



ALAGAPPA UNIVERSITY



(A State University Established in 1985)

Karaikudi - 630003. Tamil Nadu, India



FACULTY OF SCIENCE DEPARTMENT OF BIOMEDICAL SCIENCES



M.Sc., BIOMEDICAL SCIENCES

REGULATIONS AND SYLLABUS

(For the candidates admitted from the
Academic Year 2022 - 2023)

**DEPARTMENT OF BIOMEDICAL SCIENCES
M.SC., BIOMEDICAL SCIENCES**

**REGULATIONS AND SYLLABUS
[For the candidates admitted from the Academic Year 2022 – 2023 onwards]**



ALAGAPPA UNIVERSITY
(A State University Accredited with “A+” grade by NAAC (CGPA: 3.64) in the Third Cycle
and Graded as Category-I University by MHRD-UGC)
Karaikudi -630003, Tamil Nadu.

The panel of Members-Broad Based Board of Studies

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>Chairperson: Name: Dr. S. Ravikumar, Designation: Professor and Head, Department of Biomedical Sciences, Alagappa University, Teaching Experience:28 years, Research Experience:28 years, Area of research: Drugs from the Ocean</p> |  |
| <p>Foreign Expert: Name: Dr. K. Anand, D. Tech, PrChemSA, MRSC , Designation: Research Scientist: NRF-DSI Innovation Fellow, Department: Department of Chemical Pathology, University of the Free State: Teaching Experience: Nil , Research Experience: 8 years, Area of Research: Medical Biochemistry</p> |  |
| <p>Indian Expert: Name: Dr. K.Ruckmani, Designation: Professor Department: Department of Pharmaceutical Technology: Anna University, Teaching Experience:28 years, Research Experience:28 years, Area of Research: Nanobio translational research</p> |  |
| <p>Indian Expert: Name: Dr. N. Thajuddin, Designation: Professor Department: Dept. of Microbiology, Bharathidasan University, Teaching Experience:30 years, Research Experience: 30 years, Area of Research: Micro algal technology</p> |  |
| <p>Industry Expert: Name: Dr. S. Jacob Inbaneson, Designation: General Manager, Athenese-DX. Pvt. Ltd, Module No. 407 & 408, 4th Floor, TICEL Bio Park II No.5, CSIR Road, Taramani, Chennai 600113, Teaching Experience:4 years; Research experience: 12 years, Area: Biomedical device</p> |  |
| <p>Members (All Department faculty) Name: Dr. S. Ravikumar, Designation: Professor and Head, Department, Department of Biomedical Sciences, Alagappa University, Teaching Experience:28 years, Research Experience:28 years, Area of Research: Drugs from the Ocean</p> |  |
| <p>Members (Special Invitee) Name: DR. R. Aananthi, Designation: Assistant Professor & Medical Officer, Department: Alagappa University College of physical education, Alagappa University, Teaching Experience:5 years, Research Experience:5 years, Area of Research: General physician</p> |  |
| <p>Alumnus/Alumna: Name: Mr. R. Jayasathya, Current position- Nil Type of Profession, Nil, Professional address: Nil</p> |  |

ALAGAPPA UNIVERSITY
DEPARTMENT OF BIOMEDICAL SCIENCES
Karaikudi -630003, Tamil Nadu.

REGULATIONS AND SYLLABUS-(CBCS-University Department)
[For the candidates admitted from the Academic Year 2022 – 2023 onwards]

Name of the Department : Biomedical Sciences
Name of the Programme : Biomedical Sciences
Duration of the Programme : Full Time (Two Years)

Choice-Based Credit System

A choice-Based Credit System is a flexible system of learning. This system allows students to gain knowledge at their own tempo. Students shall decide on electives from a wide range of elective courses offered by the University Departments in consultation with the Department committee. Students undergo additional courses and acquire more than the required number of credits. They can also adopt an inter-disciplinary and intra-disciplinary approach to learning, and make the best use of the expertise of available faculty.

Programme

“Programme” means a course of study leading to the award of a degree in a discipline.

Courses

‘Course’ is a component (a paper) of a programme. Each course offered by the Department is identified by a unique course code. A course contains lectures/tutorials/laboratory /seminar/project / practical training/report writing /Viva-voce, etc or a combination of these, to meet effectively the teaching and learning needs.

Credits

The term “Credit” refers to the weightage given to a course, usually in relation to the instructional hours assigned to it. Normally in each of the courses credits will be assigned on the basis of the number of lectures/tutorial/laboratory and other forms of learning required to complete the course contents in a 15-week schedule. One credit is equal to one hour of lecture per week. For laboratory/field work one credit is equal to two hours.

Semesters

An Academic year is divided into two **Semesters**. In each semester, courses are offered in 15 teaching weeks and the remaining 5 weeks are to be utilized for conduct of examination and evaluation purposes. Each week has 30 working hours spread over 5 days a week.

Medium of Instruction:
English only

Departmental committee

The Departmental Committee consists of the faculty of the Department. The Departmental Committee shall be responsible for admission to all the programmes offered by the Department including the conduct of entrance tests, verification of records, admission, and evaluation. The Departmental Committee determines the deliberation of courses and specifies the allocation of credits semester-wise and course-wise. For each course, it will also identify the number of credits for lectures, tutorials, practical, seminars etc. The courses (Core/Discipline Specific Elective/Non-Major Elective) are designed by teachers and approved by the Departmental Committees. Courses approved by the Departmental Committees shall be approved by the Board of Studies/Broad Based Board of Studies. A teacher offering a course will also be responsible for maintaining attendance and performance sheets (CIA -I, CIA-II, assignments and seminar) of all the students registered for the course. The Non-major elective programme, MOOCs coordinator and Internship Mentor are responsible for submitting the performance sheet to the Head of the department. The Head of the Department consolidates all such performance sheets of courses pertaining to the programmes offered by the department. Then forward the same to be Controller of Examinations.

Programme Educational Objectives- (PEO)

| | |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PEO-1 | The program is to foster high-quality innovative research and teaching and interdisciplinary knowledge to develop specialist academicians and intellectual leaders with excellent professional skills in biomedical sciences. |
| PEO-2 | The programme will provide students with a firm grounding in current understanding of the structure and function of the human body in health and disease |
| PEO-3 | To develop into highly-skilled and knowledgeable scientists whom we expect to flourish in the new era of biomedicine |
| PEO-4 | To learn current developments in the field of biomedical sciences and further pursue to do advanced research into the underlying causes of these disorders, diseases, diagnosis and treatments |
| PEO-5 | To orient the students to solve laboratory skills such as planning of experiments, data acquisition, management and analysis to a selected research problem |
| PEO-6 | To create a passion for research while inculcating a scientific temperament and a knowledge inquisitive mind with the main aim of contributing towards human health through basic cum applied research |
| PEO-7 | To engage the students with the fundamental concepts in the field of human anatomy & Physiology, biochemistry, medical oncology and toxicology to a succinct research problem in the chosen specialty area with modern techniques with infrastructure and equipment facility |
| PEO-8 | To contributed in the field of research and development, involved in the development of molecular diagnostic devices and technologies, pharmaceuticals, veterinary biomedicine and medical interventional strategies |
| PEO-9 | To expose the students to various advanced molecular, immunological, genetics, Bioinformatics techniques sequence analysis and related services to the needs of academics, industries, hospitals, and other service sectors |
| PEO-10 | To expose and make the students orientation with solving the research problems, development of the technologies and products for further applications and translational investigation |

Programme Specific Objectives-(PSO)

| | |
|-------|------------------------------------------------------------------------------|
| PSO-1 | Enable students to acquire laboratory skills in biomedical science |
| PSO-2 | Unique courses on forensic science, bioengineering and artificial organs |
| PSO-3 | Learn courses from other departments and MOOCS open platform |
| PSO-4 | Knowledge on the exploration of newer drugs from marine origin |
| PSO-5 | Training in diagnostic laboratory/hospital during two months summer holidays |

Programme Outcome-(PO)

| | |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PO-1 | Thorough knowledge in handling the human disease diagnosis kits |
| PO-2 | Understanding the principles and applications of the forensic science, bioengineering and artificial organs |
| PO-3 | Gain knowledge on the courses other than the core and elective courses |
| PO-4 | Trained with additional practical skills through hands on training |
| PO-5 | Recognize the contribution of the basic biomedical sciences to advancing public health sciences. |
| PO-6 | Apply fundamental concepts of the biomedical sciences to explore public health issues, in particular, prevention, diagnosis, and treatment of disease. |
| PO-7 | Students would be oriented for undertaking a research career in a top most Institution across the globe or to take a jobs in Biomedical, pharmaceutical, diagnostic and clinical-related industries. |
| PO-8 | Students would be ready to solve and biomedical problems to develop and formulate appropriate questions, organize and test hypotheses, and apply research results to improve healthcare sectors by molecular diagnostics and process and products |
| PO-9 | Highly competent human resources could be generated with knowledge in one or more of the following areas: Human Genetics, Medical oncology, pharmacology, Clinical Biochemistry etc., with various advanced techniques. |
| PO-10 | With the extensive hands-on training in the program, after completing this course, students would be highly knowledgeable in the biomedical sciences and their implication to the advancement of human health and biomedical developments. |

Programme Specific Outcome-(PSO)

| | |
|-------|---------------------------------------------------------------------------------------------------------------------|
| PSO-1 | Gain knowledge about contribution of each organ system to the maintenance of homeostasis. |
| PSO-2 | Acquire knowledge on the biomolecules and their importance in normal functioning of living organisms. |
| PSO-3 | Empathize the cascade mechanisms underlying the process over identification of pharmaceutically active compound |
| PSO-4 | Understand the mode of transmission of diseases and its diagnosis. |
| PSO-5 | Understanding the kinds of naturally occurring and synthetic toxic substances with our different biological systems |

Eligibility for admission

A candidate who has passed Bachelor's Degree in Biological Sciences (Anatomy, Physiology, Genetics, Medical Biochemistry, Pathology, Physiology, Pharmacology and Environmental toxicology, Endocrinology, Microbiology, Biochemistry, Biotechnology, Biomedical Science, Botany, Zoology, Bioinformatics, Marine Biology, Computational Biology, B. Pharm, B.Sc., Nursing (3or4years), Pharmacology) with at least 55% of marks and 50% marks for SC/ST candidates as main course of study of any university accepted by the syndicate as equivalent thereto, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the M.Sc. Degree in Biomedical Science of this university after a course of study of two academic years.

Minimum Duration of programme

The programme is for a period of two years. Each year shall consist of two semesters viz. Odd and Even semesters. Odd semesters shall be from June / July to October / November and even semesters shall be from November / December to April / May. Each semester there shall be 90 working days consisting of 6 teaching hours per working day (5 days/week).

