Name of faculty: Science	**Department:** Biotechnology
Program: B.Sc. Biotechnology	**Type:** Theory + Practical
Subject: DSC-5 Plant Science Paper -II	**Semester:** 3
Credit: 04 + 02	**Total learning hours:** 60

Course Description:

The main objective of this course will be to inculcate strong fundamentals on modern and classical aspects of Plant biology. Further it will create a platform for higher studies in plant physiology, plant morphology, metabolic processes, nutrient assimilation and stress physiology.

Student Learning Outcome: After completion of this course the students will be able to:

- Understand the various physiological and biochemical pathways in plants
- Differentiate between different floral parts and pre and post fertilization developmental changes
- Understand the morphology, structure and functions of various parts of plants.
- Learn the complex regulations and changes for stress physiology in plants
- Learn different types of tissues and their role of mineral nutrition and solute transport in different organs of plants

UNIT-1: Plant Morphology (8 hrs)

1.1 Shoot system - Parts and functions
1.2 Root system- types, functions and modifications
1.3 Flower- Parts and functions, Development of structure of embryo sac
1.4 Fertilization, Double fertilization, Reduction Division

UNIT-2: Plant-Water Relations (7 hrs)

2.1 Structure, properties and role of water in plants
2.2 Diffusion, Osmosis, water potential and its components, Turgor pressure, Wall pressure and interrelationship
2.3 Water uptake and transport, Ascent of sap theories, Transpiration mechanism and its regulation, Factors influencing transpiration rate
2.4 Stomatal structure – mechanism of stomatal movement; anti-transpirants

Unit 3: Mineral nutrition and Solute transport (7 hrs)

3.1 General roles of mineral elements in plants Macronutrients and micronutrients
3.2 Essential nutrients and their deficiency symptoms
3.3 Role and interaction of soil, roots and microbes with mineral elements.
3.4 Ion transport in roots, Hydroponics and aeroponics

Unit 4: Tissues and types (8 hrs)

4.1 Meristematic tissue and Classification of Meristems
4.2 Apical meristems of Stem and Root
4.3 Permanent tissue and classification types Simple, Complex and Secretory tissues
4.3 Anatomical differences of dicot and monocots leaf and roots

Unit 5: Metabolic Processes (8 hrs)
5.1 Structure of chloroplast; Action spectra, Absorption spectra
5.2 Photosynthesis: photosynthetic pigments, O_2 evolution, photophosphorylation, CO_2 fixation - C3- C4 and CAM plants
5.3 Significance of Carbon fixation, Photorespiration and its significance
5.4 Salient features of Starch and Sucrose synthesis sites

Unit-6: Growth and Regulation (7 hrs)
6.1 Physiological role of Phytohormones, Auxins, Kinetin, Gibberellins, ABA and Ethylene: action and their application
6.2 Seed germination, Seed dormancy, breaking dormancy
6.3 Physiological basis of germination
6.4 Embryogenesis, stages of embryogenesis, Parthenocarpy, abscission and senescence

Unit 7: Nutrient Assimilation and Photomorphogenesis (8 hrs)
7.1 Nitrogen metabolism : atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation
7.2 Concept of photomorphogenesis
7.3 Phytochrome and its properties, photoperiodism and vernalization
7.4 Florigen theory of flowering

Unit 8: Stress Physiology (8 hrs)
8.1 Water deficit and drought tolerance
8.2 Role of ABA during water deficit and changes in the gene expression
8.3 ABA dependent and ABA independent signalling for stress regulation
8.4 Morphological, biochemical and molecular changes during Heat, Chilling, freezing, and salinity stress

References and Textbooks:

- Salisbury,P.B. & Ross,C.W. (1992).Plant Physiology 4th Edition, Wadsworth Publishing, California. ISBN: 9788123910437
- Hopkins, W.G.(1995). Introduction to Plant Physiology 4th Edition, John Wiley & Sons, New York. ISBN: 978-0470247662
- Pandey, S.N. & Sinha, B.K.(2016).Plant Physiology 4th Edition, Vikas Publishing House Pvt. Ltd, New Delhi, ISBN: 9788125918790
- Verma, S.K. & Verma, M. (2012). A Text book of Plant Physiology, Biochemistry and Biotechnology, S.Chand & Company, Ltd., New Delhi. ISBN: 9788121906272
- Noggle, G.R. & Fritz, G.J. (1986). Introductory Plant Physiology. Prentice-Hall of India Pvt Ltd, New Delhi. ISBN: 9780135020968
- Devlin, R.M. & Witham, F.H. (1986). Plant Physiology. CBS Publishers & Distributors, New Delhi. ISBN: 9780871507655
- Lincoln Taiz, Eduardo Zaiger, Ian Moller, Angus Murphy. (2018) Plant Physiology 6th Edition, Sinqaur Associates Inc. Publishers. ISBN: 9781605357454

Practicals:

1. Determination of osmotic potential of plant cell sap by plasmolytic method using leaves of *Rhoeo / Tradescantia* and by potato osmoscope experiment
2. Structure of stomata (dicot & monocot) using specimen/permanent slides/ Photographs.
3. Determination of rate of transpiration using cobalt chloride method.

