SEMESTER II			
Core V : Techniques in Biology			
Code: 17PZOC22	**Hrs/Week: 6**	**Hrs /Sem:90**	**Credits:4**

Objectives

- To inculcate research aptitude in students
- To introduce the principles and applications of various instruments used in Biology and to prepare them to use these techniques in their own research

Unit I **Research Designing**

Introduction – types, preparation of index cards, literature collection-sources – literature citation – manuscript preparation of research report, Internet and e-journals- thesis formating and typing – laboratory safety – biosafety levels – biohazardous wastes – safety measures in a laboratory

Unit II **Microscopy Types**

Principle, construction and applications of Phase contrast- Polarization –Electron microscope– types-fixation and staining techniques for EM (freeze –etching and freeze fracture), fluorescence - flow cytometry - atomic force and magnetic force microscope – micrometry.

Unit III **Spectroscopic Techniques**

Absorption and emission principles – construction and applications of UV-visible spectrophotometer-spectroflurometer-flame photometer-atomic absorption and emission spectrophotometer -NMR and Mass spectrometer in Biology

Unit IV **Centrifugation and Chromatographic Techniques**

Principles of centrifugation— ultra centrifuge, differential centrifugation- density gradient – isopycnic - Principle, instrumentation and application of chromatography – column - gas - liquid - HPLC – ion exchange-affinity- gel filteration.

Unit V **Electrophoresis & Radioactive Techniques**

Principle and applications of electrophoresis – agrose-PAGE- SDS-PAGE-isoelectric focusing- radioisotopes used in Biology GMcounter, solid and liquid scintillation counters – sample preparation for radioactive counting, autoradiography-calorimetry – bomb calorimeter , calorific value- applications.

Books for Reference

1. Palanichamy S. and M. Shanmugavelu. 1997.Research Methods in Biological Sciences. Palani Paramount Publication, Palani.
2. Keithwilson and John Walker, 2010 Principles and Techniques of Biochemistry and Molecular Biology. 7th Edition Cambridge University Press
3. Gurumani 2011. Research Methodology for Biological Sciences. M.J.P. Publishers, Chennai.
4. Palanivelu. P.Analytical Biochemistry and Separation Techniques.IV Edition 21st century Publications Palkalai Nagar, Madurai
5. Veerakumari. L 2007. Bioinstrumentation.M.J.PPublishers,Chennai.
6. AparnaMathur 2013.Laboratory Instrumentation. Black Prints .New Delhi
7. ChinmoyGoswami, AbhijitPaintalandRabindra Narain.2011 Hand Book of Bioinstrumentation. South Anarkali Delhi.
8. Debbie Holmes Peter Moody and Diana Dine, 2006. Research Methods for the Biosciences
9. RabindraNarain ,2012. Practical Immunolgy. Wisdom Press New Delhi

PRACTICALS

Hrs / Week - 2

1. Sub – cellular fractionation of rat liver (centrifugation)
2. Measurement of cell size by micrometry
3. Phase contrast microscopic observation of living cells
4. Estimation of lipids (Bragdon method)
5. Absorption spectra of proteins/ pigments
6. Column chromatographic separation of plant pigments.
7. Use of different instruments in research methodology.
    a. Electron microscope
    b. Spectrophotometer
    c. Chromatography
    d. HPLC
    e. PAGE Unit

SEMESTER II			
Core	**VIII**	**Microbiology**	
19PZOC24	**Hrs/ Week : 4**	**Hrs / Sem : 60**	**Credits : 4**

Vision : To prepare graduate students with thorough knowledge and understanding of the core concepts in the field of Microbiology

Mission : To equip the students with knowledge about Taxonomy, organization, multiplication and infection of microbes and to develop expertise in microbiological techniques.

Course Outcome :

CO.NO	Upon completion of this course, the students will be able to	PSO addressed	CL
CO- 1	classify micro organisms focusing on the modern trends of Taxonomy	1	Un
CO- 2	prepare media to be utilized in the cultivation of microorganisms	2	Ev
CO-3	understand the structural organization and life cycle of microorganisms	2	Un
CO-4	explain the role of microorganisms in fermentation, medicine and the production of microbial products	2	An
CO-5	gain familiarity with the unique role of pathogens in human infectious diseases	2	Ev
CO-6	identify the methodologies used in disease treatment and prevention	6	An
CO-7	demonstrate practical skills in the use of technologies and methods common to microbiology	8	Ev
CO-8	apply scientific methods in the design and execution of experiments	8	Ap

SEMESTER II			
Core VIII		Microbiology	
19PZOC24	Hrs/ Week : 4	Hrs / Sem : 60	Credits : 4

Unit I Classification

Classification of microorganism – Five Kingdom concept . Modern trends of bacterial Taxonomy- Ribosomal RNA and sequencing - Construction of phylogenetic tree. General characters of main groups of microorganisms.