Components

A PG programme consists of a number of courses. The term "course" is applied to indicate a logical part of the subject matter of the programme and is invariably equivalent to the subject matter of a "paper" in the conventional sense. The following are the various categories of the courses suggested for the PG programmes:

- A. Core courses (CC)- "Core Papers" means "the core courses" related to the programme concerned including practical's and project work offered under the programme and shall cover core competency, critical thinking, analytical reasoning, and research skill.
 - B. Discipline-Specific Electives (DSE) means the courses offered under the programme related to the major but are to be selected by the students, shall cover additional academic knowledge, critical thinking, and analytical reasoning.
 - C. Non-Major Electives (NME)- Exposure beyond the discipline
- Students have to undergo a total of two Non Major Elective courses with 2 credits offered by other departments (one in II Semester another in III Semester).
 - A uniform time frame of 3 hours on a common day (Tuesday) shall be allocated for the Non-Major Electives.
 - Non Major Elective courses offered by the departments pertaining to a semester should be announced before the end of previous semester
 - Registration process: Students have to register for the Non-Major Elective course within 15 days from the commencement of the semester either in the department or NME portal (University website).

D. Self Learning Courses from MOOCs platforms.

- MOOCs shall be on voluntary for the students.
- All PG programmes students have to undergo a total of 2 Self Learning Courses (MOOCs) one in II semester and another in III semester.
- The actual credits earned through MOOCs shall be transferred to the credit plan of programmes as extra credits. Otherwise 2 credits/course be given if the Self Learning Course (MOOCs) is without credit.
- While selecting the MOOCs, preference shall be given to the course related to employability skills.

E. Projects / Dissertation /Internships (Maximum Marks: 200)

The student shall undertake the dissertation/Project work during the fourth Semester.

➤ **Plan of work**

Project/Dissertation

The candidate shall undergo Project/Dissertation Work during the final semester. The candidate should prepare a scheme of work for the dissertation/project and should get approval from the guide. The candidate, after completing the dissertation /project work, shall be allowed to submit it to the university departments at the end of the final semester. If the candidate is desirous of availing the facility from other departments/universities/laboratories/organizations they will be permitted only after getting approval from the guide and HOD. In such a case, the candidate shall acknowledge the same in their dissertation/project work.

➤ **Format to be followed for dissertation/project report**

The format /certificate for thesis to be followed by the student are given below

- Title page
- Certificate
- Acknowledgment
- Content as follows:

| Chapter No | Title | Page number |
|------------|-----------------------|-------------|
| 1 | Introduction | |
| 2 | Aim and objectives | |
| 3 | Review of literature | |
| 4 | Materials and methods | |
| 5 | Result | |
| 6 | Discussion | |
| 7 | Summary | |
| 8 | References | |



Format of the title page

Title of Dissertation/Project work

Dissertation/Project submitted in partial fulfillment of the requirement for the degree of Master of Science to the Alagappa University, Karaikudi -630003.

By

(Student Name)

(Register Number)

University Logo

Department of -----

Alagappa University

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216, QS BRICS Rank-104, QS India Rank-20)

Karaikudi - 630003 (Year)

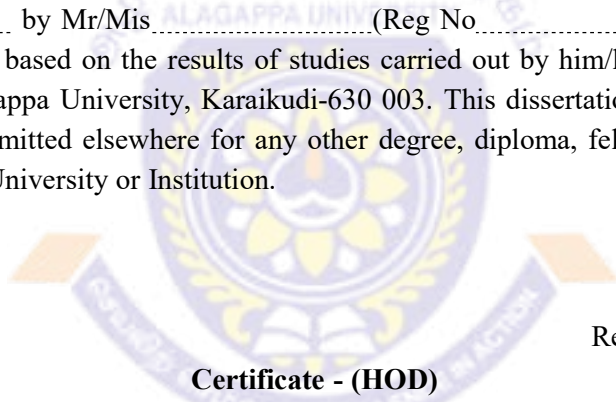
➤ **Format of certificates**

Certificate -Guide

This is to certify that the **Dissertation/Project** entitled "-----" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the degree of Master of Science in ----- by Mr/Mis ----- (Reg No -----) under my supervision. This is based on the results of studies carried out by him/her in the Department of -----, Alagappa University, Karaikudi-630 003. This dissertation/Project or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar titles or record of any University or Institution.

Place: Karaikudi

Date: _____



Research Supervisor

Certificate - (HOD)

This is to certify that the thesis entitled "-----" submitted by Mr/Mis ----- (Reg No: -----) to the Alagappa University, in partial fulfilment for the award of the degree of Master of ----- in ----- is a bonafide record of research work done under the supervision of Dr. -----, Assistant Professor, Department of -----, Alagappa University. This is to further certify that the thesis or any part thereof has not formed the basis of the award to the student of any degree, diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Date: ____

Head of the Department

Declaration (student)

I hereby declare that the dissertation entitled "-----" submitted to the Alagappa University for the award of the degree of Master of Science in ----- has been carried out by me under the guidance of Dr. -----, Assistant Professor, Department of -----, Alagappa University, Karaikudi – 630 003. This is my original and independent work and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi

Date: _____

Internship

The students who have opted for an Internship must undergo industry/hospital training in the reputed organizations to accrue industrial knowledge in the second semester vacation holidays or other than the regular class hours. The student has to find industry/hospital related to their discipline (Public limited/Private Limited/owner/NGOs etc.,) in consultation with the faculty in charge/Mentor and get approval from the head of the department and Departmental Committee before going for an internship.

➤ **Format to be followed for Internship report**

The format /certificate for internship report to be followed by the student are given below

➤ **Title page -Format of the title page**

Internship report submitted in partial fulfilment
of the requirement for the Master of degree into the
Alagappa University, Karaikudi -630003.

By (Student Name)

(Register Number) University Logo

Department of -----

Alagappa University

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank-216, QS BRICS Rank-104, QS India Rank-20) Karaikudi - 630003 (Year)

➤ **Certificate-(Format of certificate – faculty in-charge)**

This is to certify that the report entitled “.....”
submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the Master of Science in
-----by Mr/Mis----- (Reg No -----) under my supervision. This is
based on the work carried out by him/her in the organization M/S ----- . This
Internship report or any part of this work has not been submitted elsewhere for any other degree,
diploma, fellowship, or any other similar record of any University or Institution.

Place:

Research Supervisor

Date: _____

Certificate (HOD)

This is to certify that the Internship report entitled “-----” submitted by Mr/Mis.-----(**Reg No**-----) to the Alagappa University, in partial fulfilment for the award of the Master of Science in ----- is a bonafide record of Internship report done under the supervision of-----, Assistant Professor, Department of -----, Alagappa University and the work carried out by him/her in the organization M/S ----- . This is to further certify that the internship report or any part thereof has not formed the basis of the award to the student of any degree, diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Date:

Head of the Department

Certificate-(Format of certificate – Company supervisor or Head of the Organization)

This is to certify that the Internship report entitled “-----” submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the Master of Science in -----by Mr/Mis----- (Reg No -----) under my supervision. This is based on the work carried out by him/her in our organization M/S ----- for the period of three months or ----- . This Internship report or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar record of any University or Institution.

Place:

Supervisor or in charge

Date:_____

Declaration (student)

I hereby declare that the internship report entitled “-----” submitted to the Alagappa University for the award of the **Master of Science in** -----has been carried out by me under the supervision of -----, Assistant Professor, Department of-----, Alagappa University, Karaikudi – 630 003. This is my original and independent work carried out by me in the organization M/S ----- for the period of three months or -----and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Date:_____

- Acknowledgment
- Content as follows:

| Chapter No | Title | Page number |
|------------|---------------------------------------------|-------------|
| 1 | Introduction | |
| 2 | Aim and objectives | |
| 3 | Organisation profile /details | |
| 4 | Methods / Work | |
| 5 | Observation and knowledge gained | |
| 6 | Summary and outcome of the Internship study | |
| 7 | References | |

No. of copies of the dissertation/project report/internship report

The candidate should prepare three copies of the dissertation/project/report and submit the same for the evaluation of examiners. After evaluation, one copy will be retained in the department library, one copy will be retained by the guide and the student shall hold one copy.

Teaching methods

The class room teaching would be through conventional lecture, use of OHP, power point presentation and novel innovative teaching ideas like television and computer aided instruction. Periodic field visit enable the student for gathering the practical experience and up to date industrial scenario. Student seminars would be arranged to improve their awareness and communicative skill. In the laboratory, instruction would be given for the safe handling of chemicals and instruments. The practical experiments shall be conducted with special efforts to inculcate scientific knowledge among students. The students shall be trained to handle advanced instrumental facilities and shall be allowed to do experiments individually. Periodic test would be conducted to students to assess their knowledge. Slow learners would be identified and will be given special attention.

Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students who have earned 74% to 70% of attendance need to apply for condonation in the prescribed form with the prescribed fee. Students who have earned 69% to 60% of attendance need to apply for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 60% of attendance are not eligible to appear for the End Semester Examination (ESE). They shall redo the semester(s) after completion of the programme.

Examination

The examinations shall be conducted separately for theory and practical's to assess (remembering, understanding, applying, analysing, evaluating, and creating) the knowledge required during the study. There shall be two systems of examinations viz., internal and external examinations. The internal examinations shall be conducted as Continuous Internal Assessment tests I and II (CIA Test I & II).

A. Internal Assessment

The internal assessment shall comprise a maximum of 25 marks for each subject. The following procedure shall be followed for awarding internal marks.

Theory -25 marks

| Sr.No | Content | Marks |
|-------|------------------------------------------------|-------|
| 1. | Average marks of two CIA test | 15 |
| 2. | Seminar/group discussion/quiz | 5 |
| 3. | Assignment/field trip report/case study report | 5 |
| | Total | 25 |

Practical -25 Marks

| | | |
|---|----------------------------------------|----------|
| 1 | Major Experiment | 10 marks |
| 2 | Minor Experiment | 5 marks |
| 3 | Spotter (2x 5/ 4 x4) or any other mode | 10 marks |
| | Total | 25 Marks |

Project/Dissertation/internship-50 Marks (assess by Guide/incharge/HOD/supervisor)

| | | |
|---|------------------------------|----------|
| 1 | Two presentations (mid-term) | 30 Marks |
| 2 | Progress report | 20 Marks |
| | Total | 50 Marks |

B. External Examination

- There shall be examinations at the end of each semester, for odd semesters in the month of October / November; for even semesters in April / May.