Reference and Textbooks for Practical:

- R. Sivakumar, P. Boominathan, C.N Chandrasekar, Practical Plant Physiology, Narendra Publishing, ISBN: 9789384337247
- N.K. Gupta, M.K. Sangha, Manju Bala, Sunita Gupta, Practical In Plant Physiology And Biochemistry, Scientific Publishers (India), ISBN: 978-9386102638

Name of the Faculty: Science	**Department:** Biotechnology
Program: B.Sc. Biotechnology	**Type:** Theory + Practical
Subject: DSC-6 Animal Science – II	**Semester:** 3
Credit: 04 + 02	**Total Learning Hours:** 60
Course Description: The course will provide fundamental understanding in the fields of animal physiology, histology & anatomy. Students will gain knowledge about the basics of reproduction. These will prepare students for further advanced research & learning. Also it will provide a base for many entrance exams & summer internships.	
Student Learning Outcome: After completion of this course student will ● Will be well informed about the fundamental knowledge of animal tissues, histology, anatomy, physiology & behaviour. ● Get basic information about anatomy, physiology & reproduction of humans. ● Develop thinking abilities of the student for research in the areas of physiology & reproduction & also help him/her in answering the questions at entrance exams where such topics are included.	

Unit 1 Animal Behaviour (07 Hours)

1.1 Types of behaviour – Innate & learned, tropism, taxis, reflexes, instincts, acquired/learned- conditioning

1.2 Social Behaviour- Social organization of termites & monkeys

1.3 Biological Communication – Tail Waggle dance of honey bee, communication in mormyrid electric fish

1.4 Sexual Behaviour – Mating behaviour in Stickleback fish, Mating Activities of Balloon Fly

1.5 Birds migration

Unit – 2 General Anatomy (07 Hours)

2.1 Derivatives of Integument with respect to glands and digital tips

2.2 Brief account of Gills, lungs, air sacs and swim bladder

2.3 Types of Receptors & Sense Organs (Compound & simple, human, Ears/ nose)

2.4 Organization & Microscopic anatomy of Skeletal Muscle Fibre

2.5 Dentition in mammals

Unit 3 Human Anatomy (07 Hours)

3.1 Structure & Internal Anatomy of Heart

3.2 Brain & Hypothalamus

3.3 Male reproductive system

3.4 Female reproductive system

3.5 Lymphatic System with special emphasis on Thymus & Spleen

Unit 4 Tissue System (09 Hours)

4.1 Epithelial Tissue

4.2 Connective Tissue -I

4.3 Connective Tissue- II

4.4 Nervous & Muscle Tissue

4.5 Histology of Stomach, Intestine, Liver, Kidney, Testis & Ovary

Unit- 5 Human Physiology (08 Hours)

5.1 Fluid, Electrolyte & Acid-Base Homeostasis

5.2 Sliding theory of muscle contraction & Muscle Metabolism
5.3 Cardiac Cycle & Cardiac output
5.4 Propagation of Action & Graded potential, Signal Transmission at Synapse
5.5 Neurotransmitters, Neuroplasticity & Reflex Action

Unit 6 Endocrinology (07 Hours)
(Structure of Glands, Hormones & their Functions)
6.1Introduction
6.2 Pituitary Gland
6.3 Thyroid & Parathyroid glands
6.4 Adrenal Gland
6.5 Pancreas

Unit 7 Reproductive Physiology (08 Hours)
7.1 Gametogenesis (Spermatogenesis & Oogenesis)
7.2 Reproductive Cycles (Estrous, Rut & Menstrual Cycle)
7.3 Fertilization
7.4 Cleavage, Blastula & Gastrula
7.5 Regeneration

Unit 8 Animal Physiology (07 Hours)
8.1 Bioluminescence
8.2 Osmoregulation in Aquatic Animals
8.3 Biological Clocks- Circadian Rhythms, Lunar Rhythms
8.4 Parthenogenesis
8.5 Metamorphosis

