

DAV UNIVERSITY, JALANDHAR

DAV UNIVERSITY JALANDHAR



Course Scheme & Syllabus

For

**Bachelor of Science (Hons.) Zoology
(Program ID-8)**

1st TO 6th SEMESTER

Syllabi Applicable For Admissions in 2014

DAV UNIVERSITY, JALANDHAR

Scheme of Courses Zoology Bachelor of Science (Hons.) Zoology

Semester 1

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO101	Animal diversity-I	4	1	0	4	25	25	25	25	100
2	BOT101	Plant Diversity-I	4	1	0	4	25	25	25	25	100
3	CHE153	Organic Chemistry	4	1	0	4	25	25	25	25	100
4	BCH101	Biomolecules	4	1	0	4	25	25	25	25	100
5	SGS101	Human Values and ethics	2	0	0	2	25	25	25	25	50
6	EVS102	Environment Education	3	0	0	2	25	25	25	25	50
7	ZOO102	Animal diversity-I LAB	0	0	3	2	20	-	-	80	50
8	BOT102	Plant Diversity-I LAB	0	0	3	2	20	-	-	80	50
9	CHE154	Organic Chemistry LAB	0	0	4	2	20	-	-	80	50
10	BCH102	Biomolecules LAB	0	0	3	2	20	-	-	80	50
			21	4	13	28					700

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Scheme of Courses Zoology Bachelor of Science (Hons.) Zoology

Semester 2

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO103	Animal diversity-II	4	1	0	4	25	25	25	25	100
2	BOT103	Plant Diversity-II	4	1	0	4	25	25	25	25	100
3	CHE 155	Spectroscopy	4	1	0	4	25	25	25	25	100
4	EVS103	Road Safety and Legal Awareness	2	0	0	2	25	25	25	25	50
5	SGS102	General Knowledge and Current affairs	2	0	0	2	25	25	25	25	50
6	ENG151	Basic Communication skills	4	0	0	3	25	25	25	25	75
7	SGS104	Stenography	2	0	0	1	25	25	25	25	25
8	ZOO104	Animal diversity-II LAB	0	0	3	2	20	-	-	80	50
9	BOT104	Plant Diversity-II LAB	0	0	3	2	20	-	-	80	50
10	CHE156	Chemistry Lab	0	0	4	2	20	-	-	80	50
11	ENG152	Basic Communication skills LAB	0	0	2	1	20	-	-	80	25
11	SGS105	Stenography LAB	0	0	2	1	20	-	-	80	25
			22	3	14	28					700

- A: Continuous Assessment: Based on Objective Type Tests
 B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type Tests
 E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

DAV UNIVERSITY, JALANDHAR

**Scheme of Courses Zoology
Bachelor of Science (Hons.) Zoology**

Semester 3

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO201	Fundamentals of Cell Biology	4	1	0	4	25	25	25	25	100
2	ZOO202	Comparative Functional Anatomy of Invertebrates	4	0	0	3	25	25	25	25	75
3	ZOO203	Comparative Functional Anatomy of Vertebrates	4	0	0	3	25	25	25	25	75
4	CHE253	Inorganic Chemistry-II	4	1	0	4	25	25	25	25	100
5	ENG180	English	4	0	0	4	25	25	25	25	100
6	ZOO204	Fundamentals of Cell Biology LAB	0	0	3	2	20	-	-	80	50
7	ZOO205	Comparative Functional Anatomy of Invertebrates LAB	0	0	2	1	20	-	-	80	25
8	ZOO206	Comparative Functional Anatomy of Vertebrates LAB	0	0	2	1	20	-	-	80	25
9	CHE254	Inorganic Chemistry-II LAB	0	0	4	2	20	-	-	80	50
			20	1	5	24					600

- A: Continuous Assessment: Based on Objective Type Tests
 B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type Tests
 E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

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**Scheme of Courses Zoology
Bachelor of Science (Hons.) Zoology**

Semester 4

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO207	Fundamentals of Animal Physiology	4	1	0	4	25	25	25	25	100
2	ZOO208	Principles of Genetics	4	1	0	4	25	25	25	25	100
3	BOT311	Plant Physiology	4	1	0	4	25	25	25	25	100
4	BCH103	Metabolism	4	1	0	4	25	25	25	25	100
5	CSA253	Basic Computer Applications	4	0	0	3	25	25	25	25	75
6	ZOO209	Principles of Genetics LAB	0	0	3	2	20	-	-	80	50
7	ZOO210	Fundamentals of Animal Physiology LAB	0	0	3	2	20	-	-	80	50
8	BOT312	Plant Physiology LAB	0	0	3	2	20	-	-	80	50
9	BCH104	Metabolism Lab	0	0	3	2	20	-	-	80	50
10	CSA254	Basic Computer Applications LAB	0	0	2	1	20	-	-	80	25
			20	4	4	28					700

- A: Continuous Assessment: Based on Objective Type Tests
 B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type Tests
 E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

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Scheme of Courses Zoology Bachelor of Science (Hons.) Zoology

Semester 5

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO301	Fundamentals of Animal Development	4	0	0	3	25	25	25	25	75
2	ZOO302	Fundamentals of Animal Ecology	4	0	0	3	25	25	25	25	75
3	ZOO303	Fundamentals of Animal Behaviour	2	0	0	2	25	25	25	25	50
4	MIC301	Basic Immunology	4	1	0	4	25	25	25	25	100
5	CHE353	Physical Chemistry	4	1	0	4	25	25	25	25	100
6	ZOO304	Fundamentals of Animal Development LAB	0	0	3	2	25	25	25	25	50
7	ZOO305	Fundamentals of Animal Ecology LAB	0	0	2	1	20	-	-	80	25
8	ZOO306	Animal Behaviour LAB	0	0	2	1	20	-	-	80	25
9	MIC302	Basic immunology LAB	0	0	3	2	20	-	-	80	50
10	CHE354	Physical Chemistry LAB	0	0	2	2	20	-	-	80	50
11	ZOO307	Educational Tour	0	0	0	1	-	-	-	-	25
			18	2	7	24					600

- A: Continuous Assessment: Based on Objective Type Tests
 B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type Tests
 E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

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Scheme of Courses Zoology Bachelor of Science (Hons.) Zoology

Semester 6

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	ZOO308	Basics of Animal Biotechnology	4	0	0	3	25	25	25	25	75
2	ZOO309	Basic Techniques in Zoology	4	0	0	3	25	25	25	25	75
3	ZOO310	Applied Zoology	4	0	0	3	25	25	25	25	75
4	ZOO311	Principles and Theories of Evolution	2	0	0	2	25	25	25	25	50
5	BTY308	Genomics and Proteomics	2	1	0	2	25	25	25	25	50
6	BOT313	Reproductive Biology of Angiosperms	4	1	0	4	25	25	25	25	100
7	ZOO312	Basics of Animal Biotechnology LAB	0	0	2	1	25	25	25	30	25
8	ZOO313	Basic Techniques in Zoology LAB	0	0	2	1	25	25	25	30	25
9	ZOO314	Applied Zoology LAB	0	0	2	1	20	-	-	80	25
10	ZOO315	Principles and Theories of Evolution LAB	0	0	2	1	20	-	-	80	25
11	BTY311	Genomics and Proteomics LAB	0	0	2	1	20	-	-	80	25
12	BOT314	Reproductive Biology of Angiosperms LAB	0	0	3	2	20	-	-	80	50
			20	2	5	24					600

- A: Continuous Assessment: Based on Objective Type Tests
 B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type Tests
 E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Syllabus

SEMESTER 1

Course Title: Animal Diversity I

Paper Code: ZOO 101

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To acquaint students with the general characters and classification of invertebrate phyla and the affinities between different groups. To impart knowledge regarding the morphological, anatomical and physiological make up of a few representative organisms from each phylum.

UNIT-A 15 hours

- Description of animal diversity. Principles of classification-salient features and classification upto orders in non-chordates. Structural organization in different classes of non-chordates.
- Protozoa: locomotion, osmoregulation, nutrition and reproduction in Protozoa. Detailed Study of *Euglena*, *Amoeba*, *Paramecium*, *Plasmodium*

UNIT-B 18 hours

- Origin of Metazoa-metamerism and symmetry.
- Porifera: skeleton and canal system. Detailed study of *Sycon*
- Coelenterata: corals and coral reefs, polymorphism in Hydrozoa. Detailed study of *Obelia*, Sea anemone.
- Platyhelminthes: reproduction, variation in life cycles, parasitic adaptations and evolution of parasitism in Helminthes. Detailed study of *Planaria*, *Fasciola*, *Taenia*
- Nematoda: pseudocoelom, parasitic adaptations. Detailed study of *Ascaris*

UNIT-C 15 hours

- Annelida: coelom, metamerism, excretion. Detailed study of *Nereis*, *Pheretima*, *Hirudinaria*
- Arthropoda: vision, respiration and larval forms. Social life in insects. Detailed study of *Palaemon*, *Periplaneta*

UNIT-D 12 hours

- Mollusca: torsion and detorsion, shell and respiration. Detailed study of *Pila*, *Unio*, *Sepia*
- Echinodermata: water vascular system and larval forms. Detailed study of *Asterias*.

Reference books

1. Kotpal, R.L., Modern Text Book of Zoology Invertebrates, 10th ed., Rastogi Publishers, Meerut, 2012.
2. Kotpal, R.L., Minor phyla, 5th ed., Rastogi Publishers, Meerut, 2006.
3. Dhama, P.S. and Dhama, J.K., Invertebrate Zoology, 5th ed., R. Chand & Co., New Delhi, 2004.
4. Parker, T.J. and Haswell, W.A., Text book of Zoology, Invertebrates, 7th ed., Vol. I (eds. A.J. Marshall & W.D. Williams), CBS Publishers & Distributors., Delhi, 1992.
5. Hyman L.H. The Invertebrates. Vol. I, II, III, IV and V. McGraw Hill Book Company. Inc., New York. London. Toronto, 1959.

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Diversity I Lab

Paper Code: ZOO 102

L	T	P	Credits	Marks
0	0	3	2	50

General survey of invertebrate phyla through slides/specimens/charts/models/e-resources:

- Protozoa: *Amoeba*, *Euglena*, *Paramecium* and *Vorticella*, *Balantidium*, *Nyctotherus*, *Opalina*, Radiolarians and Foraminiferans.
- Porifera: *Sycon*, *Grantia*, *Spongilla*, *Euplectella*, *Hyalonema*, *Chalina*, *Euspongia*, Temporary mounts of gemmules and spicules of *Sycon*.
- Coelenterata: *Hydra*, *Obelia*, *Porpita*, *Velella*, *Physalia*, *Aurelia*, *Metridium*, *Alcyonium*, *Tubipora*, *Zooanthus*, *Madrepora*, *Favia*, *Fungia*, *Gorgoni*, *Pennatula*, *Sertularia*, *Plumularia*, *Pennaria*, *Bougainvillea*, statocyst of *Aurelia*.
- Platyhelminthes: *Planaria*, *Fasciola* (W.M. & T.S.), larval stages of *Fasciola*, *Taenia* (scolex, proglottids-mature and gravid), *Ascaris* (male and female).
- Annelida: *Pheretima*, T.S. of typhlosolar region, setae, pharyngeal nephridia, septal nephridium and integumentary nephridium of *Pheretima*, *Eutyphoeus*, *Lumbricus*, *Nereis*, parapodium of *Nereis*, *Heteronereis*, *Polynoe*, *Aphrodite*, *Amphitrite*, *Chaetopterus*, *Anodonta*, *Mytilus*, *Pholas*, *Pecten*, *Haliotis*, *Aplysia*, *Doris*, *Limax*, *Pila*, *Sepia*, *Octopus*, *Nautilus*, *Chiton* and *Anodonta*. *Arenicola*, *Hirudinaria*, *Pontobdella*.
- Arthropoda: *Peripatus*, *Lepisma*, cockroach, trachea and mouth parts of cockroach, grasshopper, praying mantis, earwig, dragonfly, termite (queen and other castes), ant, butterfly, moth, beetle, wasp, honeybee, crab, prawn, *Lepas*, *Balanus*, *Apus*, *Limulus*, scorpion, spider, millipede and centipede, *Cypris*, *Cyclops*, *Daphnia*, Prawn, Gill and statocyst of Prawn.
- Mollusca: *Anodonta*, *Mytilus*, *Pholas*, *Pecten*, *Haliotis*, *Aplysia*, *Doris*, *Limax*, *Pila*, Glochidium larva and radula of *Pila*, *Sepia*, *Octopus*, *Nautilus*, *Chiton* and *Anodonta*.

Demonstration of anatomy of the following animals through charts/e-resources/dissection of animal

- Earthworm: digestive, reproductive and nervous systems
 - Cockroach: digestive, nervous and reproductive systems, mouth parts of cockroach
 - Prawn: digestive and nervous systems. Appendages and gills of prawn.
 - *Anodonta*: digestive and nervous systems,
 - *Pila*: digestive and nervous systems, radula of *Pila*
- Asterias: Aristotle's lantern, tube feet.

Note: Practicals related to Animal Diversity I Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

SEMESTER 2

Course Title: Animal Diversity II

Paper Code: ZOO 103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To acquaint students with the general characters and classification of chordates and the affinities between different groups. To impart knowledge regarding the morphological, anatomical and physiological make up of a few representative organisms from each phylum.

UNIT-A 15 hours

- Origin and general characters of chordates with detailed classification of each animal group with special emphasis on salient features and interrelationships
- Hemichordata: Hemichordates as link between non-chordates and chordates with detailed study of *Balanoglossus*
- Urochordata: development, affinities, retrogressive metamorphosis. Detailed study of *Herdmania*.
- Cephalochordata: development, affinities. Detailed study of *Branchiostoma*.

UNIT-B 15 hours

- Cyclostomata: migration. Detailed study of *Petromyzon*
- Pisces: scales, fins, migration, parental care. Detailed study of *Scoliodon*, and *Labeo*

UNIT-C 12 hours

- Amphibia: Respiration, Parental care. Detailed study of *Rana*
- Reptilia: Terrestrial adaptations, parental care. Detailed study of *Uromastix*

UNIT-D 18 hours

- Aves: Respiration, Flight, Endothermy. Detailed study of *Columba*
- Mammals: Integument, Dentition. Detailed study of *Oryctogalus*

Reference books

1. Dhama, P.S., Dhama, J.K., Chordate Zoology, 5th ed., R. Chand & Co., New Delhi, 2006.
2. Kotpal, R.L., Text Book of Zoology- Vertebrates, Rastogi Publications, Meerut, 2012.
3. Parker, T.J., and Haswell, W.A., A Text Book of Zoology Vertebrates, 7th ed. Vol. II (eds. A.J. Marshall & Williams, W.D.), Mac Millan, London, 1972.
4. Dodson, E.O., A Text Book of Zoology, CBS Publishers & Distributors, Delhi, 1976.