- A candidate who does not pass the examination in any course(s) may be permitted to appear in such failed course(s) in the subsequent examinations to be held in October / November or April / May. However candidates who have arrears in Practical shall be permitted to take their arrear Practical examination only along with Regular Practical examination in the respective semester.
- A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulation prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.
- For the Project Report/ Dissertation Work / internship the maximum marks will be 100 marks for project report evaluation and for the Viva-Voce it is 50 marks (if in some programmes, if the project is equivalent to more than one course, the project marks would be in proportion to the number of equivalent courses).
- Viva-Voce: Each candidate shall be required to appear for Viva-Voce Examination (in defense of the Dissertation Work /Project/ internship).

C. Scheme of External Examination (Question Paper Pattern)

Theory - Maximum 75 Marks

| | | | |
|------------------|-------------------------------------------------------------------------------|-------------------|---------------------------------------|
| Section A | 10 questions. All questions carry equal marks. (Objective type questions) | 10 x 1 = 10 Marks | 10 questions – 2 each from every unit |
| Section B | 5 questions Either / or type like 1.a (or) b. All questions carry equal marks | 5 x 5 = 25 | 5 questions – 1 each from every unit |
| Section C | 5 questions Either / or type like 1.a (or) b. All questions carry equal marks | 5 x 8 = 40 | 5 question –Should cover all units |

Practical –Maximum 75 Marks

| | | |
|-----------|-------------------------|----------|
| Section A | Major experiment | 15 Marks |
| Section B | Minor experiment | 10 Marks |
| Section C | Experimental setup | 5 Marks |
| Section D | Spotters (5 x 5 marks) | 25 Marks |
| Section E | Record note | 10 Marks |
| Section F | Vivo voce | 10 Marks |

Dissertation /Project report/Internship report Scheme of evaluation

| | |
|------------------------------------------------|-----------|
| Dissertation /Project report/Internship report | 100 Marks |
| Vivo voce | 50 Marks |

Results

The results of all the examinations will be published through the Department where the student underwent the course as well as through University Website

Passing minimum

- A candidate shall be declared to have passed in each course if he/she secures not less than 40% marks in the End Semester Examinations and 40% marks in the Internal Assessment and not less than 50% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.
- The candidates not obtained 50% in the Internal Assessment are permitted to improve their Internal Assessment marks in the subsequent semesters (2 chances will be given) by writing the CIA tests and by submitting assignments.
- Candidates, who have secured the pass marks in the End-Semester Examination and in the CIA but failed to secure the aggregate minimum pass mark (E.S.E + C I.A), are permitted to improve their Internal Assessment mark in the following semester and/or in University examinations.
- A candidate shall be declared to have passed in the Project / Dissertation / Internship if he /she gets not less than 40% in each of the Project / Dissertation / Internship Report and Viva-Voce and not less than 50% in the aggregate of both the marks for Project Report and Viva-Voce.
- A candidate who gets less than 50% in the Project / Dissertation / Internship Report must resubmit the thesis. Such candidates need to take again the Viva-Voce on the resubmitted Project report.

Grading of the Courses

The following table gives the marks, Grade points, Letter Grades and classifications meant to indicate the overall academic performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade (Performance in Paper / Course)

| RANGE OF MARKS | GRADE POINTS | LETTER GRADE | DESCRIPTION |
|-----------------------|---------------------|---------------------|--------------------|
| 90 - 100 | 9.0 – 10.0 | O | Outstanding |
| 80 - 89 | 8.0 – 8.9 | D+ | Excellent |
| 75 - 79 | 7.5 – 7.9 | D | Distinction |
| 70 - 74 | 7.0 – 7.4 | A+ | Very Good |
| 60 - 69 | 6.0 – 6.9 | A | Good |
| 50 - 59 | 5.0 – 5.9 | B | Average |
| 00 - 49 | 0.0 | U | Re-appear |
| ABSENT | 0.0 | AAA | ABSENT |

- a) Successful candidates passing the examinations and earning GPA between 9.0 and 10.0 and marks from 90 – 100 shall be declared to have Outstanding (O).
- b) Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80 - 89 shall be declared to have Excellent (D+).
- c) Successful candidates passing the examinations and earning GPA between 7.5 – 7.9 and marks from 75 - 79 shall be declared to have Distinction (D).
- d) Successful candidates passing the examinations and earning GPA between 7.0 – 7.4 and marks from 70 - 74 shall be declared to have Very Good (A+).
- e) Successful candidates passing the examinations and earning GPA between 6.0 – 6.9 and marks from 60 - 69 shall be declared to have Good (A).
- f) Successful candidates passing the examinations and earning GPA between 5.0 – 5.9 and marks from 50 - 59 shall be declared to have Average (B).
- g) Candidates earning GPA between 0.0 and marks from 00 - 49 shall be declared to have Re-appear (U).
- h) Absence from an examination shall not be taken as an attempt.

From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated respectively by **Grade Point Average (GPA)** and **Cumulative Grade Point Average (CGPA)**. These two are calculated by the following formulate

$$\text{GRADE POINT AVERAGE (GPA)} = \frac{\sum_i C_i G_i}{\sum_i C_i}$$

GPA = Sum of the multiplication of Grade Points by the credits of the courses
Sum of the credits of the courses in a Semester

Classification of the final result

| CGPA | Grade | Classification of Final Result |
|-----------------------------|------------|--------------------------------|
| 9.5 – 10.0 | O+ | First Class – Exemplary* |
| 9.0 and above but below 9.5 | O | |
| 8.5 and above but below 9.0 | D++ | First Class with Distinction* |
| 8.0 and above but below 8.5 | D+ | |
| 7.5 and above but below 8.0 | D | |
| 7.0 and above but below 7.5 | A++ | First Class |
| 6.5 and above but below 7.0 | A+ | |
| 6.0 and above but below 6.5 | A | |
| 5.5 and above but below 6.0 | B+ | Second Class |
| 5.0 and above but below 5.5 | B | |
| 0.0 and above but below 5.0 | U | Re-appear |

The final result of the candidate shall be based only on the CGPA earned by the candidate.

- a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall be given Letter Grade (O+), those who earned CGPA between 9.0 and 9.4 shall be given Letter Grade (O) and declared to have First Class –Exemplary*.
- b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade (D+), those who earned CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.
- c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade (A+), those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.
- d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B), those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade (B+) and declared to have passed in Second Class.
- i) Candidates those who earned CGPA between 0.0 and 4.9 shall be given Letter Grade (U) and declared to have Re-appear.
- e) Absence from an examination shall not be taken as an attempt.

$$\text{CUMULATIVE GRADE POINT AVERAGE (CGPA)} = \frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_n \sum_i C_{ni}}$$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of Grade Points by the credits of the entire Programme}}{\text{Sum of the credits of the courses for the entire Programme}}$$

Where 'Ci' is the Credit earned for Course i in any semester; 'Gi' is the Grade Point obtained by the student for Course i and 'n' refers to the semester in which such courses were credited.

CGPA (Cumulative Grade Point Average) = Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note: * The candidates who have passed in the first appearance and within the prescribed Semesters of the PG Programme are alone eligible for this classification.

Maximum duration of the completion of the programme

The maximum period for completion of **M.Sc.**, in Biomedical Sciences shall not exceed eight semesters continuing from the first semester.

Conferment of the Master's Degree

A candidate shall be eligible for the conferment of the Degree only after he/ she has earned the minimum required credits for the Programme prescribed therefor (i.e. 90 credits). Programme).

Village Extension Programme

The Sivaganga and Ramnad districts are very backward districts where a majority of people Lives in poverty. The rural mass is economically and educationally backward. Thus the aim of the introduction of this Village Extension Programme is to extend out to reach environmental awareness, social activities, hygiene, and health to the rural people of this region. The students in their third semester have to visit any one of the adopted villages within the jurisdiction of Alagappa University and can arrange various programs to educate the rural mass in the following areas for three day based on the theme.1. Environmental awareness 2. Hygiene and Health. A minimum of two faculty members can accompany the students and guide them.



M.Sc., Biomedical Sciences

Programme structure

| S. No | Paper Code | Title of the paper | T/P | Credits | Hours/Week | Marks | | | |
|---------------------|------------------|--------------------------------------|------------------------------------------------------------------------------------|---------|--------------|-----------|------------|-------------|-------------|
| | | | | | | I | E | Total | |
| I Semester | | | | | | | | | |
| 1 | 508101 | Core 1 | Human Anatomy and Physiology | T | 5 | 5 | 25 | 75 | 100 |
| 2 | 508102 | Core 2 | Medical Biochemistry | T | 4 | 4 | 25 | 75 | 100 |
| 3 | 508103 | Core 3 | Clinical Pathology | T | 4 | 4 | 25 | 75 | 100 |
| 4 | 508104 | Core 4 | Lab-I : Human Anatomy and Physiology Medical Biochemistry Clinical Pathology | P | 4 | 8 | 25 | 75 | 100 |
| 6 | 508105 | Core 5 | Lab-II : Techniques in Biomedical Science-I | P | 4 | 6 | 25 | 75 | 100 |
| 7 | 508501 508502 | DSE*-1 | Bioinformatics and IPR / Marine Pharmaceuticals | T | 3 | 3 | 25 | 75 | 100 |
| | | | | | 24 | 30 | 150 | 450 | 600 |
| II Semester | | | | | | | | | |
| 8 | 508201 | Core 6 | Medical Genetics | T | 5 | 5 | 25 | 75 | 100 |
| 9 | 508202 | Core 7 | Pharmacology | T | 5 | 5 | 25 | 75 | 100 |
| 10 | 508203 | Core 8 | Lab-III: Medical Genetics, Pharmacology | P | 4 | 8 | 25 | 75 | 100 |
| 11 | 508204 | Core 9 | Lab-IV: Techniques in Biomedical Sciences-II | P | 4 | 6 | 25 | 75 | 100 |
| 12 | 508503 508504 | DSE*2 | Forensic Science / Artificial organs | T | 3 | 3 | 25 | 75 | 100 |
| 13 | | Non-Major Elective ** | | T | 2 | 3 | 25 | 75 | 100 |
| 14 | | Self-learning course (SLC) –MOOCs*** | | T | Extra credit | | | | |
| | | | | | 23 | 30 | 150 | 450 | 600 |
| III Semester | | | | | | | | | |
| 15 | 508301 | Core 10 | Toxicology | T | 5 | 5 | 25 | 75 | 100 |
| 16 | 508302 | Core 11 | Medical Oncology | T | 5 | 5 | 25 | 75 | 100 |
| 17 | 508303 | Core 12 | Lab-V : Toxicology, Medical Oncology | P | 4 | 8 | 25 | 75 | 100 |
| 18 | 508304 | Core 13 | Lab-VI-Techniques in Biomedical Sciences-III | P | 4 | 6 | 25 | 75 | 100 |
| 19 | 508505 508506 | DSE*3 | Biomaterials and Tissue Engineering / Bio-imaging Technology | T | 3 | 3 | 25 | 75 | 100 |
| 20 | | Non-Major Elective ** | | T | 2 | 3 | 25 | 75 | 100 |
| 21 | | Self-learning course (SLC) –MOOCs*** | | T | Extra credit | | | | |
| | | | | | 23 | 30 | 150 | 450 | 600 |
| IV Semester | | | | | | | | | |
| 22 | 508999 | Core 14 | ****Dissertation Work | P | 15 | 20 | 50 | 150 | 200 |
| 23 | 508777 | Core 15 | Hospital training | P | 5 | 10 | 50 | 150 | 200 |
| | | | | | 20 | 30 | 100 | 300 | 400 |
| Total | | | | | 90 + | | 550 | 1650 | 2200 |

DSE – Student Choice and it may be conducted by parallel sections.