List of References & Text Books

- Chordate Embryology Developmental Biology by P S Verma & V K Agarwal, S. Chand Pub.
- Principles of Anatomy & Physiology by Gerad J Tortora & Bryan H Derrickson, Wiley Pub.
- Text Book of Medical Physiology by Guyton & Hall, Elsavier
- Developmental Biology by Scott F Gilbert, Sinauer Associates Inc.
- An Introduction to embryology by B. I Balinsky,Cangage Learning India
- Animal Behaviour by Dr V. K Agarwal, S Chand Pub.
- Animal Behaviour by M.P. Arora , Himalaya Pub. House

List of Open Source Software/ Learning Websites

- https://youtu.be/k_h0xbHqsZA Animal Physiology Lecture series by Prof.Mainal Das, Dept. of Biotech., IIT Kanpur
- https://youtu.be/BKxpNsZvA1k Developmental Biology Lecure series by Prof. Subramanium, IITM

Practicals
1) Histology of Different Tissues with the help of Slides/ charts & study of Microtome
2) Study of integument derivatives, gills, swim bladder, air sac, compound eye by charts, slides/ specimen
3) To study Reaction Time & Reflex Action

References & Textbooks for Practicals

- Practical Zoology: Vertebrates by S S Lal, Rastogi Publications
- Practical Zoology Volume III by S S Lal, Rastogi Publications

Name of the Faculty: Science	**Department:** Environmental Science
Program: B.Sc.	**Type:** Theory + Practical
Subject: SEC-1 Environmental Microbiology	**Semester:** 3
Credit: 04 + 02	**Total Learning Hours:** 60

Student Learning Outcome: After completion of this course student will

- Have Basic understanding of microbiology of air, water and soil
- Know microbial hazards of environmental origin
- Know treatment of drinking water
- Have basic concept of indicator microorganisms
- Learn sampling and cultural methods for the detection of microorganisms in environmental samples

Unit-1 Soil Microbiology

1.1 Historical perspective and modern environmental microbiology
1.2 Soil as a microbial environment
1.3 Microorganisms in surface soils
1.4 Distribution of microorganisms in soil
1.5 Microorganisms in subsurface environment

Unit-2 Aeromicrobiology

2.1 Important airborne pathogens and toxins
2.2 Aerosols and their nature
2.3 Bioaerosol control
2.4 Biosafety in laboratory

Unit-3 Aquatic Microbiology

3.1 Introduction to aquatic microbiology
3.2 Microbial habitats in the Aquatic Environments
3.3 Aquatic Environments
3.4 Aquatic microbes as future foods

Unit-4 Environmentally Transmitted Pathogens

4.1 Environmentally transmitted bacteria
4.2 Parasitology
4.3 Environmentally transmitted viruses
4.4 Transport of pathogens in environment

Unit-5 Indicator Microorganisms

5.1 Coliforms
5.2 Fecal Streptococci
5.3 Other potential indicator organisms
5.4 Standards and criteria for indicators

Unit-6 Drinking Water Treatment

6.1 Water treatment processes
6.2 Water treatment requirements

6.3 Water distribution systems
6.4 Microbial growth in distribution systems

Unit-7 Environmental Sample Collection and Processing

7.1 Sampling of soils and sediments
7.2 Sampling strategies and methods for water
7.3 Devices for collection of air samples
7.4 Detection of microorganisms on fomites

Unit-8 Cultural Methods for Detection of Microorganisms

8.1 Cultural methods for bacteria
8.2 Culture media for bacteria
8.3 Cultural methods for fungi
8.4 Cultural methods for algae and cyanobacteria

References and Textbooks: (With Author, Edition, Publishers, ISBN)

- Pepper IL, Gerba CP, Gentry TJ, Maier RM, editors. Environmental microbiology. Academic press; 2011 Oct 13. 978-0123705198

Practicals:

1. Heterotrophic plate count of soils
2. Study of microorganisms present in ambient air by settling plate method
3. Enumeration of coliforms by MPN method

Name of Faculty: Science	**Department:** Biotechnology
Program: B.Sc. Biotechnology	**Type:** Theory
Subject: DSE-3 Developmental Biology	**Semester:** 3
Credit: 02	**Total Learning Hours:** 30

Course Description:
Students will be able to understand & know important phenomena of embryology & developmental biology. Students will gain knowledge about the basic concepts of gamete formation, fertilization, germ layers & organ formation.

Student Learning Outcome: After completion of this course the students will

- Be educated about fundamental concepts & applications of embryology & developmental features of animals & plants.
- Be able to face entrance exams like NET/ SLET & students will be able to write concepts for summer internships.
- Be prepared for important advanced subjects like stem cell research, IVR, ART & research in reproductive & developmental fields.
- Be able to use this knowledge in advanced experiments of animal & plant biotechnology.