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Diversity II Lab

Paper Code: ZOO 104

L	T	P	Credits	Marks
0	0	3	2	50

General survey of chordates through slides/specimens/charts/models/e-resources:

- Hemichordata: *Balanoglossus*
- Protochordata - *Herdmania*, pharynx and spicules of *Herdmania*, *Molgula*, *Ciona*, *Ascidia*, *Botryllus*, *Pyrosoma*, *Salpa*, *Doliolum*, *Oikopleura* and *Branchiostoma*, T.S. *Branchiostoma* through different regions
- Cyclostomata – *Myxine*, *Petromyzon* and *Ammocoetes* larva. Chondrichthyes - *Zygaena*, *Pristi.*, *Narcine*, *Trygon* and *Rhinobatos*.
- Actinopterygii – *Polypterus*, *Acipenser*, *Lepidosiren*, *Mystus*, *Catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Hippocampus*, *Syngnathus*, *Exocoetus*, *Anabas*, *Diodon*, *Ostracion*, *Tetradon*, *Echeneis*, *Lophius*, *Solea* and *Anguilla*, cycloid and ctenoid scales of fishes.
- Dipneusti (Dipnoi) – Any of the lungfishes.
- Amphibia – *Necturus*, *Proteus*, *Amphiuma*, *Salamandra*, *Ambystoma*, *Triton*, *Hyla*, *Rhacophorus* *chthyophis* and *Axolotl* larva.
- Reptilia- Tortoise, Turtle, *Hemidactylus*, *Calotes*, *Draco*, *Varanus*, *Phrynosoma*, *Chamaeleon*, *Typhlops*, *Python*, *Ptyas*, *Bungarus*, *Naja*, *Hydrus*, *Vipera*, *Crocodylus*, *Gavialis* and Alligator.
- Aves : *Anas*, *Ardea*, *Milvus*, *Pavo*, *Tyto*, *Alcedo*, *Eudynamis*, *Casuaris*; and *Struthio*.
- Mammalia – *Echidna*, *Ornithorhynchus*, *Macropus*, *Erinaceus*, *Sorex*, *Loris*, *Macaca*, *Manis*, *Hystrix*, *Funambulus*, *Felis*, *Capra*, *Canis*, *Herpestes*, *Pteropus* and *Leo*.

Demonstration of anatomy of the following animals through charts/e-resources/dissection of animal

- - Herdmania*: General Anatomy, pharynx and spicules
 - Labeo*: Digestive and reproductive systems, skeleton
 - Rana*: Digestive, arterial, venous and reproductive systems. Skeleton
 - Varanus*: Digestive, arterial, venous and reproductive systems. Skeleton
 - Hen: Digestive, arterial, venous and reproductive systems. Skeleton
 - Rat: Digestive, arterial, venous, urinogenital systems, skeleton

Note: Practicals related to Animal Diversity II Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

SEMESTER 3

Course Title: Fundamentals of Cell Biology

Paper Code: ZOO 201

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To impart knowledge on the structural and functional organization of animal cell with detailed description of all cellular organelles. To acquaint students with important cell cycle, cell division, cell-differentiation, cell-cell interaction, cell signalling, cell death etc.

UNIT-A 10 hours

- Plasma membrane: chemical structure and different models, Membrane differentiation, junctions and transport mechanisms. Properties of excitable cells-neurons and muscles, membrane potential

UNIT-B 13 hours

- Detailed account of structure and function of cell and cell organelles. Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast

UNIT-C 10 hours

- Cell coat and cell recognition
- Cell-cell interaction
- Extracellular matrix of animal cells

UNIT-D 12 hours

- Cell cycle and its regulation
- Cell signalling
- Cell migration
- Cell Differentiation
- Cell Death
- Cancer cells

Reference books

1. DeRobertis, EDP, De Robertis, E.M.F. Cell Biology and Molecular Biology. Eighth Edition. W.B. Saunders Co., Philadelphia, 1995.
2. Powar, C.B., Cell Biology, 3rd ed., Himalaya Publishing House, Mumbai, 2010.
3. Alberts, B. Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P., Molecular Biology of the Cell, 5th ed., Garland Science, Taylor and Francis Group, New York, 2008.
4. Lodish, H., Berk, A. Matsudaira, P. et al., Molecular Cell Biology, 5th ed., WH Freeman & Co., New York, 2004.
5. Karp, G., Cell Biology, 6th ed., John Wiley & Sons, Inc., 2010.
6. Cooper, G.M. and Hausman, R.E., The Cell A Molecular Approach, 4th ed., ASM Press, Washington DC, 2007.

DAV UNIVERSITY, JALANDHAR

Course Title: Comparative functional anatomy of invertebrates

Paper Code: ZOO 202

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To acquaint students with the internal structure and physiological mechanisms of invertebrates

UNIT-A 10 hours

- Organization of Coelom: acoelomates, pseudocoelomates, coelomates, Protostomia and Deuterostomia
- Locomotion: flagellar and ciliary movement in Protozoa. Hydrostatic movement in Coelenterata, Annelida and Echinodermata

UNIT-B 12 hours

- Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan, filter feeding in Polychaeta, Mollusca and Echinodermata.
- Respiration: organs of respiration-gills, lungs and trachea, respiratory pigments and mechanism of respiration.

UNIT-C 13 hours

- Excretion: organs of excretion-coelom, coelomoducts, nephridia and malphigian tubules, mechanisms of excretion, osmoregulation
- Nervous system: primitive nervous system- Coelenterata and Echinodermata. Advanced nervous system-Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda). Trends in neural evolution

UNIT-D 10 hours

- Invertebrate larvae: Larval forms of free living invertebrates, larval forms of parasites, strategies and evolutionary significance of larval forms.
- Minor Phyla: concept and significance. Organization and general characters.

Reference books

1. Hyman L.H. The Invertebrates. Vol I. Protozoa through Ctenophora, McGraw Hill Co., New York.
2. Barrington EJW. Invertebrate structure and function. Thomas Nelson and Sons Lts., London.
3. Jagerstein G. Evolution of Metazoan life cycle. Academic Press, New York & London.
4. Hyman L.H. The Invertebrates, Vol2. McGraw Hill Co., New York & London
5. Barnes, RD. Invertebrate Zoology, II edition, W.B. Saunders Co., Philadelphia

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L	T	P	Credits	Marks
4	0	0	3	75

Course Title: Comparative functional anatomy of vertebrates

Paper Code: ZOO 203

Course Objective: To acquaint students with the internal structure and physiological mechanisms of vertebrates.

UNIT-A 15 hours

- Origin of Chordata. Concept of Protochordata
- The nature of vertebrate morphology- Definition, scope and relation to other disciplines. Importance of the study of vertebrate morphology.
- Origin and classification of vertebrates
- Vertebrate integument and its derivatives: Development, general structure and function of skin and its derivatives. Glands, scales, horns, claws, nails, hoofs, feathers and hairs.

UNIT-B 12 hours

- General plan of circulation in various groups: blood, evolution of heart, evolution of aortic arches and portal system.
- Respiratory System: Characters and Respiratory tissue, Internal and External respiration, Comparative account of respiratory organs
- Evolution of urinogenital system in vertebrate series

UNIT-C 8 hours

- Skeletal system: form, function, body size and skeletal elements of the body
- Comparative account of jaw suspensorium, vertebral column, limbs and girdles.

UNIT-D 10 hours

- Sense organs: simple receptors, organs of olfaction and taste, lateral line system, electroreception
- Nervous system: comparative anatomy of the brain in relation to its functions, comparative anatomy of spinal cord, nerves-cranial, peripheral and autonomouss nervous systems

Reference books

- Alexander RM. The Chordata. Cambridge University Press, London.
- Barrington EJW. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinburgh
- Carter GS. Structure and habit in vertebrate evolution-Sedgewick and Jackson, London
- Kingsley JS. Outlines of comparative autonomy of vertebrates. Central Book Depot. Allahabad.
- Kent CG. Comparative anatomy of vertebrates.

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- Milton Hilderbrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York
- Smith HS. Evolution of chordate structure. Hold Rinehart and Winston Inc., New York

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Course Title: Fundamentals of Cell Biology Lab

Paper Code: ZOO 204

L	T	P	Credits	Marks
0	0	3	2	50

- Parts of light microscope and their maintenance.
- Cell structure: prokaryotic and eukaryotic cell types with the operation of light microscope.
- Separation and isolation of cells by sedimentation velocity in unit gravity.
- Study of subcellular organelles: methods of disrupting cells

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Course Title: Comparative functional anatomy of invertebrates Lab

Paper Code: ZOO 205

L	T	P	Credits	Marks
0	0	2	1	25

The following practicals will be conducted using animal material/charts/models/e-resources.

- Cultures of *Amoeba* and study of its responses.
- Chemotactic behaviour of insects for feeding
- Nervous System: Crab
- Mounting: nephridium and spermatheca and setae in earthworm
- Respiratory system: mounting of gills, trachea of insects.
- Sectional view of *Sycon* (T.S., L.S.), *Grantia* (T.S.)
- Slides of *Obelia* polyp and medusa, *Pennaria*, *Aurelia*-Tentaculocysts
- Minor Phyla: Slides of *Bugula*, *Plumatella*, *Cristatella*, *Pectinella*

Note: Practical related to Comparative functional anatomy of invertebrates Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Comparative functional anatomy of vertebrates Lab

L	T	P	Credits	Marks
0	0	2	1	25

Paper Code: ZOO 206

The following practicals will be conducted using animal material/charts/models/e-resources.

- Dissections: Rat- Digestive, Reproductive, arterial, venous systems, neck nerves.
- Study of skeleton of fishes, amphibians, reptiles, birds and mammals.
- Study of structure of vertebrate eye, ear, brain, heart and their differences in different classes.

Note: Practical related to Comparative functional anatomy of vertebrates Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

SEMESTER 4

Course Title: Fundamentals of Animal Physiology

Paper Code: ZOO 207

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To acquaint the students with functioning of various systems of animal body.

UNIT-A

15 hours

- Aim and scope of Physiology-Cell Physiology, mammalian physiology, comparative physiology and applied physiology.
- Chemical foundations of physiology-solutions, osmotic pressure, diffusion, pK, pH, buffers.
- Heterotrophic forms of nutrition, transport and mixing of food in the alimentary canal, secretory functions of digestive tract, digestion, absorption and malfunctions of GIT.

UNIT-B

12 hours

- Blood-Composition and function of blood and lymph, blood groups, blood coagulation, structure and function of haemoglobin, Blood Homeostasis.
- Heart-Structure, Heart as a pump, origin, conduction and regulation of heart beat. Pulse, blood pressure, capillary pressure, Cardiac cycle and ECG.

UNIT-C

15 hours

- Mechanism and control of breathing. Pulmonary ventilation, physiological principles of gaseous exchange, transport of oxygen and carbon dioxide in blood, regulation of respiration.
- Structure and function of kidney, physiology of urine formation, control of extracellular fluid, osmolality and counter current mechanism, role of ADH and aldosterone

UNIT-D

18 hours

- Physiology of neuronal function. Functioning of excitable tissues, membrane potential, action potential and its propagation, synaptic and junctional transmission
- Physiology of sense organs and receptors
- An overview of endocrine glands, their hormones and disorders
- Physiology of male and female reproduction.
- Integration of tissue functions-neuronal and endocrine aspects.

Reference books

1. Guyton, A.X., Text Book of Medical Physiology, 7th edition, Saunders Company, 1986.
2. Best, J.P., Best and Taylor's physiological basis of medical practice, 11th ed., William and Wilkins, 1985.
3. Hoar, W.S., General and comparative physiology, Adaptation and Environment, 3rd ed., Cambridge University Press, 1983.
4. Rhoades, R.A., Tanner, G.A., Medical Physiology, 2nd ed., Lippincott Williams and Wilkins, 2003.

DAV UNIVERSITY, JALANDHAR

Course Title: Principles of Genetics

Paper Code: ZOO 208

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To give an insight into evolution of genetic material, its functional aspects and changes in the environment that bring about evolution.

UNIT-A

10 hours

- Mendelian principles: dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests.

UNIT-B

18 hours

- Extensions of Mendelian principles: codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.
- Gene mapping methods: linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
- Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes, maternal inheritance.

UNIT-C

15 hours

- Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.
- Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.
- Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

UNIT-D

17 hours

- Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.
- Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.
- Applied Genetics. Introduction to applications of genetic engineering techniques.

Reference books

1. Goodenough, U., Genetics, IIIrd ed., Philadelphia, Saunders College Pub., 1984.
2. Swanson C.P., Merz T, and Young W.J., Cytogenetics - The Chromosome in Division, Inheritance and Evolution, IInd ed., Prentice Hall of India, New Delhi, 1982.
3. Gardner, E.J. and Snustad, D.P., Principles of Genetics, 7th ed., New York, John Wiley, 1984.
4. Winchester, A.M., Genetics - A survey of the Principles of Heredity, 3rd ed., Calcutta, Oxford and IBH Pub. 1972.
5. Gupta P.K., Genetics, Rastogi Publishers, Meerut, 2011
6. Gupta P.K., Cell and Molecular Biology, 3rd ed., Rastogi Publishers, Meerut, 2005.
7. Snustad, D.P. and Simmons, M.J., Principles of genetics, 4th ed., John Wiley & Sons Inc. NJ, 2006

DAV UNIVERSITY, JALANDHAR

Course Title: Principles of Genetics Lab

Paper Code: ZOO 209

L	T	P	Credits	Marks
0	0	3	2	50

- Study of mitosis from onion root tips by making temporary squash preparations and staining with aceto carmine/aceto orcein.
- Study of chromosomes (meiosis and mitosis) from the testicular tissue of grasshoppers/cockroach etc.
- Preparation of temporary squash preparations of salivary glands for studying polytene chromosomes of *Chironomus*/mosquito/*Drosophila*.
- Mammalian blood smear preparation for the study of drum sticks as sex chromatin test (rat or human).
- Study of sex chromatin from human buccal mucosa.
- Study of metaphase karyotypes from permanent/temporary slides of invertebrate and vertebrate species such as beetles, mosquitoes, grasshoppers, flies, spiders, man, rat, mice and bat etc. plus numerical or structural aberrations, if any.
- Study of Mendelian ratios from the study of seed coat colour pattern of bean seeds (Monohybrid and Dihybrid ratios).
- Survey of human subjects for the demonstration of the frequency of dominant and recessive traits such as free and attached pinna, rolling of tongue, eye colour, hair colour etc.
- Screening of films of Heredity, gene expression, DNA structure/cell division etc. available in the Department.