Unit II Cultivation of microorganisms

Preparation of culture media – Isolation and maintenance of pure culture- Cultural and morphological characteristics of bacteria – Microscopic examination of microorganisms- gram staining- acid fast staining – spore staining - capsular staining – flagellar staining.

Unit III Microbes – Structural organization

Structural organization of bacteria, virus and fungi – Life cycle of Actinomycetes, yeast and mycoplasma.

Unit IV Production of microbial products

Yeast fermentation and its products – Production of alcohol, beer and wine. Mixed fermentation product- Production of vinegar. Production of antibiotics - penicillin and tetracycline.

Unit V Microbial diseases

Protozoan diseases- ameobiais and sleeping sickness. Bacterial diseases- diphtheria, tetanus and gonorrhea. Viral diseases- chikungunya, dengue fever, rabies and ebola. Fungal diseases- actinomycosis and aspergillosis.

Books for Reference

1. Arti Kapil. 2016. *Text Book of Microbiology*. 9th Edition. University Press. Hyderabad.
2. Dubey, R .C and D.K. Maheswari. 2006. *A Text Book of Microbiology.* S chand & Co New Delhi.
3. Roger Stainer, John Lingraham, Mark I Wheelis and Page R. Painter. 1992. *General Microbiology* Mac Millan, Hampshire, London.
4. Pelzer Chan and Krieg. 1998. *Microbiology.* 2nd Edition. Tata MC Grow Hill Publishing Company, New Delhi.
5. Presscott Harley and Klein. 2005. *Microbiology.* WCB MC Graw Hill Co New York.
6. Purohit, S.S. 1991. *Microbiology – Fundamentals and Application*. M/ S Saraswathi Publication, India

7. Power, C.B, and K.F. Daginawala. 1988. *General Microbiology* . Vol I & II. Himalaya Publishing House, Mumbai.
8. Vijaya Ramesh. 2007. *Food Microbiology.* MJP Publishers, Chennai.

PRACTICALS

Hrs / Week : 2 **Credit: 1**

1. Sterilization Techniques

2. Sample handling for microbial studies

3. Preparation of culture media:

Nutrient broth, Nutrient agar, Potato dextrose agar, Mullen- Hinters agar

4. Counting of viable cells (CFU/ ml) by serial dilution & spread plate or pour plate methods

5. Gram staining

6. Spore staining

7. Simple biochemical tests of bacteria

a Acid and gas production in glucose broth

b Starch hydrolysis

c Catalase

d Nitrate reduction

8. Dye reduction test in milk

9. Test for antibiotic sensitivity

10. Isolation of symbiotic nitrogen fixing bacteria from root nodules

11. Observation of algae, fungi and blue green algae

Books for Reference:

1. Kannan N. 1996. *Laboratory Manual in General Microbiology.* Palani Paramount Publications, Palani.
2. James Cappuccino and Natalie Sherman. 1990. *Microbiology A Laboratory Manual*. Addison - Wesly- Hyman Inc,Tokyo.
3. Dubey R.C. and D.K. Maheswari. 2008. *Practical Microbiology*. S Chand & Company Ltd., New Delhi.

SEMESTER – III			
Core XII : Research Methodology			
Code : 19PZOC34	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

Vision

To inculcate research aptitude in students

To be leaders in making use of various scientific techniques and research methods available to and usable by scholars

.