Unit – 1 Introduction to Developmental Biology (02 Hours)
1.1 Definitions, Historical review & Branches of Embryology
1.2 Landmark Theories of Embryology
1.3 Applications of Developmental Biology
1.4 Methods in the study of Embryonic Development

Unit-2 Basic Concepts of Development (04 Hours)
2.1 Developmental dynamics of cell specification
2.2 Morphogenesis & cell adhesion
2.3 Gradient Theory
2.4 Embryonic Induction & competence
2.5 Differentiation

Unit-3 Gametogenesis & Fertilization (04 Hours)
3.1 Spermatogenesis & Oogenesis
3.2 Eggs & Sperms (Structure & Types)
3.3 Monospermy & Polyspermy
3.4 Mammalian Fertilization

Unit-4 Genetics of Axis Specification in Drosophila (04 Hours)
4.1 Primary Axis Formation during Oogenesis
4.2 Generating dorsal-ventral pattern in the embryo
4.3 Segmentation & anterior-posterior body plan

Unit-5 Chick Embryology (04 Hours)
5.1 Structure & chemistry (Unfertilized & Fertilized) Egg
5.2 Cleavage & Blastulation
5.3 Gastrulation
5.4 Neurulation
5.5 Development of chick according to hours of incubation (24, 48, 72 hours)

Unit- 6 Organogenesis of Frog (04 Hours)
6.1 Development of Appendages/ Limb
6.2 Development of Heart
6.3 Development of accessory organs of Alimentary Canal

Unit- 7 Fertilization & Post Fertilization Development in Plants (04 Hours)
7.1 Flower structure and reproductive parts
7.2 Sporogenesis, Gametogenesis, Fertilization & Double fertilization
7.3 Seed, embryo and endosperm development in dicot and monocot seeds
7.4 Germination: Types, factors necessary for germination

Unit- 8 Plants Morphogenesis & Organogenesis (04 Hours)
8.1 Floral evocation, floral meristems and types of floral organs
8.2 Fruit: Development, Dehiscence and classification of fruit (three groups)
8.3 Circadian rhythms, Photoperiodism, Classification of plants according to their photoperiodic response
8.4 Vernalization, Biochemical signalling involved in flowering: concept of florigen

References & Text Books

- P S Verma & V K Agarwal, Chordate Embryology Developmental Biology, S. Chand Publishers, ISBN: 9788121902618
- S.F Gilbert & M.J.F Barresi, Developmental Biology, 11th Edition, Sinauer Associates Inc. ISBN: 9781605356044
- B. I Balinsky, B.C Fabian, An Introduction to embryology 5th edition (2012), Cengage India, ISBN: 978-8131517499
- Lincoln Taiz, Eduardo Zaiger, Ian Moller, Angus Murphy. (2018) Plant Physiology 6th Edition, Sinqaur Associates Inc. Publishers. ISBN: 9781605357454
- Dutta,A.C.; A Class book of Botany; 17th edition; Calcutta: Oxford University Press, 1976, ISBN: 978-0195653076
- Buchanan, B.B., Gruissem, W. and Jones, R.L. -Eds. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, USA. John Wiley & Sons Inc, United States, ISBN: 9780470714218
- Westhoff, P. (1998) Molecular Plant Development: from gene to plant. Oxford University Press, UK. ISBN: 0198502036
- Turnbill, G.N. -Ed. (2005) Plant Architecture and its Manipulation, ARPP Rev. Vol.17, Blackwell Publ. CRC Press, USA. ISBN: 1405121289

List of Open Source Software/ Learning Websites

- https://www.youtube.com/channel/UCA_hJn1x6DaOhVvB6TWYt1w/feed
- https://youtu.be/BKxpNsZvA1k Developmental Biology Lecture series by Prof. Subramanium, IITM

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc.	**Type:** Theory
Subject: DSE-3 Food and Dairy Microbiology	**Semester-**3
Credit: 02	**Total learning hours:** 30

Course description:
This paper covers the principles of food fermentation and the role of beneficial microbes; the role of microorganisms and food spoilage; pathogenic microorganisms, infection and intoxication, the principles to control microbial growth; as well as food safety and quality management. Provide students with theoretical knowledge and practical abilities required to work in the food industry, research centers, and food-related national and international organizations.

Student learning outcome:

- Important pathogens and spoilage microorganisms in foods and the conditions under which they will grow, conditions under which the important pathogens are commonly inactivated, killed or made harmless in food.
- Principles involving food preservation and understanding the role and significance of microbial inactivation, adaptation and environmental factors on growth and response of microorganisms in various environments.
- Principles of food science to control and assure the quality of food products and safety standards to be followed in a food and Dairy industry.