Note: Practicals related to Principles of Genetics Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Physiology Lab

Paper Code: ZOO 210

L	T	P	Credits	Marks
0	0	3	2	50

- Identification of food stuffs-starch, sucrose, glucose, proteins and fats.
- Demonstration of osmosis and diffusion.
- Demonstration of the presence of amylase enzyme in saliva. Effect of pH and temperature on enzyme action.
- Determination of coagulation and bleeding time of blood.
- Determination of blood groups of human blood samples.
- Recording of blood pressure of man.
- Enumeration of red blood corpuscles and white blood corpuscles of man.
- Estimation of haemoglobin content in blood.

Note: Practicals related to Fundamentals of Animal Physiology Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

SEMESTER 5

Course Title: Fundamentals of Animal Development

Paper Code: ZOO 301

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To give students a brief overview of the developmental processes in animals.

UNIT-A 10 hours

- Introduction to developmental biology
- Gametogenesis: spermatogenesis and oogenesis, vitellogenesis, egg membranes.

UNIT-B 12 hours

- Fertilization: sperm-egg interactions-biochemical events, post fertilization events,
- Parthenogenesis
- Embryonic Development: Types of animal eggs, patterns of cleavage, blastulation, gastrulation, fate maps and cell lineage

UNIT-C 9 hours

- Implantation and Decidualization in mammals
- Extra embryonic membranes, types and physiology of placenta
- Cell Differentiation, Organizer-Concept, Induction process
- Organogenesis of heart, kidney, nervous system and sense organs.

UNIT-D 9 hours

- Post embryonic development-insects and amphibians
- Genes in development
- Regeneration in invertebrates and vertebrates, development of immune system in vertebrates
- Gerontology-ageing, concepts and models
- Teratogenesis

Reference books

1. Balinsky, B.I. and Fabian, B. C., An Introduction to Embryology, 5th ed., Saunders, Philadelphia (2012).
2. Gilbert, S. F., Developmental Biology, 9th ed., Sinauer Associates Inc Publishers (2010).
3. Browder, L.W., Developmental Biology, 3rd ed., Saunders College Publishing (1991).
4. Muller, W. A., Developmental Biology, Springer (1997).
5. Rastogi, V. B. and Jayaraj M. S., Developmental Biology, Kedar Nath Ram Nath, Meerut (2009)
6. Wolpert, L. et al., Principles of Development, 2nd ed., Oxford (2001)
7. Wright, S. J., A Photographic Atlas of Developmental Biology, Morton Publishing Company (2005).

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Ecology

Paper Code: ZOO 302

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To educate the students about the basic environmental phenomena like ecosystem, energy flow through the ecosystem and biogeochemical cycles. To enable the students understand the adaptations of the animals to their environment.

UNIT-A

11 hours

- Aim and scope of ecology
- The environment: physical environment; biotic environment; biotic and abiotic interactions.
- Precipitation patterns, vegetation, soil types-causes and consequences
- Habitat and niche: concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

UNIT-B

15 hours

- Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations.
- Species interactions: Types of interactions, intraspecific and interspecific competition, Competitive Exclusion.
- Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

UNIT-C

18 hours

- Ecological succession: types; mechanisms; changes involved in succession; concept of climax.
- Ecosystem: structure and function; energy flow and mineral cycling (C,N, P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).
- Wild life management, conservation of renewable resources.

UNIT-D

16 hours

- Environment pollution: air, water, soil, noise, radioactive pollution. pollution control strategies
- Zoogeography: principles concepts of parallelism, endemism, etc. factors affecting animal distribution
- Zoogeographical realms and faunal peculiarities. evolution of realms, plate tectonics and continental drifts, Island zoogeography.

Reference books

1. Krebs, J.C., Ecology, Harper & Row, Publ., New York, 2009.
2. Odum, E.P. and Barrett G.W., Fundamentals of Ecology, Thomson Brooks/Cole, 2005.
3. Clarke, G. L., Elements of Ecology, John Wiley & Sons, New York, 1954.
4. Kendeigh, S.C., Ecology with special reference to animals and man, Prentice Hall of India, N. Delhi, 1961.
5. Smith, Ecology, Harper & Row Publishers, New York, 1990.
6. Kormondy, E.J., Concepts of Ecology, 2nd ed., Prentice Hall of India, New Delhi, 2005.

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Behaviour
Paper Code: ZOO 303

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: The main objective of the course is to acquaint students with different behavioural patterns of animals and to understand animal psychology.

UNIT-A 12 hours

- Definition of behaviour. introduction to ethology, psychology versus ethology
- The sensory world of animals- behaviour equipment (senses, organs)

UNIT-B 14 hours

- Patterns of behaviour- individual behavioral pattern, homing behaviour
- Genetics of behaviour, learning behaviour

- Evolutionary approach to behavior, levels of natural selection

UNIT-C 10 hours

- Reproductive behavioural patterns: courtship and ritual behavior, mating, parental investment

UNIT-D 9 hours

- Comparative aspects of learning: definition and forms of learning behavior, development of learning, mechanisms of learning behavior, Imprinting
- Human ethology-general aspects

Reference books

1. Drickamer & Vessey: Animal Behaviour, Concepts, Processes and Methods (Wadsworth)
2. Grier: Biology of animal behaviour (Mosby College)
3. Immelmann: Introduction to Ethology (Plenum Press)
4. McFarland: Animal Behaviour, Psychology, Ethology and Evolution (Pitman)

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Development

Laboratory

Paper Code: ZOO 305

L	T	P	Credits	Marks
0	0	3	2	50

The following practicals will be conducted using animal material/charts/models/e-resources.

- Study of the slides showing the development of frog from zygote upto 7mm embryo.
- Study of the slides of *Amphioxus* and *Herdmania* larvae
- Study of life cycle of butterfly and moth
- Study of different invertebrate larvae

Note: Practical related to Fundamentals of Animal Development Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Ecology Lab

Paper Code: ZOO 305

L	T	P	Credits	Marks
0	0	2	1	25

- Estimation of Temperature, pH, TDS and dissolved oxygen through portable water analysis kits.
- Field study of different ecosystems.
- Study of the following with the help of atlas/maps/charts:
Hydroelectric projects
Nuclear Power Projects
Thermal Power Projects.
- Study of the following with the help of atlas/maps/charts: :
Coal fields
Oil wells
Oil refineries

DAV UNIVERSITY, JALANDHAR

Course Title: Fundamentals of Animal Behaviour Lab

Paper Code: ZOO 306

L	T	P	Credits	Marks
0	0	2	1	25

- Habituation in earthworm/mosquito larva
- Feeding behavior in housefly
- An investigation into the locomotory behaviour of maggots of the house fly
- Interspecific association-cattle and egrets /flocking behaviour in pigeons.
- Film shows on animal behaviour
- Social behaviour of honey bees and ants
- Study of structural organization of the hive

DAV UNIVERSITY, JALANDHAR

SEMESTER 6

Course Title: Fundamentals of Animal Biotechnology

Paper Code: ZOO 308

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: The acquaint students with cell, tissue and organ culture techniques.

UNIT-A	9 hours
<ul style="list-style-type: none">• Introduction to animal biotechnology.• History and development of animal cell culture• Natural niches of animal cell	
UNIT-B	12 hours
<ul style="list-style-type: none">• Techniques and types of animal tissue culture.• Culture media and their components• Biomatrix• Growth Kinetics	
UNIT-C	15 hours
<ul style="list-style-type: none">• Differentiation, transformation and transplantation of cultured cells,• Scale up methods and bioreactors• Organ culture, cell fusion• Hybridoma technology and cell lines	
UNIT-D	9 hours
<ul style="list-style-type: none">• Basics of genetic engineering• Applications and impact of recombinant DNA technology• Transgenic animals and their uses• Ethical issues and biosafety regulations	

Reference books

1. RW Old and SB Primrose: Principles of gene manipulation: An introduction to genetic engineering.
2. RA Meyers (Ed.): Molecular Biology and Biotechnology, (VCH Publishers)
3. Glick: Molecular Biotechnology

DAV UNIVERSITY, JALANDHAR

Course Title: Basic Technique in Zoology

Paper Code: ZOO 309

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To provide expertise to the students in animal handling and basic techniques used in zoology laboratory.

UNIT-A 7 hours

- Collection, maintenance, rearing, upkeep of animals in captivity
- Preservation (dry and wet techniques), classification, labeling, etc.
- Ethical issues related to animal health and their use for zoological studies

UNIT-B 9 hours

- Collection of tissues and fluids from animals.
- Routes of administration of test chemicals in animals
- Preparations of reagents, fixatives, stains and tissue processing for biological preparations.

UNIT-C 9 hours

- Details of microtomy
- Basic and selective staining methods
- Frozen cryocut sections
- Principles of biochemistry

UNIT-D 9 hours

- Principles of microscopy and its upkeep
- Tissue processing for biochemical estimations
- Slide preparations for cytological studies

Reference books

1. Gurumani, N., Research methodology for Biological Sciences, MJP Publishers, Chennai. (2007).
2. Freshney, R.I., Culture of Animal Cells: A manual of basic technique, 5th Ed., Wiley Liss Inc., New York. (2006).
3. Benett, A.H. and Usterbere, H, Phase Microscopy: Principle and applications, John Wiley and Sons, London (1951).
4. Dawes, C.J., Techniques for Transmission and Scanning Electron Microscopy, Ladd Rew. Ind., Inc., Publishers (1981).
5. Freefelder, D, Practical Biochemistry: Application to Biochemistry and Molecular Biology, W.H. Freeman, (1982).
6. Watt, J.M., The Principles and Practice of Electron Microscopy, Watt (1985).

DAV UNIVERSITY, JALANDHAR

Course Title: Applied Zoology

Paper Code: ZOO 310

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To make students well-versed with different applications of Zoology.

UNIT-A 15 hours

- Useful animals and their products
- Outlines of apiculture, sericulture, lac culture, edible and pearl oyster culture, pisciculture, poultry farming, dairy farming, etc.

UNIT-B 14 hours

- Important human and veterinary parasites- protozoans and helminthes
- Life cycle and biology of *Plasmodium*, *Trypanosoma*, *Leishmania*, *Ascaris*, *Wuchereria*, *Fasciola*, *Schistosoma*, *Taenia*

UNIT-C 9 hours

- Molecular and cellular basis of host-parasite interactions
- Arthropods as vectors of human diseases
- Mode of transmission of pathogens by vectors

7 hours

UNIT-D

- Biology and control of chief insect pests of agriculture importance.
- Birds, pests and their control
- Life cycle, damage and control of rodent pests of agriculture.

Reference books

1. Ichchpujani R.L. & Rajesh Bhatia, Medical Parasitology, 3rd Ed. Jaypee Brothers Medical Publishers, New Delhi (2002).
2. Lynne Shore Garcia, Diagnostic Medical Parasitology 4th Ed. ASM Press, Washington DC, (2001).
3. Parija, S. C. Textbook of Medical Parasitology, All India Publishers and Distributors (2001)
4. Smyth, J.D., Introduction to Animal Parasitology, Hodder & Stoughton, London (2005).
5. Chatterjee, K. D., Parasitology: Protozoology and Helminthology, 13th ed., CBS publishers and distributors Pvt Ltd (2009)
6. Cheng, T.C., General Parasitology, 2nd ed., Academic Press, London (1986).
7. Noble, E.R. & Noble, G.A., Parasitology : The biology of animal parasites 5th edition,
8. Lea & Febiger, Philadelphia (1982).
9. Larry S. Roberts & John Janovy Jr., Foundations of Parasitology Mc. Graw Hill Book Co., (2000).
10. *Aquaculture Production*. FAO. Fisheries Circular No.815, No.4, Rev.FAO Rome (1998).
11. Mohan Joseph, M, Aquaculture in Asia, Asian Fisheries Society, Manglore (1990).
12. Mishra, R.C., Honey bees and their management in India, ICAR Publications, (1995).
13. Winston, M. L., The Biology of Honey Bee, Harvard University Press (1991).

DAV UNIVERSITY, JALANDHAR

Course Title: Principles and Theories of Evolution

Paper Code: ZOO 311

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective: To give students an insight into the origin of life and evolutionary history of animals

UNIT-A

18 hours

- Emergence of evolutionary thoughts: Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis.
- Origin of cells and unicellular evolution: origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

UNIT-B

6 hours

- Paleontology and evolutionary history: the evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including *Homo*.

UNIT-C

9 hours

- Molecular evolution: concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.

UNIT-D

12 hours

- The mechanisms: population genetics – populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.

Reference books

1. Dodson., A Text Book of Evolution, Saunders, W.B., Philadelphia, London, 1952.
2. Shull., Evolution, 2nd Edition, Jodhpur, J.V., Publishing House, 2008.
3. Lull, R.S., Organic Evolution, 1st Edition, The McMillan Company, 1961.
4. Stirton, R.A., Time, Life and Man, John, Wiley and Sons, 1959.
5. Colbert, E.H., Evolution of Vertebrates, John, Wiley and Sons, 1955.
6. Hall., B.K. and Grimsson, B.H., Strickberber's Evolution, Jones and Bartlett Publishers
7. Sudburg, Massachusetts, 2000.989.

Course Title: Fundamentals of Animal Biotechnology Lab

Paper Code: ZOO 312

- Study of slides of specialized cells
- Cell organelle separation
- Introduction to animal tissue culture laboratory
- Preparation and sterilization of culture media and glassware
- Demonstration of PCR and cloning.

L	T	P	Credits	Marks
0	0	2	1	25

DAV UNIVERSITY, JALANDHAR

Course Title: Basic Techniques in Zoology Lab

Paper Code: ZOO 313

L	T	P	Credits	Marks
0	0	2	1	25

The following practicals will be conducted using animal material/charts/models/e-resources.

- Collection of small and large animals
- Preservation of specimens from museum
- Demonstration of injection routes and collection of fluids in albino rats
- Sacrificing the animal and fixation of material and its processing for histological slides of selected organs of rat
- Section cutting, stretching, staining and mounting of sections and their microscopic study.

Note: Practical related to Basic Techniques in Zoology Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Applied Zoology Laboratory

Paper Code: ZOO 314

The following practicals will be conducted using animal material/charts/models/e-resources.

L	T	P	Credits	Marks
0	0	2	1	25

- Study/Survey of economically important animals
- Study of protozoan, helminth parasites and arthropod vectors associated with human diseases
- Study of vertebrate pests of agricultural crops and their control
- Study of fish farm, apiary, poultry or dairy farm.

Note: Practical related to Applied Zoology Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Principles and Theories of Evolution Lab

Paper Code: ZOO 315

L	T	P	Credits	Marks
0	0	2	1	25

- Visit to Museum of Department of Anthropology, P.U., Chandigarh.
- Study of models of ancestry of Elephant.
- Study of some charts relevant to Palaeontology

DAV UNIVERSITY, JALANDHAR

INTERDISCIPLINARY COURSES OFFERED TO OTHER DEPARTMENTS

Course Title: Introduction to Life Sciences

Paper Code: ZOO 151

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: To acquaint students from non-medical background with the basic important aspects of biology.