Mission

To introduce the principles and applications of various instruments used in Biology and to prepare them to use these techniques in their own research

Provide an environment to students to participate in consulting and improve their skills

To build scientific teams that can combine various techniques and to create novel approaches to understanding

Strengthen research by assisting students using scientific techniques in the most optimal way.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	demonstrate critical thinking and scientific approach in the design and implementation of an experiment.	1,3	Un, Cr
CO-2	effectively communicate scientific ideas in both written and oral formats	1,2	Un, Ev
CO-3	acquire a broad range of basic laboratory skills to perform experiments and for employment prospects	5	Un, Ap
CO-4	demonstrate and apply a working comprehension of the technical and procedural aspects of laboratory testing, safety and ethical standards of practices	4	Ap
CO-5	write a research report and thesis and Appreciate the components of scholarly writing and evaluate its quality.	6	Cr,Ev
CO-6	verify and test important facts and find solutions to scientific problems	7	An
CO-7	develop new scientific tools, concepts and theories to solve and understand scientific problems	7	Cr
CO-8	design and conduct independent laboratory or field research that is consistent with the highest standards and practices of research	8	Ap

SEMESTER – III			
Core XII : Research Methodology			
Code : 19PZOC34	Hrs / Week : 5	Hrs / Sem : 75	Credits : 4

Unit I Research Designing

Introduction – literature collection-sources – literature citation – manuscript preparation of research report, Internet and e-journals- thesis formating and typing – safety measures in a laboratory – Plagiarism (URKUND)

Unit II Microscopy Types

Principle, construction and applications of Phase contrast- Polarization – Electron microscope– types (SEM,TEM)- fixation and staining techniques for EM (freeze - etching and Freeze fracture), fluorescence - flow cytometry - atomic force and magnetic force microscope – micrometry.

Unit III Spectroscopic Techniques

Absorption and emission principles – construction and applications of UV-visible spectrophotometer, FTIR, spectrofluorometer- flame photometer-atomic absorption and emission spectrophotometer -NMR and Mass spectrometer in Biology

Unit IV Centrifugation and Chromatographic Techniques

Principles of centrifugation— ultra centrifuge, differential centrifugation- density gradient– isopycnic- Principle, instrumentation and application of chromatography – column - gas - liquid - HPLC – ion exchange - affinity- gel filteration.

Unit V Electrophoresis & Radioactive Techniques

Principle and applications of electrophoresis – agrose - PAGE- SDS-PAGE- isoelectric focusing- radioisotopes used in Biology GMcounter, solid and liquid scintillation counters – sample preparation for radioactive counting. Autoradiography - calorimetry – bomb calorimeter, calorific value- applications.

Books for Reference

1. Palanichamy S. and M. Shanmugavelu. 1997. *Research Methods in Biological Sciences*. Palani Paramount Publication, Palani.
2. Gurumani. 2011. *Research Methodology for Biological Sciences*. M.J.P. Publishers, Chennai.
3. Veerakumari. L. 2007. *Bioinstrumentatio*n. M.J.P Publishers, Chennai.
4. Aparna Mathur. 2013. *Laboratory Instrumentation*. Black Prints. New Delhi.
5. Chinmoy Goswami, Abhijit Paintal and Rabindra Narain. 2011. *Hand Book of Bioinstrumentation.* South Anarkali Delhi.

6. Debbie Holmes Peter Moody and Diana Dine, 2006. *Research Methods for the Biosciences.* Oxford University Press, UK.
7. Rabindra Narain . 2012. *Practical Immunology*. Wisdom Press, New Delhi.

PRACTICALS
Hrs / Week - 2 **Credits - 1**

1. Fractionation of rat liver by density gradient
2. Measurement of cell size by micrometry
3. Phase contrast microscopic observation of living cells
4. Estimation of lipids (Bragdon method)
5. Absorption spectra of proteins/ pigments
6. Column chromatographic separation of plant pigments.
7. Calculation of citation index in SCI/ Scopus/ Google scholar/ICI
8. Use of different instruments in research methodology.(Spotters)
    i. Electron microscope
    ii. Spectrophotometer
    iii. Chromatography
    iv. HPLC
    v. SDS - PAGE

Books for Reference

1. Gurumani. 2011. *Research Methodology for Biological Sciences*. M.J.P. Publishers, Chennai.
2. Veerakumari. L. 2007. *Bioinstrumentation.* M.J.P. Publishers, Chennai.

SEMESTER II			
Core V : Animal Physiology			
Course Code: 21PZOC21	**Hrs/ Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Objectives:

- To provide students with an outstanding educational experience that prepares them for different careers, innovative and cutting edge research, and academia.
- To equip the students in the discipline of Physiology, by imparting knowledge and understanding of structure and function of human biological systems.
- To foster the development of professional skills through well designed curriculum; based on experiments, training and research.