Unit-1:Introduction and scope of Food Microbiology (Duration: 02 Hrs)

1.1 Definition of food

1.2 Basic Food categories and its group

1.3 Food as a substrate for microorganisms

Unit-2: Principles of food preservation-I (Duration:04 Hrs)

2.1 Introduction to Principles of food preservation

2.2 Asepsis, Removal of microorganisms and Anaerobic condition for preservation

2.3 Preservation by use of high temperature and

2.4 Preservation by use of low-temperature

Unit-3:Principles of food preservation-II (Duration:03 Hrs)

3.1 Preservation by drying

3.2 Preservation by drying radiation

3.3 Preservation by food Additives

Unit-4: Microbial spoilage of foods (Duration: 06 Hrs)

4.1 Contamination and Spoilage of food:

4.2 Spoilage of Cereals and Cereal Products

4.3 Spoilage of Vegetables and fruits

4.4 Spoilage of canned foods

4.5 **F**ood in relation to Disease: Food borne Illness
4.6 Food-borne poisoning, Infection and Intoxication

Unit-5:Use of Microorganisms As Food And Food Supplements (Duration:04 Hrs)
5.1 Single cell protein
5.2 List of fermented foods
5.3 Production of breads

Unit-6: Dairy microbiology (Duration:06 Hrs)
6.1 Definition, types of Milk and its Classification
6.2 Indian standards for market milk
6.3 Milk Components and its nutritive value
6.4 Types of Microorganisms present in Raw Milk
6.5 Contamination, Spoilage and Preservation of milk and milk products
6.6 Fermented Dairy Products: Fermented milks and Cheese

Unit-7: Advances in Dairy Technology (Duration:03 Hrs)
7.1 Self-life prediction methods for milk
7.2 Microbial control by new non thermal methods
7.3 Concept of Probiotics

Unit-8: Microbial standards for food safety and quality management: (Duration: 02 Hrs)

8.1 Indicators of Food Microbial Quality and safety
8.2 Hazard Analysis and Critical Control Points (HACCP)

Reference Book:

Doyle M.P. and Buchanan R.L. (2013), Food Microbiology:Fundamentals and Frontiers, American Society for Microbiology; 4th Ed.

Dubey, R.C. (2010). Textbook of Biotechnology, S. Chand. Multicolor 1st Ed.

Frazier, W. C. and Westhoff, D. C., (2014). Food Microbiology, 5th Ed., Tata Mc-Graw Hill, India.

James M. Jay (2000) Modern Food Microbiology.6th Ed., AN ASPEN PUBLICATION® Aspen Publishers, Inc. Gaithersburg, Maryland.

Manoranjan, K. (2002). Food Analysis and Quality Control,1st Ed., Agrotech Publishing Academy.

Microorganisms in Foods 7: Microbiological Testing in Food Safety Management, by International Commission for the Microbiological Specifications of Foods (ICMSF), Springer; 1st ed. (2012) (ISBN-13 : 978-1461352211).

Modi H.A. (2009),Dairy Microbiology, pointer publishers, ISBN-13 : 978-8179102893

Robinson, R. K. (Ed.). (2005). *Dairy microbiology handbook: the microbiology of milk and milk products*. John Wiley & Sons.
Singh B.D. (2010),Biotechnology expanding Horizons, kalyani publishers, ISBN-13 : 978-8127261535
Sukumar De. (2013). Outlines of Dairy Technology, Oxford university. (ISBN:978-0-
19561194-6
Wiley, J., Sherwood, L. & Woolverton C., (2017). Prescott, Harley, and Klein's Microbiology, 10th Ed., McGraw-Hill Science/Engineering/Math.

For Further Reading:

Adams, M. R., & Moss, M. O. (2003). *Food microbiology*. PANIMA PUBLISHING CORPORATION; 2nd Ed.(ISBN-13 : 978-8186535370)
Marth, E. H., & Steele, J. (Eds.). (2001). *Applied dairy microbiology*. CRC Press.
Pelczar, M. J., & Chan, E. C. S. (1998). *Microbiology,* 5Ed., Tata-McGraw-Hill.
Purohit, S. S., (2006). *Microbiology: Fundamentals and Applications*, 7Ed., Agrobios
(India).
Spreer, E. (2017). *Milk and dairy product technology*. Routledge.
Walstra, P., Walstra, P., Wouters, J. T., & Geurts, T. J. (2005). *Dairy science and technology*. CRC press.

