DISCIPLINE SPECIFIC CORE COURSE –18 :

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibilitycriteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Evolutionary Biology(BS-DSC-603)	4	2		2	Class XII pass with Biologyand chemistry, as one of the papers in Class XII	NA

Learning Objectives

The Learning Objectives of this course are as follows:

- To stress the importance of evolution in biology and introduce students to all aspects of evolutionary biology.
- to make the students familiar with basic history of evolutionary concept, its criticism and its development as a science.
- They will learn about history of life through fossils and other evidences helping them analyze the evolutionary relationships between species.
- They will develop a deep understanding of the mechanisms that fuel the evolution of biological systems and will have an insight into the origin and evolution of species.

Learning outcomes

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

- Students will learn about the origins and development of evolutionary thought.
- Students will learn about the compelling evidence in favor of evolution likefossils, comparative anatomy and molecular homologies.
- Students will learn about the origin and history of life through fossil records.
- Students will understand how biodiversity is generated by repeated speciation andlost over time due to mass extinctions.
- Students will understand how the forces of evolution like variations, naturalselection, genetic drift and migration shape populations.
- Students will learn how novelty in organisms arises, how organisms adapt to theirenvironment and about our origins from our primate ancestors.

SYLLABUS OF DSC-18

Theory

Credits: 2 Total weeks: 15

Unit I: Historical Review of Evolutionary Concept No. of hours: 3

Pre-Darwinian ideas: List of contributors influencing Darwin indicated as a *timeline.*
Lamarckism: Darwinism: Post-Darwinian era: Modern synthetic theory; Neo-Darwinism.

Unit II: History of Life **No. of hours: 7**

Chemogeny: An overview of prebiotic conditions and events; experimental proofs to abiotic origin of micro- and macro-molecules. Current concept of chemogeny: RNA firsthypothesis. Biogeny: Cellular evolution based on proto-cell models (coacervates and proteinoid microspheres). Origin of photosynthesis, Evolution of oxygen and ozone buildup and significance. Evolution of Eukaryotes from Prokaryotes (endosymbiotic theory), multicellularity. Cambrian explosion and timeline of plant and animal evolution in the Phanerozoic eon. Mass-scale extinctions: causes, significance and events. Cretaceous-Tertiary Mass Extinction in detail.

Unit III: Evidences of Evolution **No. of hours: 5**

General evidences, Fossils, Concept of Stratigraphy and geological timescale, Dating methods (K-Argon and Radiocarbon dating); Convergent and Divergent Evolution, Adaptiveradiation, Phylogeny of horse as a model. Molecular clock, Neutral theory of evolution and;Basics of molecular phylogenetics.

Unit IV: Forces of Evolution **No. of hours: 6**

Concept of micro- and macro-evolution (Role of gene regulation in macroevolution usingexample of beak development in Darwin's finches): A brief comparison Natural selection asa guiding force: Its attributes and action, basic characteristics of natural selection. Co-adaptation and co-evolution, Industrial melanism; antibiotic resistance. Modes of selection(Stabilizing, directional, disruptive), sexual selection, kin selection, artificial selection, Polymorphism and Balanced lethal systems.

Hardy Weinberg equilibrium,Genetic Drift (Sewall Wright effect) as a stochastic/randomforce: Basic characteristics of drift; selection vs. drift, Bottleneck effect, Founder principle.

Unit V: Product of Evolution: Speciation **No. of hours: 5**

Concept of species as a real entity- Morphological and Biological species concept, Micro- evolutionary changes (inter-population variations, clines, Ring species, Races, polymorphism)Mechanisms of speciation, Allopatric, Peripatric, Parapatric and sympatric; Patterns of speciation. Anagenesis and Cladogenesis; Phyletic Gradualism and Punctuated Equilibrium (Quantum Evolution), Basis of speciation: Isolating mechanisms

Unit VI: Human Ancestry and Phylogeny **No. of weeks: 4**

Primate characteristics and unique Hominin characteristics. Advantages and adaptations of bipedalism. General characteristics , distribution of Australopithecines, Homo habilis, Homoergaster, Homo erectus (Java Man , Peking man), Neanderthal man and Homo sapiens. Briefoverview of

Multiregional and Out of Africa hypothesis for origin and migration of Modern humans.

PRACTICALS

TOTAL HOURS: 60 **CREDITS: 2**

1. Study of types of fossils (e.g. Body fossils, trails, casts, molds and others) and Index fossils of Palaeozoic era
2. Connecting links/transitional forms - *Eg. Euglena, Neopilina, Balanoglossus, Chimaera, Tiktaalik, Archaeopteryx and* Living fossils - Eg. *Limulus, Peripatus*, *Latimeria, Sphaenodon*
3. Vestigial, Analogous and Homologous organs using photographs, models orspecimen
4. Problems based on Hardy Weinberg equilibrium
5. Simulation experiments using colored beads to understand the effects of Naturalselection on allele frequencies
6. Simulation experiments using colored beads to understand the role of Bottleneckeffect/Founder effect on allele frequencies
7. Darwin's finches with diagrams/ cutouts of beaks of different species.
8. Digit reduction and teeth modification in horse phylogeny (study from chart),
9. Study of monkey and human skull - A comparison to illustrate common primate andunique Hominin features
10. Construction of Phylogenetic tree using morphological characters
11. Educational visit to Geology/ Anthropology museums, Delhi University

Essential readings:

1. Barton N.H., Briggs D.E.G., Eisen J.A., Goldstein D.B. and Patel N.H.,(2007)1st Ed. *Evolution*, Cold Spring Harbor Laboratory Press.
2. Futuyma Douglas and Mark Kirkpatrick (2017) 3rd Ed.*Evolutionary Biology*,Oxford University Press
3. Hall B. K. and Hallgrimson B., (2014) 5th Ed.*Strickberger's Evolution.* Jones and Bartlett
4. Ridley M., (2003) 3rd Ed.*Evolution* Wiley-Blackwell
5. Zimmer C. and Emlen D. J., (2013) 1st Ed. *Evolution: Making Sense ofLife*, Roberts & Co.

Additional resources

1. Darwin C., (2003)*The Origin of Species: 150th Anniversary Edition* , PenguinUSA
2. https://evolution.berkeley.edu/evolibrary/home.php
3. Kolbert E., (2015)*The Sixth Extinction: An Unnatural History,* Bloomsbury
4. Weiner J. (1995),*The Beak of the Finch: A Story of Evolution in Our Time*, Vintage

Note: Examination scheme and mode shall be as prescribed by the Examination Branch,University of Delhi, from time to time.