Course outcomes

CO. No	**Upon completion of this course, students will be able to**	**PSOs addressed**	**CL**
CO- 1	compare digestive and circulatory system and infer regulation of blood pressure and heart beat	1, 2	Un,An
CO-2	understanding mechanisms of respiration and point out physiological adaptations to special conditions	1, 2	Un,An
CO-3	indicate the relationship between different environments and excretory organs and osmo ionic regulation	5	Ap, An
CO-4	appraise neuromuscular mechanisms and relate the physical and chemical phenomena	2 , 6	Un, Ev
CO-5	associate the endocrine glands with physiological actions and develop healthy life style	2, 4	Un,Cr
CO-6	perceive the steps involved in transmission of nerve impulses	5	Ev
CO-7	relate the structure and physiology of muscular system	7	Un
CO-8	elaborate the integration and interactions of hormones	8	Cr

Unit I **Digestive and Circulatory Systems**

Digestive system - gastrointestinal secretary functions and the glands - role of GI hormones. Structure of mammalian heart-cardiac cycle - cardiac output- control of heart beat - blood pressure and its regulation – related diseases (hypertension, hypotension, stroke).

Unit II **Respiratory System**

Human respiration**:** Anatomy and Physiology of the respiratory tract- transport of oxygen and carbondioxide-regulation of respiration-artificial respiration-physiological response to oxygen deficient stress (diving, high altitude) and exercise.

Unit III **Neuromuscular System**

Nervous system: neurons –structure and types- nerve impulse propagation – concept of synapse- transmission of electrical and chemical synapse- reflex arc-– reflex action.

Muscular system:Structural basis of contraction - sliding filament theory – mechanism and energetics of muscle contraction.

Unit IV **Excretory System**

Human kidney: nephron – mechanism of urine formation – regulation of ionic and osmoregulation in invertebrates – Protozoa, crustaceans and insects, Chordates – fishes, birds and mammals.

Unit V **Endocrinology**

Basic mechanisms of hormone action -endocrine glands in mammal –pituitary, thyroid, adrenal and islets of Langerhans - hormones and functions-hormonal disorders- role of hormones inmenstrual and estrous cycle-pregnancy – parturition – lactation - hormones and neoplastic growth.

Books for Reference

1. Hoar. *General and Comparative Physiology*. New Delhi. Prentice. Hall of India Pvt Ltd, 1975.
2. Sembulingmam K, and PremaSembulingam. *Essentials of Medical Physiology.* New Delhi: Jay Pee Brothers, 2006.

3. Kunt Schmidt-Nielsen K. *Animal Physiology, Adaptation and Environment*. Cambridge University Press. 1985.

4. Ladd Prosser C. *Comparative Animal Physiology*, Agra: Third edition. Satish Book Enterprise Book Sellers and Publishers, 1984.

5. Malcolm S. Gordon. *Animal Physiology Principles and Adaptations*. London: Third edition. Collier MacMillan International edition. Collier MacMillan Publishers. 1984.

6. Nagabhushanam, R and M.S. Kodarkar.*Textbook of Animal Physiology,* New Delhi: Oxford and IBH Publishing Co., 1978.

7. Bentley P.J. *Comparative Vertebrate Endocrinology*, Delhi: First edition Chand& Company Ltd, 1980.

8. Constance R.Martin. *Endocrine Physiology*, New York: First edition. Oxford University Press, 1985.

9. Prakash S. Lohar. *Endocrinology – Hormones and Human Health*, Chennai: MJP Publishers, 2005.

10. Sawant S.C. *A Textbook of Human Physiology* New Delhi: Wisdom Press, 2015.

PRACTICALS

Course Code: 21PZOCR3

Hrs/Week 2 **Credit : 1**

1. Estimation of haemoglobin
2. Determination of erythrocyte sedimentation rate (ESR)
3. Detection of haemin crystals of blood
4. Salt loss/ salt gain in a fish
5. Effect of temperature on oxygen consumption of fish
6. Urine analysis for sugar,albumin, urea and creatinine
7. Urine analysis for sediments
8. Assay of acid/alkaline phosphatase enzyme
9. Chart/slide/photograph

a. Endocrine glands in man - Transverse section of pituitary,thyroid,pancreas and adrenal

b. Conditional reflex

c. Pregnancy test – demonstration

Books for Reference

1. Rastogi S.C. *Experimental Physiology*, New Delhi: Wiley Eastern Limited, 1982.
2. Nigam S.C. and Omkar. *Experimental Animal Physiology and Biochemistry,* New Delhi: New Age International (P) Limited, 2006.