** NME –Student have to select courses offered by other (Faculty) departments.

*** SLC- Voluntary basis

*** Dissertation / internship report –Marks -Viva-voce (50) + thesis (100) + internal (50) = 200

T-Theory P-Practical

| Semester – I | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------|----------|------------------|-----------------|
| Core | Course code: 508101 | Human Anatomy and Physiology | T | Credits:5 | Hours: 5 |
| Unit-I | | | | | |
| Objective 1 | Learn the gross morphology, structure and functions of various organs of the human body | | | | |
| Structure of Cell, function of each components of the cell, membrane potential, action potential, generation and conduction, electrical stimulation. Blood Cell – composition, origin of RBC, blood groups, estimation of RBC, WBC and platelet. Tissues and histology, embryonic tissue, epithelial tissue, connective tissue, muscle tissue, nervous tissue and tissue membranes. Anatomy of human skin. Functions of skin temperature. Hematopoiesis, Hemoglobin structure and function. Blood bank regulation by skin. | | | | | |
| Outcome 1 | Acquire knowledge on the cells and tissues | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Describe the various homeostatic mechanisms and their imbalances | | | | |
| Structure of heart, pericardium, chambers, major blood vessels, blood supply. Cardiac Cycle, ECG, blood pressure, feedback control for blood pressure. Structure of nervous system, functions of neurons, synapse, reflexes and receptors, brain, brainstem, ventricles and spinal cord, peripheral and automatic nervous system and function of nervous tissue, reflex action, velocity of conduction of nerve impulses, autonomic nervous system. | | | | | |
| Outcome 2 | Understand the structure and functions of various human body systems | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Understand the various tissues and organs of different systems of human body | | | | |
| Parts of respiratory system - trachea and lungs, physiological aspects of respiration, exchange of gases, regulation of respiration, disturbance of respiratory function, pulmonary function test. Organization of GI system, digestion and absorption, movement of GI tract. Accessory organs-liver, spleen and pancreas. | | | | | |
| Outcome 3 | Gain knowledge about contribution of each organ system to the maintenance of homeostasis. | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Know-how the special senses and their tests | | | | |
| General Characteristic and classification of hormone, synthesis, secretion, transport, metabolism and mechanism of action of pituitary, hypothalamus, thyroid, parathyroid, adrenal, pancreas, thymus hormones. Structure and function of reproductive organs, hormones of testes and ovary, hormonal regulation of ovulation, fertilization, implantation, gestation, parturition and lactation, oogenesis, Spermatogenesis | | | | | |
| Outcome 4 | Have an understanding the physiological processes accurately with relevant scientific terminology | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Acquire the coordinated working pattern of different organs | | | | |
| Structure of Kidney and Nephron., Urine formation by kidneys: glomerular filtration, renal blood flow and their control, determinants of glomerular filtration rate (GFR)., Reabsorption and secretion along different parts of nephron., Regulation: regulation of extracellular fluid osmolarity and sodium concentration, role of thirst. Renal regulation of potassium, calcium, phosphate and magnesium, acid-base balance. Olfaction, taste, visual system, hearing and balance. | | | | | |
| Outcome 5 | It attempts to highlight the necessary information which links basic sciences and medicine | | | K5 | |

Suggested Readings:

Cinnamon L. VanPutte, Jennifer L. Regan and Andrew F. Russo, (2014). Seeley's Anatomy and Physiology, 10th edition Publisher: McGraw Hill International.

Frederic H. Martini, Judi L. Nath and Edwin F. Bartholomew, (2015). Fundamentals of Anatomy and Physiology, 10th edition Publisher: Pearson Education Limited.

Gerard J. Tortora and Bryan Derrickson., (2015) Anatomy and Physiology-Workbook, 1st edition Publisher: Wiley India Pvt. Ltd.

Gerard, T. J., & Bryan, D. (2015). Anatomy & physiology. *Indian edition, Wiley India pvt. Ltd., New Delhi*, 603-623.

Martini, F. H., Nath, J. L. & Bartholomew, E. F. (2015). Fundamentals of Anatomy and Physiology. 2001. *Pentice Hall: New Jersey*, 538-557.

VanPutte, C. (2016). *Seeley's anatomy & physiology*. McGraw-Hill Higher Education.

Bruce, J. Colbert, Jeff, J. Ankney and Karen, T. Lee (2020). Anatomy, Physiology and Diseases.

Tobin C.E., "Basic Human Anatomy", McGraw-Hill Publishing Co., Ltd., Delhi 1997

Online resources

Text Book Of Human Anatomy & Physiology- <https://www.kobo.com/in/en/ebook/text-book-of-human-anatomy-physiology>

Anatomy and Physiology Books- <https://www.bioexplorer.net/best-anatomy-and-physiology-books.html/>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | M(2) | L(1) | L(1) | S(3) | M(2) | M(2) | L(1) | L(1) |
| CO-3 | S(3) | S(3) | L(1) | M(2) | M(2) | M(2) | S(3) | L(1) | M(2) | M(2) |
| CO-4 | S(3) | M(2) | L(1) | L(1) | L(1) | L(1) | M(2) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | L(1) | S(3) | L(1) | M(2) | L(1) | L(1) | S(3) | L(1) | M(2) |
| W.AV | 3 | 2 | 1.8 | 1.4 | 1.6 | 1.8 | 2 | 1.8 | 1.4 | 1.6 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S (3) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S (3) | M(2) | M(2) | L(1) | L(1) |
| CO-3 | S (3) | S (3) | L(1) | M(2) | M(2) |
| CO-4 | S (3) | M(2) | L(1) | L(1) | L(1) |
| CO-5 | S (3) | L(1) | S (3) | L(1) | M(2) |
| W.AV | 3 | 2 | 1.8 | 1.4 | 1.6 |

1. Low , 2. Medium , 3. Strong

| Semester – I | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------|---|-----------|---------|
| Core | Course code: 508102 | Medical Biochemistry | T | Credits:4 | Hours:4 |
| Unit-I | | | | | |
| Objective 1 | Understand the structure, nomenclature, functions and importance of Biomolecules | | | | |
| Disorders of carbohydrate metabolism-overview of carbohydrate metabolism, Sugar level in normal blood – Hypo and Hyperglycemia, Renal threshold, Glycosuria, Obesity and Galactosemia, Glucose tolerance test. Diabetes mellitus. Inborn errors of carbohydrate metabolism. | | | | | |
| Outcome 1 | Acquire knowledge on the biomolecules and their importance in normal functioning of living organisms. | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Learn the elements of enzyme structure that explains their substrate specificity and catalytic activity. | | | | |
| Disorders of lipid metabolism, overview of lipid metabolism, Hypo and Hyper lipoproteinemias, disorders of triglycerides, Phospholipids and Cholesterol metabolism. Steatorrhea. Inborn errors of lipid metabolism. | | | | | |
| Outcome 2 | Gain information the metabolic pathways linked with pathological Conditions | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Outline the sequence of reactions in anaerobic metabolism. | | | | |
| Disorders of amino acid and protein metabolism-overview of amino acids and protein metabolism, Amino acid metabolism in starvation, Disorders of plasma protein – γ -globulinemia, proteinuria. urea, uric acid, creatinine, ammonia. Uremia, Uremia and Porphyria. Inborn errors of amino acid metabolism. Mineral metabolism-anaemia, cushings syndrome | | | | | |
| Outcome 3 | Get comprehensive and concise overview of the metabolic disorders | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Describe the regulatory role of hormones and basis of innate and adoptive immune response. | | | | |
| Disorders of nucleic acid metabolism, overview of purine and pyrimidine metabolism, Gout, Lesch-Nhyan syndrome, orotic aciduria and xanthinuria. Biosynthesis of nucleotides | | | | | |
| Outcome 4 | Understand the role of platelets in hemostasis and thrombosis and basis of immune response. | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Acquire knowledge on the allergic reactions and causes for allergy | | | | |
| Immunological disorders-disorders of immunoglobulin synthesis, allergy and hypersensitivity, autoimmune diseases-SLE, rheumatoid arthritis, psoriasis, multiple sclerosis. | | | | | |
| Outcome 5 | Learn the auto immune diseases | | | K5 | |
| Suggested Readings: | | | | | |
| Baynes, J.W. & Dominiczak, M.H. (2019). <i>Medical Biochemistry (5th ed.)</i> . | | | | | |
| Harvey, R. A., & Ferrier, D. R. (2011). Lippincott's illustrated reviews: Biochemistry (7 th ed.). Wolters Kluwer India Pvt. Ltd. | | | | | |
| Voet, D., & Voet, J. G. (2011). Biochemistry, 4-th Edition. <i>NewYork: John Wiley& SonsInc, 492.</i> | | | | | |
| Denise R Ferrier (2017). Lippincott's Illustrated Reviews Biochemistry (7 th ed.). | | | | | |
| Robert K. Murray and Daryl K. Granner and Peter A. Mayes and Victor W. Rodwell. (2000). Harper's biochemistry , 25 th edition | | | | | |
| Donald Voet and Judith G. Voet. (2008). Biochemistry 3 rd edition | | | | | |
| David L. Nelson and Michael M. Cox, W.H. Freeman, (2004). Lehninger principles of biochemistry 5 th edition. | | | | | |

Online resources**Biochemistry Books, Ebooks And Journals-****<https://www.us.elsevierhealth.com/medicine/biochemistry>****Medical Biochemistry - An Essential Textbook-** <https://www.thieme.in/Biochemistry-Medical-Biochemistry-An-Essential-Textbook-Panini>**Textbook of Medical Biochemistry-**https://books.google.co.in/books/about/Textbook_of_Medical_Biochemistry.html?id=BVpDI7n2M9gC&redir_esc=y**K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create**