Unit A 8 hours

- Cell structure, prokaryotic and eukaryotic Cells, Difference between plant and animal cells, cell division
- Structure and functions of biomolecules- proteins, carbohydrates, lipids, vitamins, enzymes, nucleic acids

Unit B 7 hours

- Introduction to plant kingdom and its major divisions
- Brief morphology and plant tissues
- Introduction to photosynthesis and respiration
- Process of plant growth and development

Unit C 10 hours

- Classification of animal kingdom, habits, habitat and characteristic features of important groups
- Simple and compound tissues
- Functional organization of a mammal
- Development of frog upto three germinal layers

Unit D 5 hours

- Economically important plants and animals
- Medicinal Plants
- Applications of plant tissue culture and animal cell culture

Reference books

1. Dhama, P.S. and Dhama, J.K., Invertebrate Zoology, 5th ed., R. Chand & Co., New Delhi, 2004.
2. Kotpal, R.L., Modern Text Book of Zoology, Invertebrates, 10th ed., Rastogi Publications, Meerut, 2012.
3. Dhama, P.S. and Dhama, J.K., Chordate Zoology, 5th ed., R. Chand & Co., New Delhi, 2006.
4. Kotpal, R.L., Text Book of Zoology- Vertebrates, Rastogi Publishers, Meerut, 2012.
5. Bhatia K.N., and Widge, R., Introduction of Botany, Trueman Publishers, Jalandhar, 2010.
6. Vidyarthi S., Textbook of Botany., S. Chand and Company, New Delhi, 2002.

DAV UNIVERSITY, JALANDHAR

Course Title: General Zoology

Paper Code: ZOO 152

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: To acquaint the non-medical students of Agriculture science with basics of zoology and applications of zoological science in agriculture.

Unit A

10 hours

- Introduction to Zoology.
- Structure and functions of cell and cell organelles
- Cell division-mitosis and meiosis
- Structure and function of biomolecules
- Simple and compound tissues

Unit B

8 hours

- Zoological nomenclature and principles of classification.
- Classification and general survey of animal kingdom upto classes.

Unit C

6 hours

- Functional organization and various systems of a mammal.
- Gametogenesis and development of frog upto three germinal layers

Unit D

5 hours

- Animals of economic importance in agriculture
- Common ecto and endoparasites of man and domestic animals

Reference books

1. Dhama, P.S., Agricultural Zoology. S. Chand and Company Ltd., New Delhi., 1992.
2. Linville, H.R. and Kelley, H.A., A textbook of general Zoology, DPH Publications, New Delhi, 2006
3. Frederick V.T., A textbook of Agricultural Zoology, General Books Publications, London, 2010
4. Dhama, P.S. and Dhama, J.K., Invertebrate Zoology, 5th ed., R. Chand & Co., New Delhi, 2004.
5. Kotpal, R.L., Modern Text Book of Zoology, Invertebrates, 10th ed., Rastogi Publications, Meerut, 2012.
6. Dhama, P.S. and Dhama, J.K., Chordate Zoology, 5th ed., R. Chand & Co., New Delhi, 2006.
7. Kotpal, R.L., Text Book of Zoology- Vertebrates, Rastogi Publishers, Meerut, 2012.

DAV UNIVERSITY, JALANDHAR

Course Title: General Zoology Lab

Paper Code: ZOO 153

L	T	P	Credits	Marks
0	0	0	1	25

The following practicals will be conducted using animal material/charts/models/e-resources.

Study of cell structure and cell division

Microscopic study of histological preparations of simple and compound tissues

General survey of animal kingdom upto classes with the help of slides and specimens

General survey and collection of fauna of local area

Anatomy of a mammal

Slides of frog development

Note: Practical related to General Zoology Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Biology I

Paper Code: ZOO 253

L	T	P	Credits	Marks
4	0	0	3	70

Course Objective: To introduce students of environmental sciences with

UNIT-A 7 hours

- Introduction to animal kingdom and its classification.
- Salient features of invertebrates and their classification.

UNIT-B 14 hours

- Study of habits, habitats and economic importance of *Amoeba*, *Paramecium*, *Hydra*, *Sycon*, *Taenia solium*, *Ascaris lumbricoides*, *Pheretima*, *Hirudinaria*, *Palaemon*, *Periplaneta*, *Pila*, *Limax*, *Asterias*

UNIT-C 14 hours

- Structure and function of cells and cell organelles.
- Cell division-mitosis and meiosis
- Structure and functions of biomolecules
- Type of simple and compound tissues

UNIT-D 10 hours

- Laws of inheritance. Multiple allelism. Blood groups in man.
- Genetic disorders in man and their inheritance

Reference books

1. Dhama, P.S. and Dhama, J.K., Invertebrate Zoology, 5th ed., R. Chand & Co., New Delhi, 2004.
2. Kotpal, R.L., Modern Text Book of Zoology, Invertebrates, 10th ed., Rastogi Publications, Meerut, 2012.
3. Cell Biology and Molecular Biology by D. Robertis, EDP & De Robertis E.M.F., 8th ed. Saunders & Co. Philadelphia (1995).
4. Genetics: A textbook for University students by P.K. Gupta, 3rd ed., Rastogi Pub., Meerut (1996).
5. Cytology, Genetics and Molecular Biology by P.K. Gupta, Rastogi Pub., Meerut (1991).
6. Cell Biology by C.B. Powar, 3rd ed., Himalaya Pub., Bombay (1984).
7. Genetics by Strickberger, Monroe W., 3rd ed., Macmillan Pub., New York, (1985).

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Biology I Lab

Paper Code: ZOO 254

L	T	P	Credits	Marks
0	0	1	1	30

General survey through slides/specimens/charts/models/e-resources:

Protozoa: *Amoeba*, *Paramecium*, *Euglena*, *Volvox*

Porifera: *Sycon*

Platyhelminthes: *Fasciola*, Tapeworm, *Ascaris*

Annelida: *Nereis*, *Pheretima*, *Hirudinaria*

Arthropoda: Cockroach, Prawn, Scorpion

Mollusca: *Unio*, *Pila*, *Sepia*

Echinodermata: *Asterias*, *Echinus*, *Cucumaria*

Permanent slides: Simple and compound tissues, stages of Mitosis and Meiosis

Note: Practicals related to Animal Biology I Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Biology II

Paper Code: ZOO 255

L	T	P	Credits	Marks
4	0	0	3	70

Course Objective: To introduce students of environmental sciences with

UNIT-A 5 hours

- Salient features of vertebrates and their classification

UNIT-B 15 hours

- Study of characteristic features, habits, habitats and economic importance of *Scoliodon*, *Labeo*, frog, toad, garden lizard, wall lizard, snake, crocodile, turtle, tortoise, pigeon, house sparrow, crow, vulture, kite, parrot, rat, rabbit

UNIT-C 12 hours

- Functional aspects of digestive, respiratory, circulatory and excretory systems.

UNIT-D 13 hours

- Neural and hormonal co-ordination
- Structure and functions of sense organs
- Physiology of animal reproduction
- Development of frog upto three germ layers.

Reference books

1. Dhami, P.S., Dhami, J.K., Chordate Zoology, 5th ed., R. Chand & Co., New Delhi, 2006.
2. Kotpal, R.L., Text Book of Zoology- Vertebrates, Rastogi Publications, Meerut, 2012.
3. Parker, T.J., and Haswell, W.A., A Text Book of Zoology Vertebrates, 7th ed. Vol. II (eds. A.J. Marshall & Williams, W.D.), Mac Millan, London, 1972.
4. Guyton, A.X., Text Book of Medical Physiology, 7th edition, Saunders Company, 1986.
5. Best, J.P., Best and Taylor's physiological basis of medical practice, 11th ed., William and Wilkins, 1985.
6. Hoar, W.S., General and comparative physiology, Adaptation and Environment, 3rd ed., Cambridge University Press, 1983.
7. Rhoades, R.A., Tanner, G.A., Medical Physiology, 2nd ed., Lippincott Williams and
8. Wilkins, 2003.
9. Dodson, E.O., A Text Book of Zoology, CBS Publishers & Distributors, Delhi, 1976.

DAV UNIVERSITY, JALANDHAR

Course Title: Animal Biology II Lab

Paper Code: ZOO 256

L	T	P	Credits	Marks
0	0	1	1	30

General survey through slides/specimens/charts/models/e-resources:

Hemichordata: *Balanoglossus*

Urochordata: *Herdmania*

Cephalochordata: *Branchiostoma*

Cyclostomata: *Petromyzon*

Chondrichthyes: *Scoliodon*

Osteichthyes: *Labeo*

Amphibia: Frog and Toad

Reptilia: Wall lizard, Garden lizard, Python, Cobra, Krait and Viper

Aves: Pigeon, House sparrow, Crow, Vulture, Kite, Parrot, Rat,

Rabbit

Mammalia: Rabbit

Demonstration of anatomy of the following animals through charts/e-resources/dissection of animal

Rat: digestive, arterial, venous, urinogenital systems)

Rabbit: skeleton

Note: Practicals related to Animal Biology II Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY, JALANDHAR

INTERDISCIPLINARY COURSES OFFERED BY OTHER DEPARTMENTS TO ZOOLOGY STUDENTS Semester I

Paper: Plant Diversity I (Phycology, Mycology and Lichenology)

Paper Code: BOT101

L	T	P	Credits	Maximum Marks	Minimum marks
4	1	0	4	100	40

Objective:

To acquaint the students about the morphology, biology and importance of prokaryotes, eukaryotes, algal organisms, fungal organisms and lichens.

Learning Outcome

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

Instruction for candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

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UNIT I

Plant Kingdom: Three and five Kingdom classification system and criteria; Six and eight kingdom classification; Diversity in habitat, forms, life span and nutrition; Evolution and phylogeny of land plants. **(5 Lectures)**

UNIT II

Algae: General characteristics, classification, ecology and distribution of algae; Morphology; thallus organization, cell structure, pigment system, reserve food, reproduction of Cyanophyta (*Nostoc*), Chlorophyta (*Chlamydomonas*, *Chara*), Rhodophyta (*Laminaria*), Bacillariophyta (*Pinnularia*), Xanthophyta (*Vaucheria*) and Phaeophyta (*Sargassum*); Life cycles patterns; Economic importance of algae. **(15 Lectures)**

UNIT III

Fungi: General characteristics, classification of fungi, Salient features and brief account of myxomycota (*Physarum*), oomycota (*Albugo*), chytridiomycota, (*Synchytrium*), zygomycota (*Rhizopus*), ascomycota (*Aspergillus*), basidiomycota (*Agaricus*), deuteromycetes (*Alternaria*); Life cycle patterns; Economic importance. **(15 Lectures)**

UNIT IV

Lichens: Occurrence and general characteristics of lichens; Ecology and distribution; Growth forms in lichens; Nature of association of algal and fungal partners; Reproduction in lichens; Economic importance of lichens. **(8 Lectures)**

DAV UNIVERSITY, JALANDHAR

**Paper: Plant Diversity I (Phycology,
Mycology and Lichenology) Lab**

Paper code: BOT102

L	T	P	Credits	Maximum Marks	Minimum marks
0	0	3	2	50	20

1. To learn the principles and procedures of fixation and staining.
2. To study of morphology and cell structure of the prokaryotic algae (*Nostoc*), eukaryotic algae unicellular (*Chlamydomonas*), colonial (*Volvox*), Filamentous (*Ulothrix*, *Spirogyra*, *Oedogonium*) through temporary or permanent slides.
3. To study of vegetative and reproductive structures of *Chara*, *Vaucheria*, *Batrachospermum*, *Sargassum* through temporary or permanent slides.
4. To study of the following through temporary or permanent slides:
 - (a) *Asperillus*,
 - (b) *Rhizopus*
 - (c) *Agaricus*
 - (d) *Albugo*
5. To study of growth forms of lichens (crustose, foliose, fruticose) on different substrata.
6. To study of thallus and reproductive structures (isidia, soredia, apothecium) of lichens through permanent slides.

Suggested Readings

1. Alexopolous, C.J.Mims, C.W. and Blackwell, M. *Introductory Mycology*, John Wiley and Sons, New York, 1996.
2. Hale, M.E. *The Biology of Lichens*, Arnold, London, 2001.
3. Kumar, H.D. *Introductory Phycology*, East West Press, New Delhi, 1999.
4. Lee, R.E. *Phycology*, Cambridge University Press, Cambridge, 2008.
5. Pelczar, M.J. *Microbiology*, 5th Edition, Tata Mc Graw-Hill Co, New Delhi, 2001.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

DAV UNIVERSITY, JALANDHAR

Course Title: Organic Chemistry

Course Code: CHE153

Time: 04 Hours

L	T	P	Credits	Marks	Pass Marks
4	1	0	4	100	40

Course Objectives:

This course is intended to learn the basic concepts of Organic Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of Organic chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

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PART A

Compounds of Carbon

(8 Hrs)

Differences in chemical and physical behavior as consequences of structure. Discussion (with mechanism) of reactions of hydrocarbons' ranging from saturated acyclic and alicyclic, unsaturated dienes and aromatic systems. Huckel rule; as applied to $4n+2$ systems. Industrial sources and utility of such compounds in daily life for medicine clothing and shelter.

PART B

Stereochemistry

(15 Hrs)

Structure, reactivity and stereochemistry. Configuration and conformation. Optical activity due to chirality; d, l, meso and diastereoisomerism, sequence rules. Reactions involving stereoisomerism. Geometrical isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature. Conformational isomerism – conformational analysis of ethane and n-butane; conformations cyclohexane, axial and equatorial bonds, conformations of monosubstituted cyclohexane derivatives. Newman projection and Sawhorse formula, Fischer and flying wedge formulae.

PART C

Alkyl Halides

(8 Hrs)

Structure of alkyl halides and their physical properties. Preparation from alcohols, hydrocarbons, alkenes and by halide exchange method.

Reactions : (i) Nucleophilic substitution (SN_2 and SN_1) kinetics, mechanism, stereochemistry, steric and electronic factors, reactivity of alkyl halides, rearrangement, dependence on nucleophile, role of solvent (ii) Elimination E_2 and E_1 mechanism, stereochemistry, kinetics, rearrangement.

Alcohols

(4 Hrs)

Structure, physical properties (Hydrogen bonding), Methods of preparation: Grignard synthesis (scope and limitations),

Reactions: Reactions with hydrogen halides. Mechanism and rearrangement, Reaction with Phosphorous trihalides, mechanism of Dehydration rearrangement.

PART D

Ethers

(2 Hrs)

Structure, Physical properties, preparation (Williamson synthesis). Reactions: Cleavage, by acids, Electrophilic substitution in ethers.

