Professor & Dean, Faculty of Life Sciences, Kinnaird College for Women University, Lahore.
4. Dr. Kiran Afshan, Associate Professor & Chairperson, Department of Zoology, Quaid-i-Azam University, Islamabad.
5. Dr. Kashif Mahmood, Assistant Professor & In-Charge, Department of Geography, Government College University, Faisalabad.
6. Dr. Muhammad Athar Abbasi, Professor, Institute of Chemical Sciences, Government College University, Lahore.
7. Dr. Muhammad Jawed Iqbal, Professor & Chairperson, Institute of Space Science & Technology, University of Karachi, Karachi.
8. Dr. Muhammad Latif, Assistant Professor, Department of Meteorology, COMSATS University, Islamabad.
9. Dr. Muhammad Rais, Assistant Professor, Department of Zoology, Wildlife & Fisheries, PMAS Arid Agriculture University, Rawalpindi.
10. Dr. Sajid Rahid Ahmed, Professor, College of Earth & Environmental Sciences, University of the Punjab, Lahore.
11. Dr. Sami Ullah, Associate Professor, Department of Botany, University of Peshawar, Peshawar.
12. Dr. Tahseen Fatima, Associate Professor, Institute of Food Science & Technology, Sindh Agriculture University, Tandojam.
13. Engr. Saleemullah Sohoo, Director, Higher Education Commission, Islamabad.
14. Mr. Arif Mahmood, Assistant Director, Higher Education Commission, Islamabad.
15. Mr. Qammar Abbas, Assistant Director, Higher Education Commission, Islamabad.

That after consultation and endorsement of the committee, the final draft of course outline is hereby submitted to the office of the Director Curriculum Division, HEC, Islamabad by us / the undersigned on behalf of the committee for consideration of HEC.

Dr. Muhammad Athar Abbasi	**Dr. Kiran Afshan**	**Engr. Saleemullah Sohoo**
(Convener)	(Co- Convener)	(Secretary)

PLEASE NOTE:

1. The Curriculum Division, HEC may conduct an internal review of the draft submitted by the committee and make necessary amendments as and when needed, with or without sharing reasons of the same with the committee.
2. The Curriculum Division, HEC may refer the draft submitted by the committee to other experts or a new committee for review who may propose revisions / additional recommendations in the said draft.

NATURAL SCIENCES
UGE Policy V 1.1: General Education Course

Credits: 03 (2-1)
Pre-Requisite: Nil
Offering: Undergraduate Degrees (including Associate Degrees)
Placement: 1-4 semester
Type: General Education
Fields: All

DESCRIPTION

The course provides an interdisciplinary overview of the core natural-science disciplines: Physics, Astronomy, Chemistry, Biology and Geosciences along with their everyday applications. Students explore fundamental concepts, scientific reasoning, and how science shapes daily life, technology, and the environment.

COURSE LEARNING OUTCOMES

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

1. Explain key principles from physics, astronomy, chemistry, biology, and geosciences.
2. Apply scientific methods to everyday observations.
3. Recognize the interdisciplinary nature of real-world problems.
4. Demonstrate basic laboratory and analytical skills.

SYLLABUS

1. **Introduction to Natural Sciences**
   - Definition and scope of natural sciences.
   - Scientific methods (observations, hypothesis, experimentation, theory formulation, and application).
   - Ethics in scientific advancement.
2. **Physics and Astronomy**
   - Introduction to physics, derived quantities, units and dimensions (SI system), velocity, and acceleration, Newton's laws of motion, linear momentum and conservation laws, circular motion and centripetal force.
   - Definition of work, kinetic and potential energy, conservation of energy principle, Newton's law of universal gravitation, weight and mass.
   - Types and properties of waves, sound waves and their characteristics, nature of light, reflection and refraction (Snell's law), lenses and mirrors.
   - Electric charge and current, Ohm's law, circuits, magnetic field and magnetic force, Faraday's law.
   - Solar system, Kepler's laws of planetary motion, astronomical coordinates, motion of the moon, moon sighting, eclipses.
3. **Chemistry –Matter, Chemical Reactions, and Materials**
   - Basics, states of matter, atoms, molecules and periodic table.
   - Chemical reactions – endothermic and exothermic reactions, balancing simple chemical equations, properties of acids and bases.
   - Common materials – polymers (natural and synthetic), minerals, ceramics, nanomaterials and their applications.
   - Chemical safety – non-hazardous and hazardous chemicals, handling and safe disposal of chemicals, understanding common pollutants and methods to recycle or reduce them.

4. **Biology – Cells, Genetics, Ecology, Human Body and Health**
    - Hierarchical organization of life – understanding cell structure and functions, molecules of life, food and nutrition.
    - Genetics, hereditary and molecular basis of evolution.
    - Ecological concept of ecosystem – energy flow in ecosystem, biogeochemical cycles and biodiversity conservation.
    - Structure and functions of human organs and organ system, common diseases and preventions (microbes, viruses, parasites, zoonoses, immunity, antibiotics and vaccines).
5. **Geosciences**
    - Understanding of earth – internal structure of earth and types of rocks and soil.
    - Weather and climate – climate change, climate drivers, greenhouse effect, and air, water and noise pollution.
    - Introduction of remote sensing and geographical information system (GIS).
    - Natural and human hazards – earthquake, flood, drought, heatwave, and smog.

SUGGESTED PRACTICAL WORK

1. Measurement of physical quantities using Vernier calipers and micrometer screw gauge.
2. Study of refraction through a glass slab or lens.
3. Determination of acceleration due to gravity (simple pendulum).
4. Astronomical observation.
5. Chemical laboratory protocols.
6. Safe handling and disposal of chemicals and reagents.
7. Microscopy – study of plant and animal cells.
8. Biodiversity and environment – field survey of local flora/fauna, assessment of ecosystem diversity.
9. Understanding of global coordinate systems and map projections.

Note: Any other experiment according to the available facilities at university.

SUGGESTED INSTRUCTIONAL / READING MATERIAL

1. "Fundamentals of Physics" by D. Halliday, R. Resnick & J. Walker.
2. "College Physics" by R. A. Serway, C. Vuille & J. M. Hughes.
3. "Introduction to Astronomy and Cosmology" by I. Morison.
4. "Chemistry: The Central Science" by B. H. Eugene, LeMay, B. E. Bursten, C. J. Murphy, P. M. Woodward, M.W. Stoltzfus.
5. "General Chemistry: The Essential Concepts" by R. Chang, & J. Overby.
6. "Basic Concepts of Chemistry" by L. J Mone, T. O. Dolter, & S. Gentemann.
7. "Laboratory Safety for Chemistry Students" by Jr. R. H Hill, & D. C. Finster.
8. "Biology" by N. A. Campbell & J. B. Reece.
9. "Zoology" by S. A. Miller & J. P. Harley.
10. "Integrated Principles of Zoology" by C. P. Hikman, L. S. Roberts, A. Larson.
11. "Lippincott Illustrated Review Biochemistry" by R. A. Harvey & D. R. Ferrier.
12. "Food Science" by N. Potter & J. HotchKiss.
13. "Physical Geography" by J. Patrich & T. Radtke.
14. "Introduction to Geographic Information Systems" by K. T. Chang.
15. "Introduction to Environmental Sciences and Sustainability" by E. P. Harris.