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | S(3) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | M(2) | S(3) | S(3) | M(2) | S(3) | L(1) | L(1) | M(2) | M(2) | L(1) |
| CO-3 | L(1) | M(2) | M(2) | S(3) | S(3) | M(2) | M(2) | S(3) | L(1) | M(2) |
| CO-4 | L(1) | L(1) | S(3) | M(2) | S(3) | L(1) | L(1) | M(2) | L(1) | L(1) |
| CO-5 | M(2) | S(3) | M(2) | L(1) | S(3) | L(1) | M(2) | L(1) | S(3) | L(1) |
| W.AV | 1.8 | 2.2 | 2.6 | 2 | 3 | 1.4 | 1.6 | 2 | 1.8 | 1.4 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | S(3) |
| CO-2 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-3 | L(1) | S(3) | M(2) | S(3) | S(3) |
| CO-4 | L(1) | S(3) | S(3) | M(2) | S(3) |
| CO-5 | M(2) | S(3) | M(2) | L(1) | S(3) |
| W.AV | 1.8 | 3 | 2.6 | 2 | 3 |

1.Low , 2. Medium , 3. Strong

| Semester – I | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---|-----------|---------|
| Core | Course code: 508103 | Clinical Pathology | T | Credits:4 | Hours:4 |
| Unit-I | | | | | |
| Objective 1 | Understand the concepts of cell injury, clinico-pathological correlation of common infectious and non-infectious diseases. | | | | |
| Cell Injury, wound healing. Circulatory Disturbances: Edema, chronic venous congestion, thrombosis and embolism, Infarction, shock, fluid and electrolyte imbalance. Growth disturbances and neoplasia; carcinogenesis, tumor; Laboratory diagnosis: cytological techniques including FNAC, Biopsy. Organ transplantation: Immunologic basis of rejection and graft versus host reaction. | | | | | |
| Outcome 1 | Acquire knowledge on the cytological techniques and Graft-versus-host disease. | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Correlate normal and altered morphology of different organ systems in different diseases to the extent needed for understanding of disease processes and their clinical significance | | | | |
| Infectious Diseases Mycobacterial diseases: tuberculosis and leprosy; bacterial diseases: typhoid, diphtheria, syphilis; Viral: rabies, measles; rickettsial; dengue, Chickengunya and Coronavirus, Post covid candidiasis diseases and opportunistic infections; Parasitic diseases - malaria, filaria, Amebiasis; AIDS: aetiology, modes of transmission, diagnostic procedures and handling of infected material and health education. Cardiovascular Pathology: Rheumatic heart disease, atherosclerosis and Ischemic heart disease; myocardial infarction, Hypertensive heart disease, Congenital heart disease, cardiomyopathy; diagnosis of cardiovascular diseases. | | | | | |
| Outcome 2 | Understand the mode of transmission of diseases and its diagnosis | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Learn the common immunological disorders and their resultant effects on the human body. | | | | |
| Inflammatory diseases of bronchi; pneumonia; pulmonary tuberculosis; occupational lung disorders and diagnosis. Basis of impaired renal function, urine analysis; nephritic syndrome; acute, progressive and end stage renal disease; Polycystic kidneys, diagnosis of urinary tract infections. Leukoplakia; carcinoma of oral cavity and esophagus; salivary gland tumors; peptic ulcer; tumors of stomach; inflammatory diseases of small intestine, appendix and large intestine; pancreatitis; diagnosis of gastrointestinal tract diseases. | | | | | |
| Outcome 3 | Decipher the pathogenesis of renal and gastrointestinal tract diseases | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Have an understanding of the common haematological disorders | | | | |
| Regulation of hematopoiesis; nutritional anaemias: Iron deficiency anaemia, folic Acid/Vit. B12 deficiency anaemia including pernicious anaemia, hemolytic anaemias; hemostatic disorders: Platelet deficiency; Polycythemia, myelofibrosis, multiple myeloma; Liver and Biliary Tract Pathology: Jaundice, hepatitis, cirrhosis, hepatocellular and metastatic carcinoma; Diseases of the gall bladder: Cholecystitis, cholelithiasis. Lymphoreticular System: Lymphadenitis, Hodgkin's and Non-Hodgkin's lymphoma; Diseases of spleen -Splenomegaly & Thymus -myasthenia gravis. Diagnosis of liver and biliary tract diseases. | | | | | |
| Outcome 4 | Lean the necessity of hemostatic disorders and abnormalities associated with menstrual cycle. | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Investigations of necessity to diagnose them and to determine their prognosis | | | | |
| Reproductive System - Diseases of cervix, Hormonal influences and histological appearances of different phases of menstrual cycle and the abnormalities associated with it, Diseases of uterus, trophoblastic disease. Diseases of the breast; prostate; ovarian and testicular tumors; Diagnosis of reproductive system diseases. Osteopathology: Osteomyelitis; Metabolic diseases Rickets/osteomalacia,osteoporosis, Endocrine Pathology: Diagnosis of Diabetes Mellitus; goiter, tumors of thyroid, adrenal diseases; pituitary tumors. Neuropathology: Diagnosis of pyogenic and tuberculous meningitis, brain abscess, tuberculoma; CNS tumors; CSF and its disturbances. | | | | | |
| Outcome 5 | Familiar with the knowledge on pyogenic and tuberculous meningitis. | | | K5 | |

Suggested Readings:

- Goodman, C. C., & Fuller, K. S. (2016). Pathology for the Physical Therapist Assistant.
- Larson, M.T & Donna, D.L.M. (2016). Clinical chemistry: Fundamentals and Laboratory Techniques (1st ed.).
- Mete, O., & Asa, S. L. (2016). Endocrine Pathology with Online Resource. Cambridge University Press.(ed.,)
- Rubin, R., Strayer, D. S., & Rubin, E (2008). Rubin's pathology: clinicopathologic foundations of medicine. (ed.,)
- Salvo, S. G. (2017). Mosby's Pathology for Massage Therapists
- Raphael Rubin, David S. Strayer.(2011). Pathology: Clinical pathologic foundations of Medicine(6th ed.,)
- Ozgun Mete, Sylvia L.Asa (2016). Endocrine Pathology (1st ed.,).
- Donna Larson (2016). Clinical Chemistry: Fundamentals and Laboratory Techniques (1st ed.,)

Online resources

Oxford Handbook of Clinical Pathology- <https://www.kobo.com/in/en/ebook/oxford-handbook-of-clinical-pathology-2e>

Pathology Books, Ebooks And Journals- <https://www.us.elsevierhealth.com/medical-students/pathology>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | M(2) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | M(2) | S(3) | S(3) | M(2) | M(2) | S(3) | M(2) | M(2) | L(1) | L(1) |
| CO-3 | L(1) | M(2) | M(2) | S(3) | L(1) | S(3) | S(3) | L(1) | M(2) | M(2) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | L(1) | S(3) | M(2) | L(1) | L(1) | L(1) |
| CO-5 | L(1) | M(2) | S(3) | L(1) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) |
| W.AV | 1.8 | 2.6 | 2.8 | 2 | 1.8 | 3 | 2 | 1.8 | 1.4 | 1.6 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | M(2) | S(3) |
| CO-2 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-3 | L(1) | M(2) | M(2) | S(3) | S(3) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-5 | L(1) | M(2) | S(3) | L(1) | S(3) |
| W.AV | 1.8 | 2.6 | 2.8 | 2 | 3 |

1. Low , 2. Medium , 3. Strong

| Semester – I | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---|-----------|---------|
| Core | Course code: 508104 | Practical –I Human Anatomy and Physiology, Medical Biochemistry, Clinical Pathology | P | Credits:4 | Hours:8 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Hands on experience on specimen collection, labeling and documentation ➤ To learn the techniques involved in the blood pressure measurements ➤ Understand the identification of bones and mechanisms of various inner systems ➤ Learn the quantitative and qualitative analysis of micro and macro molecules and cells in blood ➤ Learn the diagnostics procedures in important microbial infections | | | | |
| | <ol style="list-style-type: none"> 1. Specimen collection and Processing: Collection of specimen, labeling, documentation. 2. Measurement of blood pressure by using sphygmomanometer and digital meter 3. Demonstration of bones identification and side determination upper limb-clavicle, scapula, humerus, radius, ulna, lower limb-femur, hip bone, tibia, fibula, vertebral column, ribs, sternum, sacrum., 4. Demonstration of major muscles of the body-limbs, head & neck. 5. Demonstration of heart-major vessels of the body-Aorta, subclavian, carotid, brachial, radial, ulna, femoral, renal., 6. Demonstration of different parts of respiratory system 7. Demonstration of the part of digestive system 8. Demonstration of other organs- spleen, testis, uterus. 9. Protein estimation by Lowry's & Bradford methods, 10. To check purity of protein & subunit structure by SDS page 11. Isolation of genomic & plasmid DNA by using Agarose gel electrophoresis 12. Determination of Blood Groups 13. Determination of blood counts - Staining and reporting of smears-RBC, WBC,differential leucocytes count using Leishman stain, 14. Determination of packed cell Volume, 15. Determination of Erythrocyte sedimentation rate [ESR] 16. Determination of clotting time, bleeding time 17. Estimation of blood glucose, cholesterol, serum triglycerides 18. Physical and chemical examinations of urine including sugar, protein, ketone, bile salts, bile pigments. | | | | |
| Suggested Readings: | | | | | |
| <p>Baynes, J.W. & Dominiczak, M.H. (2019). <i>Medical Biochemistry</i> (5th ed.).</p> <p>Harvey, R. A., & Ferrier, D. R. (2011). Lippincott's illustrated reviews: Biochemistry (7th ed.).</p> <p>Voet, D., & Voet, J. G. (2011). Biochemistry, 4-th Edition. <i>NewYork: John Wiley & SonsInc, 492.</i></p> <p>Amitrano, R., & Tortora, G. (2012). <i>Update: anatomy & physiology laboratory manual</i></p> <p>Tortora, G. J., & Derrickson, B. (2014). <i>Anatomy and Physiology-WorkBook</i>. CBS publication.</p> <p>Pal, G. K., & Pravati, P., (2010). <i>Text Book of Practical Physiology, (3rd edn.)</i>.Universities Press (India) Private Limited.</p> <p>Pal, G. K., Pal, P., Nanda. N. & Amudharaj. D. (2015). <i>Atlas of Human Anatomy, (1st ed.)</i>. Jordi Vigue. Chambarlen Press.</p> <p>Rimoin, D. L., Pyeritz, R. E., & Korf, B. (Eds.). (2013). <i>Emery and Rimoin's essential medical genetics</i>. Elsevier.</p> | | | | | |
| Online Resources: Human Anatomy And Physiology – I Lab Manual- https://Mlrip.Ac.In/Wp-Content/Uploads/2022/03/Human-Anatomy-Physiology-I-Lab-Manual.Pdf | | | | | |
| Essentials of Human Anatomy & Physiology Lab Manual- https://www.chegg.com/textbooks/essentials-of-human-anatomy-physiology-lab-manual-3rd-edition-9780805373400-0805373403 . | | | | | |

| | |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course Outcomes (CO) | CO1- Learn specimen collecting, labeling and processing. CO2- Understanding the arrangement of various types of bones and inner systems CO3- Gain knowledge on the measurements of micro and macro molecules in human blood CO4- Acquire knowledge on the laboratory diagnosis of microbial infections. CO5- Learn the various tests involved in the assessment of blood cell counts |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | S(3) | M(2) |
| CO-2 | S(3) | S(3) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-3 | S(3) | L(1) | L(1) | S(3) | L(1) | S(3) | L(1) | L(1) | L(1) | S(3) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | L(1) | M(2) | L(1) | M(2) | S(3) | M(2) |
| CO-5 | S(3) | M(2) | L(1) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) | L(1) |
| W.AV | 3 | 2 | 1.8 | 3 | 1.8 | 2 | 1.8 | 1.6 | 2.2 | 2 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | S(3) | S(3) | S(3) | M(2) |
| CO-3 | S(3) | L(1) | S(3) | S(3) | L(1) |
| CO-4 | S(3) | L(1) | S(3) | S(3) | L(1) |
| CO-5 | S(3) | M(2) | S(3) | S(3) | S(3) |
| W.AV | 3 | 2 | 3 | 3 | 1.8 |