Aldehydes and Ketones

(8 Hrs)

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Structure, Physical Properties; Methods of Preparation: Oxidation of Primary and secondary alcohols, Oxidation of methylbenzenes, Reduction of acid chlorides, Friedel- Crafts Acylation,

Reactions; Nucleophilic addition, Addition of Grignard reagents, Addition of cyanide. Addition of Bisulphite, Addition of derivatives of ammonia. Acetal Formation, Cannizzaro reaction, Aldol Condensation.

Suggested Books:

1. R.N. Morrison & R.N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. I.L. Finar, Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. E.L. Eliel & S.H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.
4. March, Jerry Advanced Organic Chemistry: Reactions, Mechanism and Structure, 6th edition, John Wiley, 2007.

Course Title: ORGANIC CHEMISTRY LAB

Course Code: CHE154

Time: 04 Hours

L	T	P	Credits	Marks
0	0	2	2	50

Course Objectives:

This course is intended to learn the basic concepts of Organic Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Calibration of Thermometer

80-82° (Naphthalene), 113-114° (acetanilide).

132.5-133° (Urea), 100° (distilled Water)

2. Determination of melting point

Naphthalene 80-82°, Benzoic acid 121.5-122°

Urea, 132.5-133°, Succinic acid 184-185°

Cinnamic acid 132.5-133°, Salicylic acid 157-5-158°

Acetanilide 113-5-114°, m-Dinitrobenzene 90°

P-Dichlorobenzene 52°. Aspirin 135°.

3. Determination of boiling points

Ethanol 78°, Cyclohexane 81.4°, Toluene 110.6°, Benzene 80°.

4. Mixed melting point determination

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

5. Distillation

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Simple distillation of ethanol-water mixture using water condenser,

Distillation of nitrobenzene and aniline using air condenser.

6. Crystallization

Concept of induction of crystallization

Phthalic acid from hot water (using fluted filter paper and stemless funnel), Acetanilide from boiling water,

Naphthalene from ethanol,

Benzoic acid from water.

7. Decolorisation and crystallization using charcoal

Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.

Crystallization and Decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorising carbon) from ethanol.

8. Sublimation (Simple and Vacuum)

Camphor, Naphthalene, Phthalic acid and Succinic acid.

9. Extraction: the separatory funnel, drying agent:

Isolation of caffeine from tea leaves

10. Steam distillation

Purification of aniline/nitrobenzene by steam distillation.

Suggested Books:

1. Vogel A.I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith, P.W.G., Vogel's Text Book of Practical Organic Chemistry, 5th Edn., Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole, 2005.
3. Mann F.G., Saunders. P.C., Practical Organic Chemistry, Pubs: Green & Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.

DAV UNIVERSITY, JALANDHAR

Course Title: Biomolecules

Paper Code: BCH 101

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: This course introduces students to the importance of biochemistry and covers various biomolecules, with a brief overview of their chemistry, their functions and their relevance to physiology and disease.

Unit A (15 hours)

Introduction to Biochemistry

Water as a biological solvent. Weak acids and bases. pH and buffers. Henderson-Hasselbalch equation. Physiological buffers. Fitness of the aqueous environment for living organisms.

Carbohydrates

Structure of monosaccharides. Stereoisomerism and optical isomerism of sugars. Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reactions of sugars due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, function and occurrence of important ones). Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides - cellulose, chitin, agar, alginic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch. Bacterial cell wall polysaccharides. Glycoproteins.

Unit B (15 hours)

Proteins

Introduction to proteins. Classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereoisomerism and RS system of designating optical isomers. Classification and structures of standard amino acids as zwitterion in aqueous solutions. Physical and chemical properties of amino acids. Titration of amino acids. Separation of amino acids. Essential amino acids.

Structure of peptide bond. Solid-phase synthesis of peptides. Peptide sequencing. Chemical and enzymatic cleavage of polypeptide chains and separation of peptides. Levels of structure in protein architecture. denaturation and renaturation of proteins. Behaviour of proteins in solutions. Salting in and salting out of proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (haemoglobin, myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins.

Unit C (15 hours)

Nucleic Acids

Nature of genetic material. Evidence that DNA is the genetic material. Composition of DNA and RNA. Generalized structural plan and Nomenclature of nucleic acids. DNA double helix.

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Structure and roles of different types of RNA. Size of DNA in prokaryotes and eukaryotes. Central dogma of molecular biology. Concepts of gene, genome and chromosome.

Porphyrins

Porphyrin nucleus and classification of porphyrins. Important metalloporphyrins occurring in nature. Detection of porphyrins. Bile pigments – chemical nature and physiological significance.

Unit D (15 hours)

Lipids

Definition and classification of lipids. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats – hydrolysis, saponification value, rancidity of fats, Reichert-Meissel Number and reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), sphingomyelins, glycolipids – cerebroside, gangliosides. Properties and functions of phospholipids, isoprenoids and sterols.

Recommended books

1. Nelson DL & Cox M.M., Lehninger Principles of Biochemistry, 5th Edition, WH Freeman & Company, New York, 2008.
2. Voet D & Voet JG, Biochemistry, 3rd Edition, John Wiley & Sons Inc., Singapore, 2004.
3. Murray, R.K., Granner, D.K. and Rodwell, V.W. Harper's Illustrated Biochemistry, 27th Edition, McGraw Hill Company Inc. Singapore, 2006.

Course Title: Biomolecules Laboratory

L	T	P	Credits	Marks
0	0	3	2	50

Paper Code: BCH 102

Experiments:

1. Preparation of normal, molar and percent solutions.
2. Titration curve of Glycine.
3. Buffer preparation.
4. Qualitative tests for Carbohydrates, Lipids, Amino acids, Proteins, Nucleic acids
5. Preparation of casein from milk and determination of its isoelectric point.
6. Titrimetric analysis of Vitamin C.

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Course Title : Human Values and Ethics

Course Code : SGS - 101

L	T	P	Credits	Marks
2	0	0	2	50

Course Objectives

- To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
- To encourage students to read and realize the values of enlightened human beings.
- To enable students to understand and appreciate ethical concerns relevant to modern lives.

Learning Outcomes:

Students becoming responsible citizens and better professionals who practise Values and Ethics in every sphere of life.

Unit - A

Human Values

1. **Concept of Human Values:** Meaning, Types and Importance of Values. **2 hours**
2. **Human Values :** Lessons from the lives and teachings of great thinkers. **3 hours**
3. **Value Education :** The content of value education **2 hour**
4. **Value crisis and its redressal.** **1 hour**

Unit - B

Being Good and Responsible

1. Self Exploration and Self Evaluation **2 hour**
2. Acquiring Core Values for Self Development **2 hour**
3. Living in Harmony with Self, Family, Society and Nature **3 hours**
4. Values enshrined in the Constitution : Liberty, Equality Fraternity and Fundamental Duties. **3 hours**

Unit - C

Value – based living

1. Vedic values of life **2 hour**
2. *Karma Yoga and Jnana Yoga* **2 hours**
3. *Ashta Marga and Tri-Ratna* **2 hours**
4. Truth, Contentment and Wisdom **2 hours**

Unit - D

Ethical Living:

Ethics: Difference between Ethics and Values

1. Personal Ethics **2 hours**
2. Professional Ethics **3 hours**
3. Ethics in Governance **2 hours**
4. Ethics in Education **2 hours**

Total = 35 hours

Suggested Readings:

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1. Restoring Values (ed.) E. Sreedharan and Bharat Wakhlu, Sage Publications Ltd., New Delhi 2010.
2. Indian Ethos and Values by Nagarajan K, Tata McGraw Hill, 2011
3. Human Values, A N Tripathi, New Age International Publishers, New Delhi, Third Edition, 2009
4. Indian Ethos and Values in Management, 1st Edition by Sankar, Tata McGraw Hill Education Pvt. Ltd.
5. Values and Ethics, Osula, Asian Books, 2001.
6. Professional Ethics, R. Surbhiramanian, Oxford University Press, New Delhi, 2013.
7. Human Values and Professional Ethics, Rishabh Anand, Satya Prakashan, New Delhi, 2012
8. Human Values and Professional Ethics, Sanjeev Bhalla, Satya Prakashan, New Delhi, 2012.
9. Human Values and Professional Ethics, Ritu Soryan Dhanpat Rai & Co. Pvt. Ltd., First Edition, 2010.
10. Human Values and Professional Ethics by Suresh Jayshree, Raghavan B S, S Chand & Co. Ltd. , 2007.
11. Human Values and Professional Ethics, Dr. R K Shukla, Anuranjan Misra, A B Publication 2010.
12. Human Values and Professional Ethics, Sharma, Vayu Education of India Language publishers, 2012.
13. Human Values and Professional Ethics, S. Kannan, K. Srilakshmi, Taxmann Publication, Pvt. Ltd., 2009
14. Human Values and Professional Ethics, Smriti Srivastava, S K Kataria & Sons, 2001
15. Human Values and Professional Ethics, Yogendra Singh, Ankur Garg, Aitbs publishers, 2011.
16. Human Values and Professional Ethics, Vrinder Kumar, Kalyani Publishers, Ludhiana, 2013.
17. Human Values and Professional Ethics, R R Gaur, R. Sangal, GP Bagaria, Excel Books, New Delhi 2010.
18. Values and Ethics, Dr. Bramwell Osula, Dr. Saroj Upadhyay, Asian Books Pvt. Ltd., 2011.
19. Complete works of Swami Vivekanand, Advaita Ashram, Calcutta – 1931.
20. Indian Philosophy, S. Radhakrishnan, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.

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21. Essentials of Hinduism, Jainism and Buddhism, A N Dwivedi, Books Today, New Delhi – 1979
22. Light of Truth : Satyarth Parkash, Maharishi Dayanand Saraswati, Arya Swadhyay Kendra, New Delhi, 1975.
23. Dayanand : His life and work, Suraj Bhan, DAVCMC, New Delhi – 2001.
24. Moral and Political Thoughts of Mahatma Gandhi, V. Raghavan, N Iyer, Oxford University Press India, New Delhi, 2000.
25. Guru Nanak Dev's view of life, Amplified by Narain Singh, Published by Bhagat Puran Singh All India Pingalwara Society, Amritsar 2010.
26. Esence of Vedas, Kapil Dev Dwivedi, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
27. Vedic Concepts, Prof. B B Chaubey, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
28. Mahatma Gandhi : Essays and Reflections on his life and work by Saravapalli Radhakrishnan, Zaico Publication, Mumbai, 1977.
29. Lala Har Dayal, Hints for Self Culture, Jaico Publishing House, Mumbai, 1961.
30. Maharishi Swami Dayanand Saraswati, The Light of Truth (The Satyarth Prakashan), available at URL :
www.aryasamajjamnagar.org/download/satyarth_prakash_eng.pdf
31. Krishnamurti J, The First and Last Freedom, available at URL :
<http://www.jiddu-krishnamurti.net/en/th-first-and-last-freedom/>
32. Sri Raman Maharishi, Who Am I, available at URL :
http://www.sriramanamaharshi.org/resource_centre/publicatins/who-am-i-books/
33. Ramesh S Balsekar, Peace and Harmony in Daily Living, Yogi Impressions; 1st edition

Course Title: Environment Education

Paper Code: EVS102

L	T	P	Credits	Marks
3	0	0	2	50

Course Objective: This course aims at understanding the students in aspects of environmental problems, its potential impacts on global ecosystem and its inhabitants, solutions for these problems as well as environmental ethics which they should adopt to attain sustainable development.

Unit 1

The multidisciplinary nature of environmental studies (2 Hours)

Definition, scope and importance, Need for public awareness

Natural Resources: Renewable and non-renewable resources: (8 Hours)

Natural resources and associated problems.

(a) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) **Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Ecosystem:

(4 Hours)

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem:
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Unit II

Biodiversity and its conservation

4 Hours

- Introduction – Definition: Genetic, Species and Ecosystem Diversity
- Bio-geographical classification of India
- Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, global and national efforts.
- Genetically modified crops
- Cartagena Protocol
- Biodiversity Act

Environmental Pollution

8Hours

- Definition, causes, effects and control measures of:
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution

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d. Marine pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear pollution

- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

Indoor Pollution:

2 Hours

- Practical tips on how to save the self from self-inflicted pollution.
- Basics of toxicity.
- Problems of lifestyle based diseases.
- Solutions needed for safety.

Unit III

Social Issues and the Environment

7 Hours

- Population growth, variation among nations, Population explosion – Family Welfare Programmes.
- Environment and human health,
- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Laws: The Environment Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and control of Pollution) Act 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980.
- Issues involved in enforcement of environmental legislation
- Public Awareness

Unit IV

Human Population and Environment 5 Hours

- Population Growth and Variations among Nations
- Population Explosion
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Global environmental issues

5 Hours

- Stockholm Conference
- Brundtland Commission
- Montreal Protocol
- Kyoto protocol
- Earth Summit
- World Summit

Field Work

5 Hours

- Visit to a local area to document environmental assets river/ forest/ grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-Pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

References:

1. Botkin, D.B. and Kodler, E.A. (2000). Environmental Studies: The Earth as a living planet. John Wiley and Sons Inc., New York.
2. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Ltd. New Delhi.
3. Odum, E.P. (1983). Basic Ecology. Halt Saundurs, International Edition, Japan.
4. Sharma, P.D. (2004). Ecology and Environment. Rastogi Publications, Meerut.
5. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

DAV UNIVERSITY, JALANDHAR

SEMESTER 2

Paper: Plant Diversity II (Bryophytes, Pteridophytes and Gymnosperms)

Paper Code: BOT103

L	T	P	Credits	Marks	Minimum marks
4	1	0	4	100	40

Objective:

To make the students learn about morphology, biology and importance of the vascular plants.

Learning Outcome

The students will get to learn the origin of vascular systems, and seed habit from non-vascular plants.