SEMESTER II			
Core VII	**Applied Biotechnology**		
Course Code : 21PZOC23	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

Objective:

To motivate the students to develop scientific attitudes towards emerging technologies

To discover the potential sources of biotechnology and their applications in various fields

To serve as a platform for students to explore their professional skills

Course Outcome

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	perform biotechnological manipulation of microbes for production of industrially important products	1	Un
CO-2	get more insight on the application of biotechnology in treatment of diseases	3	Un
CO-3	apply biotechnology for production of pharmaceutical products .	7	Ap
CO-1	use biotechnology to monitor environmental pollution	3	Ap
CO-5	apply their knowledge to alleviate the effects of various environmental pollutants using biotechnology.	8	Ap
CO-6	create transgenic animals	3	Ap
CO-7	evaluate the ethical issues related with genetically modified organism	2	Ev
CO-8	imbibe the practical and theoretical knowledge of nanomaterials essential for pursuing higher studies.	6	Un

Unit I Microbial Biotechnology:

Isolation and improvement of microbial strains – microbial production of food – beverages - single cell proteins - methods of enzyme production - production of penicillin - bioethanol – biogas.

Unit II Biotechnology and Health Care

Gene therapy: Ex vivo - gene therapy for adenosine deaminase deficiency, in vivo gene therapy - cancer and AIDS. Pharmaceutical products: Insulin, human growth hormone. Recombinant vaccines: Hepatitis B - influenza virus. Monoclonal antibodies - production and applications.

Unit III Environmental Biotechnology

Biotechnological methods for management of pollution - atmospheric CO_2, metal pollution - biotechnological methods for measurement of pollution - Bioassays – animal test systems - molecular biology – biosensors for environmental monitoring – bioremediation.

Unit IV Genetic Engineering

Construction of animal viral vectors for animal transformations - methods of developing transgenic animals: mice - fish – genetically engineered microbes (GEMOs) - applications of genetic engineering - ethics of genetic modification of animals.

Unit V Nanotechnology

Nanomaterials, synthesis of nanoparticles: RF plasma, chemical methods, thermolysis, biological methods - biofabrication, nanobiosensor, nanofluids, nanocrystals - synthesis of nanodrugs - nanomedicine.

Books for Reference

1. Dubey R.C. *A Text Book of Biotechnology*, 4th edition. New Delhi: S. Chand& Company Ltd. 2006.
2. Singh B.D. *Biotechnology.* Revised edition. New Delhi: Kalyani Publishers. 2005.
3. Kumaresan V. *Biotechnology*. Nagerkoil: Saras Publication. 2009.
4. Rema L.P. *Applied Biotechnology*. Chennai: MJP Publishers, 2007.
5. Satyanarayana U. *Biotechnology.* Kolkatta: Books and Allied (P) Ltd. 2006.

6. Robert Preidt, Laura Costlow and Peter. *Introductory Nanotechnology*. New Delhi: Dominant Publishers and Distributors. 2007.
7. Suhas Bhattacharya. *Introduction to Nanotechnology*. New Delhi: Wisdom Press. 2013.

Practical

Course Code 21PZOCR4

Hrs/ Week : 2 **Credit: 1**

1. Isolation of plasmid DNA
2. Restriction digestion
3. Immobilization of enzymes by sodium alginate method
4. Bioadsorption or phytoremediation of an organic substrate.
5. PCR amplification.
6. SDS-PAGE
7. Mushroom culture
8. Charts and models pertaining to theory for spotters

   pBR322, monoclonal antibodies, transgenesis, organ culture, somatic cell fusion,

   Southern blotting, *Agaricus bisporus,* ultra sonication, laminar flow chamber.
9. Report of visit to biotechnology lab

Books for Reference:

1. Asish Verma, Surajit Das, Anchal Singh. *Laboratory Manual for Biotechnology*. New Delhi: S. Chand and Company. 2008.
2. Harisha S. *Biotechnology Procedures and Experiments Hand Book*. New Delhi: Infenity Science Press. 2007.
3. Joseph Sambrook and David S. Russel. *Molecular cloning - A laboratory manual.* New York, Cold Spring Harbor: Cold Spring Harbor Laboratory Press. 2001.