1. Low , 2. Medium , 3. Strong

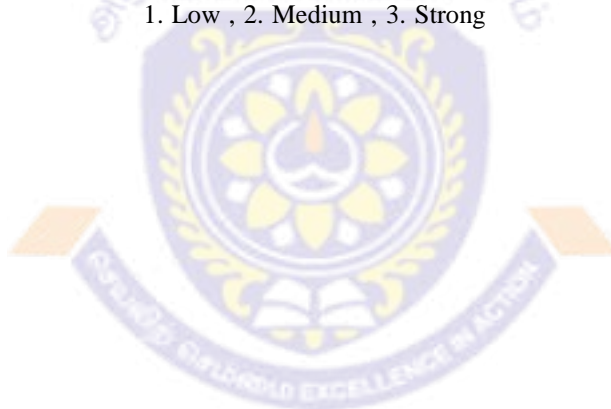
| Semester – I | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------|----------|
| Core | Course code: 508105 | Practical-II Techniques in Biomedical sciences-I | P | Credits: 4 | Hours: 6 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Understand the principles and applications of microscopy ➤ Get comprehensive and concise overview of the application of staining methods in microbial identifications ➤ Gain knowledge on the laboratory diagnosis of microbial infections ➤ Decipher the sterilization techniques, types of media ➤ Familiar with the principles and practice of biomedical wastes | | | | |
| | <ol style="list-style-type: none"> 1. Introduction to microscopes, focusing slides under low/high power and oil immersion, Principles and demonstration of various types of microscopes. 2. Demonstration of sterilization techniques-hot air oven, autoclave, bacterial filters. 3. Demonstration of commonly used culture media: LB broth, LB agar, nutrient broth, nutrient agar, blood agar, chocolate agar, MacConkey medium, Lowenstein Jensen (LJ) media, Robertson cooked meat media, sabouraud's dextrose agar 4. Gram staining, Albert's staining, acid fast staining, lactophenol cotton blue staining 5. Motility tests and biochemical tests- indole production test, methyl red test, voges proskauer test, citrate utilization test, triple sugar iron agar test, catalase test, oxidase test for bacterial identification 6. Antibiotic sensitivity test 7. Demonstration on the disposal of biomedical wastes | | | | |
| Suggested Readings: | | | | | |
| <p>Aneja, K. R. (2018). <i>Laboratory manual of microbiology and biotechnology</i>, Medtech.</p> <p>Arora, D.R., & Arora, B. (2007). <i>Practical microbiology (2nd ed.)</i>. CBS Publication.</p> <p>Barer, M. R., & Irving, W. L. (2018). <i>Medical Microbiology E-Book: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Investigation and Control</i>. Elsevier Health Sciences.</p> <p>Baynes, J.W. & Dominiczak, M.H. (2019). <i>Medical Biochemistry (5th ed.)</i>.</p> <p>Harvey, R. A., & Ferrier, D. R. (2011). <i>Lippincott's illustrated reviews: Biochemistry (7th ed.)</i>. Wolters Kluwer India Pvt. Ltd.</p> <p>Naigaonkar, M. A. (2008). <i>A manual of medical laboratory technology</i>. Pragati Books Pvt. Ltd..</p> <p>Perry, J. J., Staley, J. T., & Lory, S. (2002). <i>Microbial life</i>. Sinauer Associates Incorporated.</p> <p>Voet, D., & Voet, J. G. (2011). <i>Biochemistry, (4th ed.)</i>. NewYork: John Wiley& SonsInc, 49.</p> | | | | | |
| Online Resources: | | | | | |
| <p>Microbiology A Laboratory Manual 4th Ed. https://www.scientificpubonline.com/bookdetail/microbiology-laboratory-manual-4th-ed/9789394645516/0.</p> <p>Microbiology: A Laboratory Experience. https://milnepublishing.geneseo.edu/suny-microbiology-lab/</p> | | | | | |
| Course (CO) | Outcomes | <p>CO1- Fathom the microscopy and micrometry</p> <p>CO2- Aware the various methods of sterilization</p> <p>CO3- Understand the various culture media</p> <p>CO4- Comprehend the methods of identifications of microbes</p> <p>CO5- Learn the principles and practice of biomedical waste.</p> | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | S(3) | M(2) | S(3) | M(2) | M(2) | M(2) | L(1) | L(1) | M(2) |
| CO-3 | S(3) | M(2) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) | M(2) | S(3) |
| CO-4 | S(3) | M(2) | M(2) | S(3) | L(1) | M(2) | L(1) | L(1) | L(1) | M(2) |
| CO-5 | S(3) | M(2) | L(1) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) | L(1) |
| W.AV | 3 | 2.4 | 2.2 | 3 | 1.8 | 2 | 1.8 | 1.4 | 1.6 | 2 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | S(3) | M(2) | S(3) | M(2) |
| CO-3 | S(3) | M(2) | S(3) | S(3) | L(1) |
| CO-4 | S(3) | M(2) | M(2) | S(3) | L(1) |
| CO-5 | S(3) | M(2) | L(1) | S(3) | S(3) |
| W.AV | 3 | 2.4 | 2.2 | 3 | 1.8 |

1. Low , 2. Medium , 3. Strong



| Semester – I | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---|----------------------|
| DSE-1 | Course code: 508501 | Bioinformatics and IPR | T | Credits:3 Hours:3 |
| Unit-I | | | | |
| Objective 1 | To explain the technical know – of information that can be collected from web sources Involved in patenting of novel drugs. | | | |
| Definition and history of bioinformatics web servers. Computer system, languages (Machine, high level & assemble) & topology (LAN, WAN, &MAN)Internet basics: Internet connection, web browsing and URL. | | | | |
| Outcome 1 | Selection of biological data, submission and retrieval it from databases and design databases to store the information | | | K2 |
| Unit-II | | | | |
| Objective 2 | Understand the essential features of the interdisciplinary field of science for better understanding biological data | | | |
| Role of bioinformatics in human genome project databases, nucleic acid sequence databases (NCBI, EMBL, DDJB), protein sequence database (SWISS-PORT); data base searching: BLAST | | | | |
| Outcome 2 | Demonstrate the most important bioinformatics databases, perform text-and sequence-based searches, and analyze the results in light of molecular biological knowledge | | | K4 |
| Unit III | | | | |
| Objective 3 | To create students opportunity to interact with algorithms, tools and current scenario | | | |
| Alignments, local, global, pair wise and multiple sequences. analysis: phylogenetics (CLUSTAL, PHYLIP and UPGAMA); gene finding and gene scan. protein prediction: prediction of physical properties, secondary structure, alpha- beta structure, motifs, tertiary structure, specialized Structure and function. | | | | |
| Outcome 3 | Experiment pair wise and multiple sequence alignment and will analyze the secondary and tertiary structures of protein sequences. | | | K4 |
| Unit IV | | | | |
| Objective 4 | To make the students look at a biological problem from a computational point of view | | | |
| Molecular visualization, protein confirmation and visualization tools (RASMOL, MOLMOL and CHIME) Drug discovery: History, analog & structural, ligand designing & optimization, docking, application of molecular modeling in drug discovery. | | | | |
| Outcome 4 | Understand the data structure (databases) used in bioinformatics and interpret the information (especially: find genes; determine their functions), understand and be aware of current research and problems relating to this area. | | | K2 |
| Unit V | | | | |
| Objective 5 | To find out the methods for analyzing the expression, structure and function of DNA, RNA and proteins | | | |
| WTO-GATT & TRIPS.Different types of intellectual property rights (IPR).Intellectual property laws And the Internet. Trade Related Aspects of Intellectual Property Rights.Patents-patent applications and rules governing patent- Selected examples of patent in biotechnology. Licensing and compulsory licensing. | | | | |
| Outcome 5 | To carry out gene and protein expression patterns and modelling cellular interactions and processes. | | | K5 |

Suggested Readings:

- Lewis PO., and Zaykin D., (1997). Genetic data analysis: Computer program for the analysis of Allelic data. Available at <http://chee.unm.edu/gda>.
- Amitava chakraborti, (2000). Patenting Biotechnology certain aspects.Pp.69-75.Subbaram, N.R., (2004). Basics of IPR.Pp. 5-13.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K.& Watson, JD. (1991). Molecular Biology of the cell. Oxford (3rd ed.).Garland publishers.
- De Robertis, E. D., & De Robertis, E. M. (1987). Cell and molecular biology. Lea & Febiger.
- Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2004). Overhead Transparency Set for Lehninger Principles of Biochemistry (4th ed.).
- WH Freeman. Murray, R. K., Granner, D. K., Mayes, P. A.,& Rodwell, V. W., (2006). Harper's Biochemistry (27th ed.). McGraw Hill.
- Shaik, N.,Halid Rahman, H., Babajan, B., Elango, R. (2019). Essentials of Bioinformatics Vol.II.Springer edition., pp.328.