Instruction for candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

UNIT I

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Bryophytes: Salient features; Adaptations to land habit; Classification; Characteristic and comparative account of Muscophytina, Hepatophytina and Anthocerothytina; Variation in structure of gametophytes (Isophyllous e.g. *Funaria*; Anisophyllous e.g. *Porella* and thalloid e.g. *Marchantia*); Vegetative and asexual reproduction. (15 Lectures)

UNIT II

Pteridophytes: Salient features; Classification; Evolution of stelar system: Telome theory; The earliest known records of Pteridophytes with special reference to *Rhynia*; A general account and evolutionary significance of Psilotopsida (*Psilotum*), Lycopsidea (*Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*). (15 Lectures)

Unit III

Gymnosperms: Salient features; Distribution in India; Classification; Morphology and life history (gametophyte, sex organs and embryo) of *Cycas* (Cycadales), *Pinus* (Coniferales), *Ephedra* (Ephedrales); Pteridospermic seeds and evolution of seed habit in gymnosperm. (developmental stages not included). (15 Lectures)

UNIT IV

Economic importance of Bryophytes, Pteridophytes and Gymnosperms; Ecological importance of bryophytes (pioneer colonizers, role in water conservation, prevention of soil erosion and management of forest floors, Phytoremediation and pollution monitoring). (7 Lectures)

DAV UNIVERSITY, JALANDHAR

Paper: Plant Diversity II Lab

Paper Code: BOT104

L	T	P	Credits	Marks	Minimum marks
0	0	3	2	50	20

1. Morphological studies of *Funaria*, *Porella*, *Marchantia*, *Riccia*, *Anthoceros*.
2. Internal organization of thallus in *Anthoceros*, *Riccia*, *Marchantia*.
3. Structure of sporophytes in *Funaria*, *Marchantia*.
4. Study of morphology, anatomy and reproductive organs of *Selaginella* and *Equisetum*, *Pteris*.
5. Study of morphology, anatomy; and reproductive organs in the available Gymnosperms (*Pinus*, *Cycas*, *Ephedra*, *Zamia* and any other).

Suggested Reading

1. Bhatnagar, S.P. and Moitra, A. Gymnosperms. New Age International Limited, New Delhi, 1996.
2. Chopra, R.S. and Kumar, S.S. Mosses of Western Himalaya and Adjacent Plain, Chronica Botanica, New Delhi.
3. Coulter, J.M. and Chamberlain, C.J. Morphology of Gymnosperms, Chicago University Press, Chicago, 1917.
4. Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1989.
5. Parihar, N.S. The Biology and Morphology of Pteridophytes, The Central Book Depot, Allahabad, 1972.
6. Rashid, A. An Introduction to Pteridophytes, Vikas Publishing House Pvt. Ltd., New Delhi, 1992.
7. Richardson, D.H.S. Biology of Mosses, Blackwell Scientific Publications, Oxford, 1981.
8. Sporne, K.R. The Morphology of Pteridophytes-The Structure of Ferns and Allied Plants, B.I. Publications, Bangalore, 1982.
9. Sporne, K.R. The Morphology of Gymnosperms, B.I. Publications, Bombay, 1974.

DAV UNIVERSITY, JALANDHAR

10. Sundara Rajan, S. Introduction to Pteridophyta, Wiley Eastern India, New Delhi, 1995.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

DAV UNIVERSITY, JALANDHAR

Course Title: Spectroscopy

Course Code: CHE155

Time: 04 Hours

Course Objectives:

L	T	P	Credits	Marks	Pass Marks
4	1	0	4	100	40

This course is intended to learn the basic of spectroscopy. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the spectroscopy and its applications. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

DAV UNIVERSITY, JALANDHAR

PART A

Pure Rotational Spectra

(12 Hrs)

Classification of molecules according to their moment of inertia. Rotational energy levels of hydrogen chloride. Determination of molecular geometry by rotational spectrum, isotopic substitution effects. Stark effect, Estimation of molecular dipole moments, Selection rules, Rotational Raman Spectra, anisotropic polarizability, specific selection rule in Raman Spectra, Stokes and anti – Stokes lines.

PART B

Vibrational Spectra

(12 Hrs)

Diatomic molecules, Force constants, Fundamental vibration frequencies, anharmonicity of molecular vibrations and its effect on vibrational frequencies, second and higher harmonies. Frequencies of the vibrational transitions of HCl. Vibrational rotation spectra of CO. P, Q and R branches.

PART C

Infrared and Raman Spectra

(9 Hrs)

Vibrations of polyatomic molecules. Examples of CO₂, H₂O. Mechanics of measurement of infrared and Raman spectra absorption of common functional groups. Their dependence on chemical environment (bond order, conjugation, hydrogen bonding), the number of active infrared and Raman active lines. Fermi resonance, combination bands and overtones, complications due to interactions of vibrations of similar frequency. Application of IR in structure elucidation of organic compounds.

PART D

UV and Visible Spectroscopy

(12 Hrs)

Measurement technique, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and first excited electronic states of diatomic molecules, relationship of potential energy curves to electronic spectra. Chromophores, auxochromes, electronic spectra of polyatomic molecules. Woodward rules for conjugated dienes, unsaturated carbonyl groups, extended conjugation. Red shift, blue shift, hypo and hyperchromic effects.

Suggested Books:

1. R.S.Drago, "Physical Methods in Chemistry".
2. R.M. Silverstein, G.C. Bassler, T.C. Morrill, "Spectrometric Identification of Organic Compounds."

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3. W. Kemp, "Organic Spectroscopy".
4. D.H. Williams, I. Fleming, "Spectroscopic Methods in Organic Chemistry".
5. J.R.Dyer, "Application of Absorption Spectroscopy of Organic Compounds".
6. D. H. Williams, I. Fleming, "Spectroscopic Problems in Organic Chemistry" 1967.
7. R.C. Banks, E.R. Matjeka, G. Mercer, "Introductory Problems in Spectroscopy" 1980.
8. G.M. Barrow "Introduction to Molecular Spectroscopy".
9. C.N. Banwell "Fundamentals of Molecular Spectroscopy".
10. D.L. Pavia, G.M. Lampan and G. S. Kriz, "Introduction to Spectroscopy" Hartcourt College Publishers, 2001

DAV UNIVERSITY, JALANDHAR

Course Title: Chemistry Lab

Course Code: CHE156

Time: 04 Hours

Course Objectives:

L	T	P	Credits	Marks	Pass marks
0	0	2	2	50	20

This course is intended to learn the basic concepts of Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Determine the strength of HCl solution by titrating against NaOH solution conductometrically.
2. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator.
3. Determination of alkalinity of water.
4. Determination of surface tension of given liquid by using Stalagmometer.
5. Determination of residual chlorine in a water sample.
6. To determine the specific and molecular rotations of an optically active substance by using polarimeter.
7. To determine the composition of an unknown solution with a polarimeter.
8. Determination of the viscosity of given lubricating oil by using Redwood Viscometer.
9. Determination of distribution coefficient of I₂ between CCl₄ and Water.
10. To study the kinetics of hydrolysis of methyl acetate in the presence of hydrochloric acid.

Suggested Books:

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1. Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman Group Ltd., London & New York (1978).
2. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th edition, Pubs: R.Chand& Co., New Delhi (2002).
3. Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd. (1983).
4. Vogel's Textbook of Quantitative Chemical Analysis (revised by Jeffery, Bassett, Mendham and Denney), 5th Edn., Pubs: ELBS (1989).
5. Svehla G., Vogel's Qualitative Inorganic Analysis (revise), 6th Edn., Pubs: Orient Longman, New Delhi (1987).
6. Christian G.D., Analytical Chemistry, Pubs: John Wiley & Sons Inc.

DAV UNIVERSITY, JALANDHAR

Course Title: Road Safety and Legal Awareness

Paper Code: EVS103

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course aims to aware the students about safety measures taken during driving and commuting on roads.

Unit I

Road Safety

15 Hours

- Road safety: Concept and its importance.
- Attitude of people towards road safety
- Role of traffic police in road safety
- Traffic rules
- Traffic signs
- How to obtain driving license
- Traffic offences, penalties and procedures
- Common driving mistakes
- Significance of first-aid in road safety
- Role of civil society in road safety and Traffic police-public relationship
- Motor Vehicle Act 1998 (2010)

Unit II

Legal Awareness

10 Hours

- Legal literacy
- Child labour
- Domestic Violence
- Right to Education

References:

1. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Ltd. New Delhi.
2. Sharma, P.D. (2004). Ecology and Environment. Rastogi Publications, Meerut.
3. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

Course Title : General Knowledge and Current Affairs

Course Code : SGS-102

L	T	P	Credits	Marks
2	0	0	2	50

COURSE OBJECTIVES

The study of General Knowledge and Current Affairs has become even more important today. It is not only a major constituent of most competitive examinations but also aids in acquiring general awareness.

The objectives of this course are :

- To introduce students with the course and contents of various competitive examinations
- To prepare a foundation for appearing in various competitive examinations
- To sensitize the students about the current issues and events of national and international importance
- To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Learning Outcomes:

- Students would get an opportunity to aspire, plan and prepare for various competitive examinations in advance.
- It would polish their personalities and sharpen the skills of debates, group discussions, communication, interview etc.
- Students would acquire general awareness of National and International Events.

Unit — A

General Geography

World Geography :

The Universe, The Solar System, The Earth, Atmosphere, The World **3 hours**
we

live in, Countries rich in Minerals, Wonders of the World, Biggest and Smallest.

Indian Geography :

Location, Area and Dimensions, Physical Presence, **3 hours**

Indian States and Union Territories,
Important sites and Monuments, Largest-Longest and Highest in India.

General History

Glimpses of India History, Ancient Indian, Medieval India, Modern India, **3 hours**

Various Phases of Indian National Movement, Prominent Personalities.
Glimpses of Punjab history with special reference to period of Sikh Gurus.

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Glimpses of World History

Important Events of World History, Revolutions and Wars of Independence, **3 hours**
Political Philosophies like Nazism, Fascism, Communism, Capitalism, Liberalism etc.

Unit — B

General Polity

World Politics – Major Actors and their political relations, **3 hours**
UNO
and other organizations viz: WTO, EU, SAARC, ASEAN, BRICS, WTO, OIC, OAU, OPEC, GCC etc.

Indian Polity : Constitution of India :

Important Provisions, Basic Structure, Union Government, Union Legislature **3 hours**
and
Executive, State Government: State Legislature and Executive, Indian Judiciary, The Election Commission, Panchayati Raj System, RTI etc.

General Economy :

The process of liberalization, privatization, globalization and **3 hours**
Major
World Issues. Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology.

Unit — C

General Science :

General appreciation and understandings of science including **3 hours**
the matters of everyday observation and experience. Inventions and Discoveries.

Sports and Recreation :

The World of Sports and recreation. Who's Who is sports, Major Events, Awards and Honours. Famous personalities, Festivals. Arts and Artists. **3 hours**

Current Affairs :

National and International Issues and Events in News. Governments **3 hours**
Schemes and Policy Decisions.

India and Neighbours:

Current phase relations with China, Pakistan, Bangladesh, Nepal, Sri Lanka **3 hours**
and
Afghanistan

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Unit — D

Miscellaneous Information

Who is who

Books and Authors, Persons in News, Awards and Honours,

2 hours

Abbreviations and Sports

Total : 35 Hours

SUGGESTED READINGS :

Books

- Advance Objective General Knowledge, R. S. Aggarwal, S. Chand Publisher (2013)
- Concise General Knowledge Manual 2013, S. Sen, Unique Publishers, 2013
- Encyclopedia of General Knowledge and General Awareness by R P Verma, Penguin Books Ltd (2010)
- General Knowledge Manual 2013-14, Edgar Thorpe and Showick Thorpe, The Pearson, Delhi.
- General Knowledge Manual 2013-14, Mukhtikanta Mohanty, Macmillan Publishers India Ltd., Delhi.
- India 2013, Government of India (Ministry of Information Broadcasting), Publication Division, 2013.
- Manorama Year Book 2013-14, Mammen Methew, Malayalam Manorama Publishers, Kottayam, 2013.
- Spectrum's Handbook of General Studies – 2013-14, Spectrum Books (P) Ltd., New Delhi
- Unique Quintessence of General Studies – 2013-14, Unique Publishers, New Delhi.

CURRENT AFFAIRS

Magazines

Economic and Political Weekly, Yojna, the Week, India Today, Frontline, Spectrum. Competition Success Review, Competition Master, Civil Services Chronicle, Current Affairs, World Atlas Book

Newspapers

The Hindu, Times of India, The Hindustan Times, The Tribune

DAV UNIVERSITY, JALANDHAR

Course Title: Basic Communication Skills

Course Code: ENG151

No. Of Lectures: 45

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective:

- To enhance students' vocabulary and comprehensive skills through prescribed texts.
- To hone students' writing skills.

Learning Outcomes: Students will be able to improve their writing skills as well as will enrich their word power.

Unit – A Applied Grammar (Socio-Cultural Context)	
• Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection	4 hours
• Tenses (Rules and Usages in Socio-cultural contexts)	5 hour
• Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to	4 hours
• Passives	3 hours
• Reported/Reporting Speech	3 hour
Unit – B Reading (Communicative Approach to be Followed)	
• J M Synge: Riders to the Sea (One Act Play)	5 hours
• Anton Chekhov : Joy (Short Story)	4 hours
• Swami Vivekanand : The Secret of Work (Prose)	5 hours
Unit – C Writing	
• Paragraph and Essay Writing	4 Hours
• Letter Writing: Formal and Informal	4 hours
• Notice and Email	4 hours

References:

a. Books

DAV UNIVERSITY, JALANDHAR

1. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008.

b. Websites

1. www.youtube.com (to download videos for panel discussions)
2. www.letterwritingguide.com
3. www.teach-nology.com
4. www.englishforeveryone.org
5. www.dailywritingtips.com
6. www.englishsheets.com
7. www.mindtools.com

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced tests will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. Students are expected to provide reasoning/solution/working for the answer. They will attempt all questions. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four surprise tests will be conducted. Out of these four, two will be speaking evaluations.

Two best out of four surprise tests will be considered towards final, each of 12.5% weightage to the final. Each objective surprise test will include 20-25 questions.

The books indicated as text-book(s) are suggestive. However, any other book may be followed.

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Course Code: ENG 152

No. Of Lectures: 30

L	T	P	Credits	Marks
0	0	2	1	25

Course Objective:

- To improve fluency in speaking English.
- To promote interactive skills through Group Discussions and role plays.

Learning Outcome: Students will get exposure to speaking through the above mentioned interactive exercises. In addition, they will develop a technical understanding of language learning software, which will further improve their communicative skills.

Unit – A Speaking/Listening	
• Movie-Clippings	10 hours
• Role Plays	10 hours
• Group Discussions	10 hours

Instructions:

1. Each student will prepare a scrap file on any of the topics given by class teacher. Student should be able to justify the contents of his/her Scrap file, which carries the weightage of 10 marks. Marks will be given for originality, creativity and presentation of thoughts.
2. In the end of semester, viva exam will be conducted. Viva will be for 10 marks. Spoken English will be the focus of exam. Examiner will ask questions related to scrap file and other general (non-technical) topics.
3. In the End-term exam, lab activity will carry the weightage of 10 marks.
4. Acknowledge all the sources of information in your scrap file.

References:

Books

1. Gangal, J. K. *A Practical Course In Spoken English*. India: Phi Private Limited, 2012.
2. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012.