****

Name of faculty: Science	**Department:** Chemistry
Program: B.Sc.	**Type:** Theory
Subject: DSE-3: Textile & Dye Chemistry	**Semester-**3
Credit: 02	**Total learning hours:** 30
Course description: This course is about textile and dye chemistry which includes different types of dyes, dyeing process and its basic operations.	
Student learning outcome At the end of the course students will be able to: 1. Apply basics and illustrate the modifications in pre-treatment operation 2. Describe the developments in various dyes and dyeing process 3. Distinguish the various dye classes and their application to different fibres types. 4. Learn Basic operation in Dyeing process & Methods of dyeing Recent developments in dyeing techniques	

Unit-1 Introduction to Dye Chemistry **(05Hrs)**

1.1 Dye-Definition

1.2 Requirement of an ideal dyes (colour, solubility, linearity, coplanarity, fastness, substantively, economic viability)

1.3 Explanation of nomenclature or abbreviation of commercial dyes with at least one example

1.4 Classification of fibers and chemical structure of cellulose like Cotton, Jute etc.

1.5 Chemical structure of manmade fibers-Rayon, polyamide, polyester & polyacrylonitrile.

1.6 Classification of Dyes

1.7 Intermolecular forces related to dyeing, dye-fiber bonds, adsorption at surfaces

1.8 Mechanism of Direct, reactive, acid, disperse and other dyes on specific fibers

Unit-2 Dyeing Process **(04Hrs)**

2.1 Influence of fibre structure on dyeing

2.2 Effect of processes on fibre properties before dyeing and during dyeing

2.3 Solubility parameter and cohesive energy density interaction between dyes and polymers

2.4 Dye sorption, diffusion and rate of dyeing

Unit-3 Thermodynamics of Dyeing **(04Hrs)**

3.1 Thermodynamics of dyeing

3.2 Concept of free energy

3.3 Surface chemistry

3.4 Kinetics of dyeing

Unit-4 Operation in Dyeing process **(04Hrs)**

4.1 Basic operation in Dyeing process

4.1.1 Preparation of the fibres

4.1.2 Preparation of the dyebath
4.1.3 Application of the dye
4.1.4 Finishing

4.2 Methods of dyeing
4.2.1 Direct Dyeing
4.2.2 Vat Dyeing
4.2.3 Mordant Dyeing
4.2.4 Disperse Dyeing
4.2.5 Formation of dye on fibres
4.2.6 Dyeing of the wool with acid dyes
4.2.7 Dyeing with reactive dyes

Unit-5 Colour and Constitution of Dyes (04Hrs)

5.1 Study of Bathochromic, Hypsochromic, Hypochromic and hyperchromic effect with examples

5.2 Colour and chemical constitution
5.2.1 Definition of colour, colour and wavelength of radiation
5.2.2 Colour absorbed and colour visualized with respect to wavelength region.
5.2.3 Relation between colour and chemical constitution
5.2.4 Armstrong theory and US limitation
5.2.5 Witt's theory
5.2.6 Action of Light on dyes and dyed fibers

Unit-6 Recent Developments in Dyeing Techniques (03Hrs)

6.1 Introduction
6.2 Ultrasonic assisted dyeing
6.3 Microwave dyeing

Unit-7 Natural Dyes (03Hrs)

7.1 Medicinal properties of Natural Dyes
7.2 Basics of Natural Dyeing
7.3 Methods of Extraction of Natural dyes
7.4 Standardization of Natural dyes
7.5 Continuous dyeing and its adaptation for Natural dyeing

Unit-8 Health and Environmental Hazard of Synthetic Dyes & Remediation (03Hrs)

8.1 Processes
8.2 Impact of the textile and leather dye industry on the Environment with special emphasis on water pollution
8.3 Health Hazards: Toxicity of dyes with respect to food colours

Reference Books:

1. Chemistry of Synthetic Dyes and Pigments, Lubs H. A., Robert E, 1977, Krieger Publishing Company
2. Chemistry of Synthetic Dyes – Vol I, Venkataraman, K., 1952, Academic Press
3. Chemistry of Synthetic Dyes – Vol III, Venkataraman, K., 1952, Academic Press
4. Colour and Chemical Constitution of Organic Dyes, Griffiths J., 1976, Academic Press,
5. Color Chemistry –Synthesis, Properties and Applications of Dyes and Pigments, Zollinger H., 2nd ed., 1991,Weinheim – VCH,
6. Textiles, 10th edition, Kadolph, Sara J., edn., 2007, Pearson/Prentice-Hall, 2007, ISBN 0-13- 118769-4.
7. Synthetic organic chemistry, O.P. Agrawal, 2014, Krishan Prakashan
8. The chemistry of synthetic dyes and pigments, H. A. Lubes, 1955, New York:Reinhold Publishing
9. An introduction to synthetic dyes, D. W. Ranghekar & P. P. Singh, 1980, Himalaya Pub.
10. Chemistry of dyes & Principles of dyeing Vol II, V. A. Shehai, 1983, Sevak Publications
11. Chemistry of synthetic dyes, I. G. Vashi,
12. Chemistry of dyes and pigments, K. M. Shah, 2013, Edu. Tech Publishing
13. Synthetic dyes, G. R. Chatwal, 2009, Himalaya Publishing House