Online resources

Bioinformatics An Introductory Textbook- <https://link.springer.com/book/10.1007/978-3-662-65036-3>

Bioinformatics, 4th Edition- <https://www.wiley.com/en-ca/Bioinformatics%2C+4th+Edition-p-9781119335580>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | L(1) | L(1) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) | M(2) | M(2) |
| CO-3 | M(2) | S(3) | S(3) | M(2) | S(3) | L(1) | M(2) | M(2) | S(3) | L(1) |
| CO-4 | M(2) | L(1) | S(3) | L(1) | M(2) | L(1) | L(1) | L(1) | M(2) | L(1) |
| CO-5 | M(2) | L(1) | S(3) | L(1) | L(1) | S(3) | L(1) | M(2) | L(1) | S(3) |
| W.AV | 1.8 | 1.8 | 3 | 1.4 | 2 | 1.8 | 1.4 | 1.6 | 2 | 1.8 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | M(2) |
| CO-2 | L(1) | S(3) | S(3) | L(1) | M(2) |
| CO-3 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-4 | M(2) | S(3) | S(3) | L(1) | M(2) |
| CO-5 | M(2) | S(3) | S(3) | L(1) | L(1) |
| W.AV | 1.8 | 3 | 3 | 1.4 | 2 |

1. Low, 2. Medium, 3. Strong

| Semester – I | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------|---|----------------------|
| DSE-1 | Course code: 508502 | Marine pharmaceuticals | T | Credits:3 Hours:3 |
| Unit-I | | | | |
| Objective 1 | Gain comprehensive knowledge on the various kinds of marine natural products | | | |
| Classification of drugs of natural origin- Complex polysaccharides-Glucosaminoglycans, Glycosides. Lipids – saponins, flavonoids, tannins, terpenoids. Steroids – phenylpropanoids, alkaloids. Protein, enzymes and peptides, antibiotics, biologics and immunomodulators | | | | |
| Outcome 1 | Understand an idea about the therapeutic lead molecules from marine sources | | | K2 |
| Unit-II | | | | |
| Objective 2 | Understand the essential features of the interdisciplinary field of science for better understanding biological data | | | |
| Potential natural products from marine flora and fauna-microbes (marine fungi, bacteria, actinomycetes), algae, seagrasses, mangroves, invertebrates –sponges, cnidarians, corals, bryozoans, crustaceans, 32mollusks, echinoderms, tunicates, bryozoans, pisces, reptiles – sea snakes and marine Mammal | | | | |
| Outcome 2 | Recognise the importance of marine fauna and flora in drug Production | | | K4 |
| Unit III | | | | |
| Objective 3 | Learn the techniques involved in the evaluation of crude drugs | | | |
| Neutraceuticals from marine environment-Development of novel foods and food ingredients - Low calorie sweeteners, Nutritional enrichment - food supplements. Food colouring agents and water binding agents. | | | | |
| Outcome 3 | Gain theoretical knowledge on neutraceuticals | | | K4 |
| Unit IV | | | | |
| Objective 4 | Versed in the design and formulation of drug dosage forms | | | |
| Marine bio-toxins- cardiovascular drugs, cytotoxic compounds, antimicrobial compounds, anti-inflammatory and antispasmodic agents and other therapeutically valuable compounds, quantification of drugs. | | | | |
| Outcome 4 | Recognise the marine toxins as drugs | | | K2 |
| Unit V | | | | |
| Objective 5 | Familiarize with the types of toxins and poisons in marine organisms | | | |
| Principles of design and formulation problems encountered with the types of dosage forms. Study of the biosynthesis of marine microbial, plant and animal secondary metabolites on the process leading to the major classes of the metabolites. | | | | |
| Outcome 5 | Clear in problems encountered with the types of dosage forms | | | K5 |
| Suggested Readings: | | | | |
| Fingerman M., (2000). Recent advances in Marine Biotechnology, (ed.,) | | | | |
| Morries H. Baslow, (1969). Marine Pharmacology. The Williams & Wilkins Co., Baltimore. | | | | |
| Hall., S and G.Strichartz, (1990). Marine toxins: Origin, Structure and Molecular Pharmacology | | | | |
| Paul Singleton (1999).Bacteria in Biology, Biotech and Medicine, 5th ed., | | | | |
| Treves Brown, K.M., (2000). Applied Fish Pharmacology. (ed.,) | | | | |
| Dennis W. Ross, (2002). Introduction to molecular medicine 3rd (ed.,) | | | | |
| Rodney J.Y. (2003). Biotech and Biopharmaceuticals (ed.,). | | | | |
| Trivedi, P.C. (2004). Herbal Drugs and Biotechnology (ed.,). | | | | |

Online resources**Marine Pharmacy Guide-** <https://www.kobo.com/in/en/ebook/marine-pharmacy-guide>**Encyclopedia of Marine Biotechnology-**<https://onlinelibrary.wiley.com/doi/book/10.1002/9781119143802>**Marine Biomaterials-** <https://link.springer.com/book/10.1007/978-981-16-4787-1>**K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create**

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | S(3) |
| CO-2 | L(1) | M(2) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) | M(2) | M(2) |
| CO-3 | M(2) | L(1) | S(3) | M(2) | S(3) | L(1) | M(2) | M(2) | S(3) | L(1) |
| CO-4 | L(1) | L(1) | S(3) | L(1) | M(2) | L(1) | L(1) | L(1) | M(2) | L(1) |
| CO-5 | M(2) | M(2) | S(3) | L(1) | L(1) | S(3) | L(1) | M(2) | L(1) | M(2) |
| W.AV | 1.6 | 1.8 | 3 | 1.4 | 2 | 1.8 | 1.4 | 1.6 | 2 | 1.8 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | M(2) |
| CO-2 | L(1) | M(2) | S(3) | L(1) | M(2) |
| CO-3 | M(2) | L(1) | S(3) | M(2) | S(3) |
| CO-4 | L(1) | L(1) | S(3) | L(1) | M(2) |
| CO-5 | M(2) | M(2) | S(3) | L(1) | L(1) |
| W.AV | 1.6 | 1.8 | 3 | 1.4 | 2 |

1. Low, 2. Medium, 3. Strong

| Semester-II | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------|-----------|-------------------------------|
| Core | Course code: 508201 | Medical genetics | T | Credits :5 Hours:5 |
| Unit-I | | | | |
| Objective 1 | Understand the Law's of inheritance and pedigree analysis. | | | |
| History of Human Genetics, Mendelian principles, Allele concept, Correlation between unit factors, Differential mode of functional behavior of Alleles. Pedigrees: gathering family history, pedigree symbols, construction of pedigrees, presentation of molecular genetic data in pedigrees | | | | |
| Outcome 1 | Acquire knowledge on the family history | | K2 | |
| Unit-II | | | | |
| Objective 2 | Describe the human chromosomes banding, nomenclature and pathology of human chromosomes | | | |
| Human chromosomes, classification, Chromosome Nomenclature. Methods of chromosome analysis: chromosome banding, karyotype analysis; Molecular cytogenetics: FISH, CGH., Chromosomal aberration: Numerical and Structural aberrations. Common chromosome abnormalities in cancer, Genetics of fetal wastage. Sex-linked inheritance: colour blindness, haemophilia and muscular dystrophy. | | | | |
| Outcome 2 | Know-how the sex-linked inheritance such as colour blindness and hemophilia. | | K4 | |
| Unit III | | | | |
| Objective 3 | Learn molecular cytogenetic technique such as FISH and CGH | | | |
| Inborn errors of metabolism, disorders of amino acid metabolism, disorders of branched-chain amino acid metabolism, disorders of carbohydrate metabolism, disorders of lipid metabolism, Mucopolysaccharidoses and Albinism., Pharmacodynamics: Definition, drug metabolism, Genetic variation by the effect of drugs, Hereditary disorders with altered drug response, Pharmacogenetics, Pharmacogenomics: Animal models in pharmacogenomics, Ecogenetics | | | | |
| Outcome 3 | Learn the drug response and metabolism | | K4 | |
| Unit IV | | | | |
| Objective 4 | Describe the molecular and biochemical pathways of inborn errors of metabolism | | | |
| Inherited immunodeficiency disorders, blood groups., Genetic factors in common diseases: genetic susceptibility to common diseases, types and mechanisms of genetic susceptibility, approaches to demonstrating genetic susceptibility, type 1 diabetes, type 2 diabetes, Crohn disease, hypertension, coronary artery disease, Alzheimer disease | | | | |
| Outcome 4 | Equip knowledge on the gene mutations in human | | K2 | |
| Unit V | | | | |
| Objective 5 | Learn genetic factors in common diseases | | | |
| Haematological disorders like thalassemia, sickle cell anemia, haemoglobinopathies., Molecular pathology: Classes of gene mutations in humans, Human mitochondrial diseases, Loss of Function and Gain of functional mutations in humans, Agammaglobinemia, Diseases of collagens., Single gene disorders: Huntington disease, myotonic dystrophy, hereditary motor & sensory neuropathy, neurofibromatosis, Marfan syndrome, cystic fibrosis and inherited cardiac arrhythmias & cardiomyopathies. | | | | |
| Outcome 5 | Realise the various genetic disorders | | K5 | |

Suggested Readings:

- Chattopadhyay, I. (2018). Fundamentals of Genetiics (1st ed.). Vinod Kumar Jain, Scientific International (Pvt.) Ltd.
- Rimoin, D. L., Pyeritz, R. E., & Korf, B. (Eds.). (2013). Emery and Rimoin's essential medical genetics. Elsevier.
- Turnpenny, P. D., & Ellard, S. (2016). Emery's Elements of Medical Genetics E-Book. Elsevier Health Sciences.
- Maloy,S.R. Cronan, J.E and Freifelder (D.J.B). (2002)Modern Genetic Analysis, 2 nd (ed.,)
- Freifelder, J.B. (1993). Essentials of Molecular Biology, 2 nd (ed.,)
- Amita Sarkar (2011). A Textbook of Human Genetics (ed.,)
- Watson et al.,(2014). Molecular Biology of the Gene, 7 th (ed.,)

Online resources

Medical Genetics- <https://shop.elsevier.com/books/medical-genetics/jorde/978-0-323-59737-1>
Essential Medical Genetics, Includes Desktop Edition, 6th Edition- <https://www.wiley.com/en-fr/Essential+Medical+Genetics,+Includes+Desktop+Edition,+6th+Edition-p-9781405169745>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | S(3) | S(3) | M(2) | S(3) | M(2) | S(3) | M(2) | S(3) |
| CO-2 | S(3) | L(1) | S(3) | S(3) | M(2) | S(3) | L(1) | M(2) | M(2) | M(2) |
| CO-3 | S(3) | S(3) | M(2) | S(3) | L(1) | S(3) | M(2) | L(1) | L(1) | L(1) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | L(1) | S(3) | L(1) | L(1) | M(2) | S(3) |
| CO-5 | S(3) | L(1) | M(2) | S(3) | S(3) | S(3) | M(2) | M(2) | L(1) | M(2) |
| W.AV | 2.8 | 1.8 | 2.4 | 3 | 1.8 | 3 | 1.6 | 1.8 | 1.6 | 2.2 |