Websites

1. www.youtube.com (to download videos for panel discussions)
2. www.englishforeveryone.org
3. www.talkenglish.com
4. www.mindtools.com

DAV UNIVERSITY, JALANDHAR

Course Title: Stenography

Course Code: SGS104

L	T	P	Credits	Marks
3	0	0	1	25

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of shorthand language and would be able to apply them in daily life. Completion of the course will improve their speed of writing and typing. They would be able to pronounce the English words correctly and can use effective English communication.

<p>Unit A I. The Consonants II. The Vowels III. Intervening Vowels and Position Grammalogues, Punctuation IV. Alternative Signs for r and h V. Diphthongs Abbreviated w. VI. Phaseography Tick the VII. Circle s and z—Left and Right Motion VIII. Stroke s and z IX. Large Circles sw and ss or sz X. Loops st and str.</p>	12 hours
<p>Unit B XI. Initial Hooks to Straight Strokes and Curves XII. Alternative Forms for fr, vr, etc. Intervening Vowels XIII. Circle or Loop Preceding Initial Hook XIV. n and f Hooks XV. Circles and Loops to Final Hooks.XVI The shun hook. XVII. The Aspirate. XVIII. Upward and Downward r.XIX. Upward and downward l and sh. XX. Compound consonants XXI. Vowel indication.</p>	12 hours
<p>Unit C XXII. The halving principle (section 1). XXIII. The halving principle (section 2). XXIV. The Doubling principle. XXV. Diphonic or two vowel signs. XXVI. Medial semicircle. XXVII. Prefixes negative words. XXVIII. Suffixes and terminations. XXIX. Contractions. XXX. Figures, etc .proper names.</p>	11 hours
<p>Unit D XXXI. Note taking, transcription, etc. XXXII. Essentials vowels. XXXIII. Special contractions. XXXIV. Advanced pharseography. XXXV. Intersections. XXXVI. Business phrases. XXXVIII. Banking and stockbroking phrases. XXXIX. Insurance and shipping phrases. XL. Technical and railway phrases. XLI. Legal phrases. XLIII. Special list of words. XLIV. Shorthand in practice.</p>	10 hours
Total	45 hours

Text Book:

Pitman Shorthand Instructor and Key ,Pearson publisher.

DAV UNIVERSITY, JALANDHAR

Syllabus

Course Title: Stenography Lab

Course Code: SGS105

L	T	P	Credits	Marks
0	0	1	1	25

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of typing and would be able to apply them in daily life. Completion of the course will improve their speed of typing and typing skills.

Unit A Beginner : Basics-fjdk, sla;, ghty,vmbn,ruei,woqp,cx. .	04 hours
Unit B Shift keys, numeric pad, Digits and symbols	03 hours
Unit C Intermediate- Syllables and words.	04 hours
Unit D Expert- Paragraphs and Stories	04 hours
Total	15 hours

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SEMESTER 3

Course Title: Inorganic Chemistry

Course Code: CHE253

Time: 04 Hours

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives:

This course is intended to learn the basic concepts of Inorganic Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of Inorganic chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.

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- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Atomic Structure and periodic properties

(12 Hrs)

Wave mechanical model of Hydrogen atom, The de Broglie relationship, The uncertainty principle, Schrodinger wave equation and its derivation, Significance of Ψ and Ψ^2 , Quantum numbers, Normal and orthogonal wave functions, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations. Concept of extra stability of half and completely filled electronic configuration, Electronic configuration of elements, Penetration and shielding (The Slater's rules). The origin and distribution of the elements, The structure of the periodic table, Atomic parameters and their variation in periodic table, Electronegativity and various scales.

PART B

Ionic Compounds (Bonding and structures)

(12 Hrs)

Properties of ionic substances, Occurrence of ionic bonding, The radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Calcium carbide, Lattice energy, Born-Haber cycle, The calculations of the lattice energy on the basis of Born-Lande equation, Covalent character in predominantly ionic compounds, Imperfections of crystals, Polarizing power and polarizability of ions, Fajan's rule.

PART C

Covalent Bond

(12 Hrs)

The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory. Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO_2 , PCl_5 , SO_3), Molecular orbital theory (LCAO method), Symmetry of

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molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be_2 , N_2 , O_2 , F_2 , NO , CO , HCl , NO_2 , BeH_2).

PART D

Coordination chemistry

(8 Hrs)

Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, chelating agents, metal chelates and chelate effects, names and abbreviations of important ligands, polydentate ligands, polypyrazolyborates, macrocyclic ligands, macrocyclic effect, ketoenolates, troponates, tripod ligands, conformation of chelate rings, factors determining kinetic and thermodynamic stability.

Suggested Books:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education, Singapore, 1999.
3. J.D. Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.

Course Title: Inorganic Chemistry Lab

Course Code: CHE254

Time: 04 Hours

L	T	P	Credits	Marks
0	0	2	2	50

Course Objectives:

This course is intended to learn the basic concepts of Inorganic Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in inorganic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

Qualitative Analysis

Identification of cations and anions in a mixture which may contain combinations of acid ions.

These must contain interfering acid anions and one, the insoluble.

a) Special Tests for Mixture of anions

I. Carbonate in the presence of sulphate.

II. Nitrate in the presence of nitrite

III. Nitrate in the presence of bromide and iodide.

IV. Nitrate in the presence of chlorate.

V. Chloride in the presence of bromide and iodide.

VI. Chloride in the presence of bromide.

VII. Chloride in the presence of iodide.

VIII. Bromide and iodide in the presence of each other and of chloride.

IX. Iodate and iodide in the presence of each other.

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X. Phosphate, arsenate and arsenite in the presence of each other.

XI. Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.

XII. Borate in the presence of copper and barium salts.

XIII. Oxalate in the presence of fluoride.

XIV. Oxalate, tartrate, acetate, citrate in the presence of each other.

b) Separation and identification of cations in mixtures

i) Separation of cations in groups.

ii) Separation and identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations.

Suggested Books:

1. G. Svehla, B. Sivasankar, Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Pearson, 1996.

2. J. Bassett, R. C. Denney, G. H. Jeffery, J. Mendham, Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.

3. W. G. Palmer, Experimental Inorganic Chemistry; 1st edition, Pubs: Cambridge, 1954.

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L	T	P	Credits	Marks
4	0	0	4	100

Course Title: ENGLISH

Course Code: ENG180

Total Lectures: 60

Course Objective: To familiarize students of non-literary programmes with some of the basics of literary studies through a critical study of the prescribed texts

Learning Outcomes:

Unit – A <i>Never Never Nest</i> by Cedric Mount	
• Consumerist Lifestyle	3 hours
• Bank Loans and Modern Times	3 hours
• Character Analysis	5 hours
• Stylistic Analysis	4 hours
Unit – B <i>Guide</i> by R. K. Narayana	
• Interpersonal Relationships	4 hours
• Religious Beliefs/Rituals in Rural India	4 hours
• Character Analysis	4 hours
• Stylistic Analysis	3 hour
Unit – C <i>Twelfth Night</i> by Shakespeare	
• Salient Features of Shakespearean Comedy	5 hours
• Character Analysis	5 hours
• Stylistic and Thematic Analysis	5 hours
Unit – D <i>Animal Farm</i> by George Orwell	
• Marxist Principles	5 hours
• As a Progressive Text	5 hours
• Symbolic Analysis	5 hours

Suggested Reading:

1. Falvey, Peter ,Peter Kennedy. *Learning Language Through Literature: A Sourcebook for Teachers of English in Hong Kong*. HKU: Hong Kong University Press, 1997.
2. www.britishcouncil.com

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3. Kumar, Sukrita Paul. *Language, Literature And Creativity*. New Delhi: Orient Blackswan Pvt Ltd, 2010.
4. Swann, Joan , Robert Pope and Ronald Carter. *Creativity in Language and Literature: The State of the Art*. USA : Palgrave MacMillan, 2011.

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Semester 4

Paper: Plant Physiology

Paper code: BOT311

L	T	P	Credits	Marks	Minimum marks
4	1	0	4	100	40

Objective:

To make students learn the vital physiological processes in plants.

Learning Outcome

The study will help them to have depth knowledge of plant-water relationships, organic and mineral nutrition, respiration and photosynthesis etc.

Instruction for candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

UNIT-I

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Introduction: Introduction, definition, scope and significance of Plant Physiology.

(1 Lecture)

Plant-Water Relations : Water transport processes; diffusion and osmosis; water potential and chemical potential; absorption of water, water transport through tracheids and xylem; transpiration and its significance; factors affecting transpiration; mechanism of stomatal movement.

(5 Lectures)

Mineral Nutrition: Criteria of essentiality of elements; macro- and micronutrients; role of essential elements; mineral deficiency symptoms and plant disorders; nutrient uptake and transport mechanisms.

(3 Lectures)

UNIT-II

Photosynthesis : Historical background and significance; structure and photosynthetic apparatus; photosynthetic pigments; accessory pigments and the photoprotective carotenoids; reaction center complexes; photochemical reactions; Hill reaction; electron transport pathways in chloroplast membranes; photophosphorylation; the Calvin cycle; the C4 carbon cycle; crassulacean acid metabolism; photorespiration, factors affecting photosynthesis, Blackman's Law of limiting factors.

(10 Lectures)

Transport of Organic Substances: Transport of photosynthates; source-sink relationship; the mechanism of translocation in the phloem; assimilate partitioning.

(2 Lectures)

UNIT-III

Respiration: Glycolysis; the TCA cycle and its regulation; electron transport in mitochondria; oxidative phosphorylation; pentose phosphate pathway; cyanide-resistant respiration.

(6 Lectures)

Nitrogen Metabolism: Biological nitrogen fixation; mechanism of biological nitrogen fixation; Nodule formation and nod factors; nitrate and ammonium assimilation, role of leghaemoglobin; Factors affecting Biological nitrogen fixation.

(5 Lectures)

UNIT-IV

Growth and Development: General aspects – definitions, phases of growth; kinetics of growth; physiology of seed dormancy and seed germination; concept of photoperiodism;

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vernalization; Functions of Phytohormones – auxins, cytokinins, gibberellins, abscisic acid and ethylene; Plant movements – tropic and nastic. **(15 Lectures)**

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Paper: Plant Physiology Lab

Paper code: BOT312

L	T	P	Credits	Marks	Minimum marks
0	0	3	2	50	20

1. Preparation of molar and molal solutions and determination of solution volume of a compound.
2. To study the permeability of plasma membrane using different concentrations of organic solvents.
3. Comparative study of rate of respiration of various plant parts.
4. To extract and separate chloroplast pigments by solvent method and demonstration fluorescence in chloroplast extracts.
5. To determine the osmotic potential of vascular sap by plasmolytic method.
6. To determine the water potential of given tissue (any tuber).
7. To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. Also to study the effect of ABA on stomatal closure.
8. Role of light in germination of photoblastic seeds, e.g. *Lactuca sativa*.
9. To determine seed viability by TTC method.

Suggested Reading

1. Galston, A.W. Life Processes in Plants, Scientific American Library, Springer-Verlag, New York, USA, 1989.
2. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R., (eds), Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands, 1999.
3. Hopkins, W.G. Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA, 1995.
4. Moore, T.C. Biochemistry and Physiology of Plant Hormones (2nd edition), Springer-Verlag, New York, USA, 1989.

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5. Pandey, S.N. and Sinha, B.K. Plant Physiology. Sangam Books Limited, India, 1997.
6. Salisbury, F.B. and Ross, C.W. Plant Physiology (4th edition), Wadsworth Publishing Co., California, USA, 1992.
6. Taiz, L. and Zeiger, E. Plant Physiology (2nd edition), Sinauer Associates, Inc., Publishers, Massachusetts, 1998.
7. Mukherji & Ghosh. Plant Physiology. New Central Book Agency (P) Limited, India, New Delhi. 2009.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.

Course Title: Metabolism

Paper Code: BCH 103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: The course is designed to survey the major metabolic pathways involved in energy generation and synthesis of biomolecules.

Unit A (15 hours)

Introduction to Metabolism

General features of metabolism, experimental approaches to study metabolism – intact organisms, bacterial mutants, tissue slices, radioisotopes.

Carbohydrate Metabolism

Reactions and energetics of glycolysis. Alcoholic and lactic acid fermentations. Reactions and energetics of TCA cycle. Gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of pentose phosphate pathway. Regulation of glycolysis and TCA cycle. Photosynthesis – a brief review.

Unit B (10 hours)

Electron Transport Chain and Oxidative Phosphorylation

Structure of mitochondria. Sequence of electron carriers. Sites of ATP production. Inhibitors of electron transport chain. Chemiosmotic hypothesis. Inhibitors and uncouplers of oxidative phosphorylation. Transport of reducing potentials into mitochondria.

Unit C (20 hours)

Lipid Metabolism

Introduction. Hydrolysis of triacylglycerols. Transport of fatty acids into mitochondria. β -oxidation of saturated fatty acids. ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of ketone bodies. Oxidation of unsaturated and odd chain fatty acids. Biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol. Regulation of cholesterol metabolism.

Amino Acid Metabolism

General reactions of amino acid metabolism – transamination, oxidative deamination and decarboxylation. Urea cycle. Degradation and biosynthesis of amino acids. Glycogenic and ketogenic amino acids.

Unit D (15 hours)

Nucleotide Metabolism

Sources of atoms in the purine and pyrimidine nucleotides. Biosynthesis and degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis.

Porphyrin Metabolism

Biosynthesis and degradation of porphyrins. Production of bile pigments.

Recommended books

1. Nelson DL & Cox M.M., Lehninger Principles of Biochemistry, 5th Edition, WH Freeman & Company, New York, 2008.
2. Conn EE, Stumpf PK, Bruening G and Doi RH. Outlines of Biochemistry. 5th edition, John Wiley & Sons Inc, 1987.
3. Voet D & Voet JG, Biochemistry, 3rd Edition, John Wiley & Sons Inc., Singapore, 2004.
4. Murray, R.K., Granner, D.K. and Rodwell, V.W. Harper's Illustrated Biochemistry, 27th Edition, McGraw Hill Company Inc. Singapore, 2006.

Course Title: Metabolism Laboratory
Paper Code: BCH 104

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Estimation of blood glucose.
2. Estimation of cholesterol
3. Sugar Fermentation in Microorganisms.
4. Estimation of Glucose 6-P.
5. Assay of serum transaminases.
6. Estimation of Urea.
7. Estimation of Uric acid.
8. Estimation of Creatinine.

L	T	P	Credits	Marks
4	0	0	3	75

Course Title: Basic Computer Applications

Course Code: CSA253

Course Duration: 45 Hours

Course Objective: The students will understand the fundamental concepts of Computer. In addition, they will be proficient in using office automation tools, viz. Word, PowerPoint, Excel, etc.