Name of faculty: Science	**Department:** Environmental Science
Program: B.Sc.	**Type:** Theory
Subject: DSE-3: Agriculture and forestry	**Semester-**3
Credit: 02	**Total learning hours:** 30

Student learning outcome

- This course will develop student's exploring capacity in the field of agriculture and forest.
- The course will increase knowledge of agricultural practices and agricultural economic values in students.
- The course will develop the exploring capacity of students in wildlife and its protection movements.

Unit-1: Introduction to Agriculture (7 Lecture)

1.1 Origin, history and world agricultural system
1.2 Factors affecting to crop production
1.3 Environmental pollution and associated hazards on Agriculture
1.4 Ecological and socioeconomic dimensions of Agriculture.

UNIT-2: Principles of agronomy (7 Lecture)

2.1 Meaning, definition and scope of agronomy
2.2 Agronomic classification of crops
2.3 Tillage: types, implementation and characteristics of crop
2.4 Crop nutrition and Integrated Nutrient Management

UNIT-3 Weed Management (7 Lecture)

3.1 Introduction and classification of weed
3.2 Methods of weed control
3.3 Integrated weed management(IWM)
3.4 Herbicides: classification and methods of application

UNIT-4 Organic farming and soil health (7 Lecture)

4.1 Concept, practice and management of organic farming
4.2 Manures and compost: types and enrichment methods
4.3 Integrated Nutrient Management (INM) and Integrated Plant Nutrient supply system (IPNS)
4 .4 Soil health concept and assessment

UNIT-5 Agroforestry (7 Lecture)

5.1 Introduction and Classification of agroforestry system
5.2 Tree architecture and canopy management

5.3 agroforestry design and diagnosis in different climatic zones
5.4 Social forestry: components and achievements

UNIT-6 Introduction to Forestry (7 Lecture)
6.1 History of forestry and classification of forest
6.2 Indian and World scenario in forest
6.3 Biogeographic classifications of India and wild life in India
6.4 Forest economics: basic concept, national income and types of inflation.

Unit-7 Wildlife Management (7 Lecture)
7.1 Introduction and biological basis of wildlife management
7.2 Agencies involved in wildlife conservation.
7.3 Captive wildlife
7.4 Wildlife conflict and wildlife census

Unit-8 Carbon forestry and global climate change (7 Lecture)
8.1 Forests and global carbon cycle: flow, flux, sink, offset, fertilization, footprint and CCS
8.2 Forest soil as carbon reservoirs
8.3 Global climate change, politics and the earth reservoirs
8.4 Global climate change mechanism: CDM & REDD+

References and Textbooks: (With Author, Edition, Publishers, ISBN)

1. Balasubramaniyan, P and Palaniappan, S.P.. 2001. Principles and Practices of Agronomy. AgroBios(India)Ltd., Jodhpur.
2. Brady, N.C. and Well, R.R. 2002. The Nature and Properties of Soils (13th ed.). Pearson Education, Delhi.
3. De, G.C.1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi.
4. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7thed.). Pearson Education, Delhi.
5. ICAR.2006. Hand book of Agriculture, ICAR, New Delhi.
6. Aldrich, R.J. and Kramer, R.J. 1997. Principles in Weed Management. Panama Publications, New Delhi.
7. Rao, V.S. 2000. Principles of Weed science (2nd ed.). Oxford & IBH Publishing Co. New Delhi.
8. Reddy, S.R. 1999. Principles of Agronomy. Kalyani Publishers, Ludhiana
9. Ashton,M.S., Tyrrell,M.L., Spalding D., Gentry, B. (Eds.)(2012) Managing Forest Carbon in a changing climate. Springer Dordrecht Heidelberg London New York.

Practicals:

1. Bulk density, porosity and infiltration rate of agricultural soil
2. Determination of soil moisture by thermo-gravimetric method and volumetric methods.
3. Techniques of weed collection and preservation.
4. Survey of weeds in crop fields and other habitats- Identification and preparation of herbarium of weeds.
5. Estimation of carbon content (Organic/inorganic) in wood, soil, litter or forest based products.