SEMESTER III			
Core XII	**Research Methodology and Biotechniques**		
Course Code : 21PZOC34	**Hrs / Week : 5**	**Hrs / Sem : 75**	**Credits : 4**

Objectives

- To make students familiar with various research methods that are obligatory to do quality research in future.
- To equip the students with the knowledge of scientific paper writing
- To prepare the students to utilize the biological techniques in their research

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	demonstrate critical thinking and scientific approach in the design and implementation of an experiment.	7	Un, Ap
CO-2	develop skills to communicate scientific ideas in both written and oral formats	7	Ap
CO-3	apply a range of qualitative and quantitative research techniques to the scientific issues.	4	Ap
CO-4	identify a working comprehension of the technical and procedural aspects of laboratory testing, safety and ethical standards of practices	6	Ap
CO-5	list different methodologies to be adopted for conducting research in more appropriate manner.	6	An
CO-6	choose new scientific tools, concepts and theories to understand and solve scientific problems.	6	Ev
CO-7	develop a broad range of laboratory skills to perform experiments for employment prospects.	7	Cr
CO-8	design and conduct independent laboratory or field research that is consistent with the highest standards and practices of research	8	Cr

Unit I Research Designing

Introduction - literature collection – sources - Internet and e-journals - literature citation - experimental design - thesis formatting and typing - manuscript preparation, interpretation and report writing and Plagiarism.

Unit II Research Publication & Ethics

IPR: Patent, Copy right, H-index, I-10 index, Ethical Committee, Laboratory safety measures. Calculation of citation index in SCI/ Scopus/ Google scholar/ ICI.

Unit III Microscopy Types

Principle, construction and applications of Phase contrast – Polarization – Electron microscope – types (SEM, TEM) - fixation and staining techniques for EM (Positive and Negative staining, Metal shadowing and Freeze fracture), fluorescence – atomic force and magnetic force microscope – micrometry.

Unit IV Spectroscopic Techniques

Absorption and emission principles – construction and applications of spectrophotometer – UV - visible spectrophotometer, FTIR, spectrofluorimeter - flame photometer - atomic absorption and emission spectrophotometer, ESR and NMR.

Unit V Principles and Applications of Biotechniques

Centrifuge – types: ultra, cooling and density gradient centrifuge, column chromatography, electrophoresis: SDS-PAGE, isoelectric focusing, GM counter – sample preparation for radioactive counting – biochemical application of radioisotopes - autoradiography.

Books for Reference

1. Palanichamy S. and M. Shanmugavelu. *Research Methods in Biological Sciences*. Palani : Palani Paramount Publication.1997.
2. Gurumani. *Research Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.

3. Veerakumari. L. *Bioinstrumentatio*n. Chennai: M.J.P Publishers. 2007.
4. Aparna Mathur. *Laboratory Instrumentation*. New Delhi: Black Prints. 2013.
5. Chinmoy Goswami, Abhijit Paintal and Rabindra Narain. *Hand Book of Bioinstrumentation.* Delhi: South Anarkali. 2011.
6. Debbie Holmes Peter Moody and Diana Dine. *Research Methods for the Biosciences.* U.K. Oxford University Press. 2006.
7. Rabindra Narain. *Practical Immunology*. New Delhi: Wisdom Press. 2012.

PRACTICALS

Course Code: 21PZOCR6

Hrs/ Week : 2 **Credit : 1**

1. Fractionation of fish liver by density gradient centrifugation
2. Measurement of cell size by micrometry
3. Phase contrast microscopic observation of living cells
4. Estimation of lipids (Bragdon method)
5. Absorption spectra of proteins/ pigments
6. Column chromatographic separation of plant pigments.
7. Checking plagiarism by URKUND (online Demo).
8. Use of different instruments in research methodology (Spotters)
    a. Electronmicroscope
    b. Chromatography – HPLC
    c. SDS-PAGE
    d. G.M Counter

Books for Reference

1. Gurumani. R*esearch Methodology for Biological Sciences*. Chennai: M.J.P. Publishers. 2011.
2. Veerakumari. L. *Bioinstrumentation.* Chennai: M.J.P. Publishers. 2007.