Unit - A

Introduction to Computer Systems

- Block diagram of a computer: basic functions of each component
- Classification of Digital computers based on size
- Uses of Computers, Operating system basics - Role of operating system
- Networks & data communication
- The uses of a network
- How networks are structured: Network topologies
- Media & hardware, Internet & online resources: How Internet works
- Features of the Internet, Accessing the Internet, Working on the Internet

Unit – B

Word Processing

- Editing and Formatting a Document, Text Formatting, Paragraph Formatting, Headers and Footers
- FIND command & REPLACE command, Checking Spelling and Grammar; On-line Spelling and Grammar correction using Auto correct
- Auto Text, Using Thesaurus, Using Clip Gallery. Inserting Graphics From files
- Working with Tables -Creating Table , Entering Text in the Table
- Changing Format of Text of cells, Changing Column width and Row height, Formatting Table Border
- Using Mail Merge - Mail Merge Procedure, Printing a document

Unit - C

Spreadsheets

- Basic Operations - Arithmetic operators, Comparison operators, Text operator & (ampersand) Reference operator
- Modifying the worksheet layout - Changing Width of Column, Changing Height of Row, Deleting Rows/Columns/Cells, Moving and copying contents of cell, Alignment of text in the cell
- Printing the workbook - Setting up Print Area, Setting up Margins, Defining Header and Footer, Controlling Gridlines

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- Working with functions - Date and time function, Statistical function, Financial function, Mathematical and Trigonometric functions, Lookup and Reference Functions, Data Base functions, Text function, Logical functions
- Introduction to CHARTS - Formatting Charts
- Working with MACRO, Importing and exporting files

Unit – D

Presentations

- Creating a presentation slide, Design Templates and Blank presentations
- Power Point standard toolbar buttons
- Working with the text in a slide, Arranging Text in Different Levels
- Changing Font, Font Size and Bold; Moving the frame and inserting clip art; Different slide layouts; Formatting the Slide Design; Work with the Slide Master; Saving the presentation
- The Auto Content Wizard; Using Existing Slides; Using the different views of a slide
- Adding Transitions and Animation, Running Slide Show

Reference Books:

1. K. Kumar, and R. Rajkumar, Computer Applications in Business, Tata McGraw Hill
2. Kogent Learning Solutions Inc, Office 2010 in Simple Steps, DreamTech Press
3. A. Goel, Computer Fundamentals, Pearson
4. Silberschatz & A. Korth, Database System Concepts, New York, McGraw-Hill
5. A. Simpson, C. Robinson, Mastering Access 2000, New Delhi, BPB
6. R. K. Taxali, P C Software Made Simple, New Delhi, Tata McGraw-Hill

L	T	P	Credits	Marks
0	0	2	1	25

Course Title: Basic Computer Applications Laboratory

Course Code: CSA254

- The laboratory will comprise of using commands and tools available in MS Word, PowerPoint, and Excel.
- Assignments based on the applications of above mentioned software packages.

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Semester 5

Course Title: Basic Immunology

Paper Code: MIC301

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: This course is to learn basic immunology and clinical microbiology. Antibodies and pathogenic bacteria are covered by this course.

Unit A

History of immunology, Innate immunity, Adaptive immunity.

Hematopoiesis, Cells of immune system, Organs of immune system

Immunogenicity versus antigenicity, Epitopes, Pattern recognition receptors 10 hours

Unit B

Antibodies: Structure, Effector functions, Antibody classes and biologic activities,

Generation of antibody diversity, class switching. 10 hours

The B cell receptor, Monoclonal antibodies

Antigen antibody reaction, Cross reactivity, Precipitation reaction, Agglutination reaction, Radioimmunoassay, Enzyme linked immunosorbent assay, Western blotting, Immunoprecipitation, Immunofluorescens, Flow cytometry, Immunoelectron microscopy.

10 hours

Unit C

Major Histocompatibility complex. Antigen processing and presentation: Role of antigen presenting cells, two processing and presentation pathways.

Cytokines, Cytokines receptor, Cytokine related disease, Therapeutic uses of cytokines. 10 hours

The function of complement, Complement activation, Biological consequences of complement activation, Complement deficiencies

Vaccines, Active and passive immunization, Designing vaccine for active immunization, Whole organism vaccine, Purified macromolecules as vaccine, Recombinant vaccine. 10 hours

Unit D

Hypersensitivity and types of hypersensitivity.

Autoimmunity and tolerance and their mechanism.

10 hours

60 hours

Reference books

1. Kuby Immunology. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne. W.H. Freeman and Co. Publishers. 6th Edition. 2007
2. Janeway's Immunobiology. Kenneth Murphy, Paul Trevers, Mark Walpart. Garland Science Publishers. 2012.
3. Roitt's Essential Immunology. Ivan M. Roitt and Peter J. Delves. Blackwell Publishing Ltd. 10th Ed. 2001
4. Fundamental Immunology. William E. Paul. Lippincott Williams & Wilkins, a Wolters Kluwer business. 6th edition. 2008

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Course Title: Basic Immunology Lab

Paper Code: MIC302

L	T	P	Credits	Marks
0	0	3	2	50

1. Blood grouping
2. Differential leukocyte counting.
3. Agglutination reaction
4. Immuno-electrophoresis
5. Enzyme linked immunosorbent assay

30 hours

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Course Title: PHYSICAL CHEMISTRY

Course Code: CHE353

Time: 04 Hours

Course Objectives:

L	T	P	Credits	Marks	Pass Marks
4	1	0	4	100	40

This course is intended to learn the basic concepts of Physical Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of physical chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

Instructions for Candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.

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- The books indicated as text-book(s) are suggestive However, any other book may be followed.

PART A

Chemical Thermodynamics (15Hrs)

Objectives and limitations of Chemical Thermodynamics, State functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy.

First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion, .Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchhoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle), Entropy, Entropy changes of an ideal gas with changes in P,V, and T, Free energy and work functions, Gibbs-Helmholtz Equation., Criteria of spontaneity in terms of changes in free energy, Third law of thermodynamics, Absolute entropies.

PART B

Chemical Equilibrium (5 Hrs)

General characteristics of chemical equilibrium, thermodynamic derivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between K_p , K_c and K_x . Temperature dependence of equilibrium constant-Van't Hoff equation, homogeneous & heterogeneous equilibrium, Le Chetalier's principle.

PART C

Chemical Kinetics (15 Hrs)

Rates of reactions, rate constant, order and molecularity of reactions. Chemical Kinetics: Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-lifetime of a reaction, Methods for determining order of reaction, Effect of temperature on reaction rate and the concept of activation energy, Reaction mechanism, Steady state hypothesis

Catalysis

Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis, Unimolecular surface reactions.

PART D

Electro-Chemistry

(5 Hrs.)

Specific conductance, molar conductance and their dependence on electrolyte concentration, Ionic Equilibria and conductance, Essential postulates of the Debye-Huckel theory of strong electrolytes, Mean ionic activity coefficient and ionic strength, Transport number and its relation to ionic conductance and ionic mobility, Conductometry titrations, pH scale, Buffer solutions, salt hydrolysis, Acid-base indicators.

Electrochemical cells

(5Hrs.)

Distinction between electrolytic and electrochemical cells, Standard EMF and electrode potential, Types of electrodes, Reference electrode, Calculation of ΔG , ΔH , ΔS and equilibrium constant from EMF data, Potentiometric determination of pH, Potentiometric titrations.

Suggested Books:

1. P.W. Atkins, Physical Chemistry, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. T. Engel & P. Reid, Physical Chemistry, 1st ed., Pearson Education, 2006.
- 3 G. W. Castellan, Physical Chemistry, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
4. G. M. Barrow, Physical Chemistry 6th Ed., New York, McGraw Hill, 1996.
5. R. J. Silbey, R. A. Albert & Mounji G. Bawendi, Physical Chemistry, 4th Ed., New York: John Wiley, 2005.

This syllabus has been designed as per national syllabus suggested by UGC and covers 20% extra syllabus as per requisite of honors degree.

Course Title: PHYSICAL CHEMISTRY LAB

Course Code: CHE354

Time: 04 Hours

L	T	P	Credits	Marks	Pass marks
0	0	2	2	50	20

Course Objectives:

To teach the fundamental concepts of Physical Chemistry and their applications. The syllabus pertaining to B.Sc. (Other branches.) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Treatment of experimental data

Recording of experimental data. Significant number, accuracy and precision, error analysis.

2. Liquids and Solutions

(i) To determine relative viscosities of aqueous solutions of glycerol at different concentrations. (ii) Calculate partial molar volume of glycerol at infinite dilution from density measurement.

(ii) To determine viscosity-average molecular weight, number-average molecular weight and mean diameter of polyvinyl alcohol molecule from intrinsic viscosity data.

3. Thermochemistry

(i) To determine heat capacity of a calorimeter and heat of solution of a given solid compound.

(ii) To determine heat of solution of Solid calcium chloride and calculate lattice energy of calcium chloride using Born-Haber cycle.

(iii) To determine heat of hydration of copper sulphate.

4. Distribution Law

(i) To determine distribution (i.e. partition) coefficient of a solute between water and a non-aqueous solvent.

5. Surface Phenomena

To study the adsorption of acetic acid/oxalic acid from aqueous solution on charcoal. Verify Freundlich and Langmuir adsorption isotherms.

6. Colorimetry

(i) To verify Lambert-Beer law.

7. pH-metry

(i) To titrate a strong acid against a strong base pH-metrically.

(ii) To titrate a weak acid against a strong base and determine the ionization constant of the weak acid.

Suggested Books

1. Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman Group Ltd., London & New York (1978).
2. Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th edition, Pubs: R. Chand & Co., New Delhi (2002).
3. Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd. (1983).
4. Vogel's Textbook of Quantitative Chemical Analysis (revised by Jeffery, Bassett, Mendham and Denney), 5th Edn., Pubs: ELBS (1989).
5. Svehla G., Vogel's Qualitative Inorganic Analysis (revise), 6th Edn., Pubs: Orient Longman, New Delhi (1987).
6. Christian G.D., Analytical Chemistry, Pubs: John Wiley & Sons Inc,

This syllabus has been designed as per national syllabus suggested by UGC and covers 20% extra syllabus as per requisite of honors degree.

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SEMESTER 6

GENOMICS AND PROTEOMICS

Course Code: BTY308

L	T	P	Credits	Marks
2	1	0	2	50

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics and Proteomics.

Course Contents:

Unit - I (8 lectures)

The origin of genomes. Acquisition of new Genes. The origins of introns. Basic principles of protein structure.

Unit - II (8 lectures)

Restriction mapping, DNA & RNA fingerprinting, DNA sequencing-chemical and enzymatic methods, The Human Genome.

Unit - III (8 lectures)

Phylogeny, SAGE, ESTs, AFLP & RFLP analysis. 2D – gel electrophoresis and mass spectroscopy for proteome analysis.

Unit - IV(10 lectures)

Modeling of three-dimensional structure of a protein from amino acid sequence. Modeling mutants. Designing proteins. Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Unit - V: (8 lectures)

Protein – protein interactions: Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Recommended Books

Text: Genes & Genomes, Maxine Singer and Paul Berg

Genomes & proteomics: From protein sequence to function - S R Pennington & M. J. Dunn

References: Genomes II, T.A. Brown

Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.

Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.

A Primer of Genome Science, Greg Gibson and Spencer V. Muse

DNA: Structure and Function, Richard R. Sinden

Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown

Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.

Proteomics, T. Palzkill, Kluwer Academic Publishers

Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

GENOMICS AND PROTEOMICS LAB

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: BTY311

- Electrophoretic separation of plasmid DNA.
- Restriction, digestion & ligation of DNA.
- Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.
- Comparison of two given genomes- Mummer.
- Homology modeling of 3-D structure from amino acid sequence: SWISS-MODELLER
- Graphics tools: SWISS- PDB Viewer.

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**Paper: Reproductive Biology of
Angiosperms**

Paper code: BOT313

L	T	P	Credits	Marks	Minimu m marks
4	1	0	4	100	40

Objective:

To acquaint the students about the structure and development of different floral parts of angiosperms.

Learning Outcome

The study will make the students learn the morphology, structure, development of stamen and carpel, and fruit and seed.

Instruction for candidates:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

UNIT I

Phanerogams, the seed bearing plants: General characteristics; Historical account of embryology of angiosperms. **(3 Lectures)**

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Flower: Structure, Flower as modified shoot; Varieties of flower; Evolution, variations, genetic control of floral organs; Functions of flower; Inflorescence types. (6 Lectures)

UNIT-II

Stamen: Morphology, evolutionary trends, structure and development of anther tapetum; Microsporogenesis, structure and development of male gametophyte and aberrations; pollen tube growth. (5 Lectures)

Pollen: Structural organization, germinal furrows, wall development and ornamentation, role of callose and tapetum pollen development; pollen agglutinations, germination and storage, and allergenic aspects. (3 Lectures)

Carpel: Morphology, evolutionary trends; Structure, development and type of ovules; placentation; Archosporium; Megasporogenesis and embryo sac ontogenies; gene function and organization. (7 Lectures)

UNIT-III

Pollination: Anther dehiscence, pollen transfer mechanisms, pollinators, control of pollination; pollen pistil interaction. (2 Lectures)

Fertilization: Structure of stigma and style, stigma receptivity, post-pollination events leading to fertilization, syngamy and triple fusion; agamospermy and parthenocarpy, pseudogamy. (8 Lectures)

UNIT-IV

Endosperm: Types of development, cytology, and functions. (3 Lectures)

Embryogeny: Zygote, its structural organization, proembryo types, embryo development in monocots and dicots, nutrition of embryo.

Fruits: Development and maturation; Different types of fruits. (6 Lectures)

Paper: Reproductive Biology of Angiosperms Lab

DAV UNIVERSITY, JALANDHAR

Paper code: BOT314

1. Study of basic structure of different flowers.

2. Study of pollen grains and various pollen agglutinations.

3. Study of various developmental stages; microsporogenesis, megasporogenesis and embryo development.

L	T	P	Credits	Marks	Minimum marks
0	0	3	2	50	20

Suggested Readings

1. Barrett, S.C.H. Major Evolutionary Transitions in Flowering Plant Reproduction. Univ. of Chicago Press, 2008.
2. Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms, Vikas Publishing House, New Delhi, 1992.
3. Harder, L.D. and Barrett, S.C.H. Ecology and Evolution of Flowers, Oxford Univ. Press, 2006.
4. Johri, B.M. (Ed.). Embryology of Angiosperms, Springer - Verlag, Berlin, 1984.
5. Maheshwari, P. An Introduction to the Embryology of Angiosperm, McGraw-Hill Inc., New York, 1950.
6. Maheshwari, P. Recent Advances in the Embryology of Angiosperms, Int. Soc. Pl. Morphology, Delhi, 1963.
7. Raghavan, V. Developmental Biology of Flowering Plants, Springer Verlag, New York, 2000.

This syllabus has been designed as per national syllabus suggested by UGC and cover 20% extra syllabus as per requisite of honour degree.