Name of faculty: Science	**Department:** Chemistry
Program: B.Sc.	**Type:** Theory
Subject: DSE-3-Medicinal Chemistry	**Semester-**3
Credit: 02	**Total learning hours:** 30
Course description: This course is about Pharmaceutical chemistry which includes different types of drugs ex. General & local anesthetic, sedatives & hypnotic, analgesics & antipyretics, diuretics & antihypertensives and anticonvulsants & antihistamines.	
Student learning outcome: Student will learn following : ● Drug Receptors & Absorption ● Drug Discovery, Design & Development ● General & Local anesthetic ● Sedatives & Hypnotics ● Analgesics & Antipyretics ● Diuretics & Anti-hypertensives ● Anticonvulsants and Antihistamines	

Unit – 1: Introduction to Pharmaceutical Chemistry **(02 Hrs)**

1.1 Important Aspects of Pharmaceutical Chemistry
1.2 Importance of Chemistry in Pharmacy
1.3 Sources & Uses of Natural Drug Products
1.4 Biological, Geographical

Unit – 2: Drug Receptors & Absorption **(05 Hrs)**

2.1 Theories of Drug Action
2.2 Surface Active Agents
2.3 Metabolic Antagonism
2.4 Mechanism of Drug Action
2.5 Absorption of Drugs
2.6 Factors affecting Absorption

Unit – 3: Drug Discovery, Design & Development **(05 Hrs)**

3.1 Introduction
3.2 Molecular Modelling
3.3 Structure Activity Relationship
3.4 QSAR
3.5 Molecular Docking
3.6 Molecular Dynamics

Unit – 4: General & Local Anaesthetic **(03 Hrs)**

4.1 Classification Synthesis of Nitrous Oxide, Halothen, Thiopental Sodium & Chloroform
4.2 Classification of Local Anesthetic
4.3 Synthesis of procaine Hydrochloride, Benzocaine, Lignocaine Hydrochloride

Unit – 5: Sedatives & Hypnotics **(05 Hrs)**

5.1 Classification
5.2 SAR of Barbituric Acid Derivatives
5.3 Synthesis of Barbital, Allobarbital, HexoBarbital
5.4 SAR of Benzodiazepines
5.5 Synthesis of Diazepam, Alprazolam & Zolpidem
5.6 Synthesis of Phenobarbital & Phenytoin Sodium

Unit – 6: Analgesics & Antipyretics **(02 Hrs)**

6.1 Classification of Antipyretics & Analgesics
6.2 SAR of Morphine Analogue Salicylic Acid, Aryl Alkanoic Acid Derivatives
6.3 Synthesis of Aspirin & Paracetamol

Unit – 7: Diuretics & Anti-hypertensives **(03 Hrs)**

7.1 Classification of Diuretics
7.2 SAR, Synthesis & Uses of Hydrochlorothiazide, Hydroflumethiazide, Ethacrynic Acid, Furosemide, acetazolamide
7.3 Classification of Antihypertensives
7.4 SAR & Synthesis of Captopril, Propranolol Hydrochloride

Unit – 8: Anticonvulsants and Anti-histaminic **(05 Hrs)**

8.1 Introduction
8.2 Classification of Anticonvulsant
8.3 Synthesis of Phenobarbital & Phenytoin Sodium
8.4 Classification of Anti-histaminics
8.5 SAR of Ethanolamine Derivatives
8.6 Synthesis of Diphenhydramine Hydrochloride, Promethazine Hydrochloride

Reference Books:

1. Organic Chemistry, Seventh Edition, R.T.Morrison, R.N.Boyd, S.K.BhattacharjeeBy Pearson
2. Textbook of Organic Chemistry, By V.K.Ahluwalia, Ane Books Pvt. Ltd.
3. Organic Chemistry, Volume-1, Sixth Edition, By I.L.Finar, By Pearson
4. Introduction to Medicinal Chemistry, G.L. Patrick, 2013, Oxford University Press, UK.
5. Medicinal and Pharmaceutical Chemistry, Hakishan, V.K. Kapoor, 2017 Vallabh Prakashan
6. Principles of Medicinal Chemistry, William O. Foye, Thomas L., Lemke , David A. William, 2019, Walters Kluver
7. Medicinal Chemistry, A. Kar, 2018, New Age International Publishers
8. Pharmaceutical Chemistry, Chatwal, 2018, Himalaya Publishing
9. Essentials of Medical Pharmacology, Tripathi, 2018, Jaypee Brothers Medical Publishers
10. Medicinal Chemistry, Sriram & Yogeswari, 2010, Pearson
11. Wilson &Gisvold's TextBook of Organic & Medicinal Chemistry, 2010, Wolters Kluwer India Pvt. Ltd.