1. Low , 2. Medium , 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | L(1) | S(3) | S(3) | M(2) |
| CO-3 | S(3) | S(3) | M(2) | S(3) | L(1) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | L(1) |
| CO-5 | S(3) | L(1) | M(2) | S(3) | S(3) |
| W.AV | 2.8 | 1.8 | 2.4 | 3 | 1.8 |

1. Low, 2. Medium, 3. Strong

| Semester-II | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------|---|----------------------|
| Core | Course code: 508202 | Pharmacology | T | Credits:5 Hours:5 |
| Unit-I | | | | |
| Objective 1 | Acquire knowledge about the principles of pharmacology | | | |
| Drug Nomenclature, Generic name, Fixed dose combinations, dosage forms and Posology of Drugs. Nature & sources of drugs. Routes of administration of drugs (Oral, Tropical, Parental), their advantages and disadvantages. Absorption, Distribution, Biotransformation, Elimination. Methods of prolongation of drug effect, Factors modifying dose of a drug. Mechanism of drug action and the factors influencing it. Basic principles, mechanism of action and types of Drug receptors and Transducers (Agonist, partial agonist, inverse agonist, antagonist). | | | | |
| Outcome 1 | Imparts basic and clear understanding over the concepts and fundamental principles of pharmacology | | | K2 |
| Unit-II | | | | |
| Objective 2 | Learn the mechanism of action of several drugs over the various physiological systems | | | |
| Pharmacological classification of drugs: Pharmacology of drugs acting on autonomic (cholinergic and adrenergic systems.) peripheral and central nervous systems (anesthetics: general and local; sedatives and psychopharmacological agents). Drugs acting on the respiratory system, digestive system, renal excretory system, coagulants and anticoagulants. hematonics, Cardiovascular drugs cardiotoxic, antianginal agents, antihypertensive agents, peripheral vasodilators and drugs used in atherosclerosis. Mechanism of actions and applications of drugs used as immunostimulants, immunosuppressant, anti-psychotics, anti-depressants, narcotic analgesics, antagonists, non steroidal anti-inflammatory drugs and anti-gout drugs, adrenergic receptor blockers, neuron blockers, ganglion blockers and neuromuscular blockers. | | | | |
| Outcome 2 | Acquire knowledge over the basic principles of systemic pharmacology. | | | K4 |
| Unit III | | | | |
| Objective 3 | Describe the basics of Chemotherapeutic drugs and steps involved in the identification of new drugs | | | |
| Principles of chemotherapy of infection, infestation and neoplastic diseases and concepts of resistance to chemotherapeutic agents. Drug addiction and abuse. Drug discovery: Experimental methodology (<i>in vivo</i> , <i>in vitro</i> , <i>ex vivo</i>). Drug Discovery process, Early Drug Discovery (Drug screening methods, <i>in silico</i> platforms, biochemical assays, cell cultures and various animal models.) Pre-Clinical Phase (laboratory and in animal or alternative models.) and Clinical Phases (Phase I, II, III and IV.), and Regulatory Approval (NRA). Gene Therapy – An introduction and applications in High throughput screening techniques and Transgenic animal models in the development of new drugs. Cell lines and their applications in drug discovery. | | | | |
| Outcome 3 | Empathize the cascade mechanisms underlying the process over identification of pharmaceutically active compound | | | K4 |
| Unit IV | | | | |
| Objective 4 | Know the principle of identification, continuous monitoring and handling of adverse events that arouses owing to the drug | | | |
| Pharmacovigilance- signal detection systems and uses advanced data analytics. Importance of safety monitoring of Medicine, WHO international drug monitoring programme, Pharmacovigilance Program of India(PvPI), MedDRA and PSUR. Investigation of ADR/ADE and contraindications of the drug, PV laws and Guidelines. Definitions and classification of adverse drug reactions, Detection and reporting Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment Management of adverse drug reactions. Post marketing surveillance, Drug information service, drug utilization studies, therapeutic audit, essential drug concepts | | | | |
| Outcome 4 | Realize the necessity for continuous detection, assessment, understanding and prevention of adverse effects of the product | | | K2 |

| Unit V | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----|
| Objective 5 | Highlights the standards to meet the regulatory standards and prohibition of Drugs | |
| Commonly used animals in pharmacological research, limitations of animal tests, Animal handling and animal care Methods (anaesthetizing, restraining, blood collection and euthanasia.). Institutional Animal Ethics Committee, CPCSEA guidelines for breeding and stocking of animals, performance of experiments, transfer and acquisition of animals for experiment. Drugs and Cosmetics Act, 1940 and its rules 1945, Legal definitions of schedules to the Act and Rules. Classes of drugs and cosmetics prohibited from import Manufacture and sale of certain drugs with Offences and penalties., narcotic drugs and psychotropic substances Act-1985 and Rules. Manufacture of drugs for test, examination, analysis and commercial use and requirements to adopt and follow Regulatory commitments (ICH, GCP, PICS, WHO GMP, GxP) | | |
| Outcome 5 | Understand the key concepts over necessary of ethical clearance to carry out animal studies | K5 |
| Suggested Readings: August, J.T., Anders, M.W., Murad, F., & Coyle, J.C (eds.) (1994). Advances in Pharmacology (1st ed.). Academic Press Katzung, B. G. (2017). Basic and clinical pharmacology. McGraw-Hill Education. Derasari&Brahmankar (2015). Elements of Pharmacology.(ed.,) Bose, B.C.(2015) Text Book Pharmacology (ed.) Goodman and Gilman's,(2012). The Pharmacological Basis of Therapeutics (ed.) Tripathi, K.D. (2020). Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi. (ed.) Sharma H. L., Sharma K. K., (2018). Principles of Pharmacology, Paras medical publisher (ed.) | | |
| Online resources Pharmacy and Pharmacology- https://guides.lib.umich.edu/c.php?g=282760&p=1884068 Pharmacology Books, Ebooks And Journals- https://www.uk.elsevierhealth.com/medicine-and-surgery/pharmacology | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | S(3) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | L(1) | L(1) | M(2) | M(2) | M(2) | M(2) | L(1) |
| CO-3 | S(3) | M(2) | M(2) | M(2) | M(2) | S(3) | L(1) | L(1) | L(1) | M(2) |
| CO-4 | S(3) | L(1) | L(1) | L(1) | L(1) | M(2) | L(1) | M(2) | S(3) | L(1) |
| CO-5 | S(3) | S(3) | L(1) | L(1) | M(2) | L(1) | S(3) | L(1) | M(2) | L(1) |
| W.AV | S(3) | 2.2 | 1.8 | 1.4 | 1.6 | 2 | 1.8 | 1.6 | 2.2 | 1.4 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | L(1) | L(1) |
| CO-3 | S(3) | M(2) | M(2) | M(2) | M(2) |
| CO-4 | S(3) | L(1) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | S(3) | L(1) | L(1) | M(2) |
| W.AV | 3 | 2.2 | 1.8 | 1.4 | 1.6 |

1. Low , 2. Medium, 3. Strong



| Semester-II | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---|-----------|---------|
| Core | Course code: 508203 | Practical –III Medical Genetics, Pharmacology | P | Credits:4 | Hours:8 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Identification of drugs by morphological characters ➤ Physical and chemical tests for evaluation of drug wherever applicable ➤ Dissection and analysis of source organs flora and fauna for extraction of drug ➤ Identification of fibres and surgical dressings ➤ Isolation of nature products such as caffeine, starch, emetine, fixed oils | | | | |
| | <ol style="list-style-type: none"> 1. Simple mendelian traits on man –observation and recording, 2. Construction of pedigree chart for family history 3. Mounting of polytene chromosomes 4. Mitosis in onion root tip. 5. Identification of Barr body in buccal epithelial cell, 6. Diagnosis of biochemical disorder- Alkaptonuria 7. Demonstration on structure and molecular organization of chromosomes 8. Study of hereditary disorder with the aid of chromosome karyotyping 9. Animal handling and precautions 10. Routes of drug administration 11. Topical application of atropine on rabbit eye 12. Analgesic effect of diclofenac in mice using hot plate method 13. Determination and calculation of lethal dose (LD50) value 14. Collection, processing, identification and extraction of bioactive crude extracts from marine fauna and flora 15. Quantitative and Qualitative analysis of phytochemicals from marine fauna and flora 16. Extraction of neutraceuticals from marine sources | | | | |
| Course Outcomes (CO) | CO1- To know the family history CO2- Familiarise the mutations on chromosomes CO3- Understand the scientific validation and quality evaluation of drugs CO4- Learn the routes of administration of drugs CO5- Evaluation of safe and efficacy of drugs | | | | |
| Online Resources: | | | | | |
| Cell Biology And Genetics Lab Manual. https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Laboratory-Manual-17-18.pdf . Genetics Laboratory Manual. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1008&context=ny_oers . Molecular Genetics Laboratory Procedures. https://bpb-us-e1.wpmucdn.com/wordpressua.uark.edu/dist/1/802/files/2020/07/MANUAL.pdf | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | S(3) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | L(1) |
| CO-3 | S(3) | M(2) | M(2) | S(3) | S(3) | L(1) | L(1) | L(1) | S(3) | M(2) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | M(2) | L(1) | M(2) | S(3) | M(2) | L(1) |
| CO-5 | S(3) | S(3) | L(1) | S(3) | L(1) | S(3) | L(1) | M(2) | L(1) | L(1) |
| W.AV | 3 | 2 | 2.2 | 3 | 2 | 1.8 | 1.6 | 2.2 | 2 | 1.4 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | M(2) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | S(3) | M(2) |
| CO-3 | S(3) | M(2) | M(2) | S(3) | S(3) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | M(2) |
| CO-5 | S(3) | S(3) | L(1) | S(3) | L(1) |
| W.AV | 3 | 2 | 2.2 | 3 | 2 |

1. Low , 2. Medium, 3. Strong



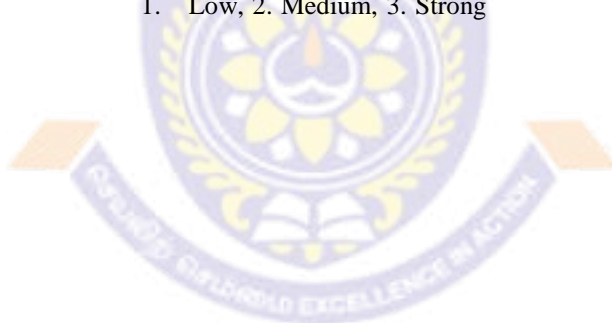
| Semester-II | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---|-----------|---------|
| Core | Course code: 508204 | Practical –IV Techniques in Biomedical sciences-II | P | Credits:4 | Hours:6 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Learn the basic concepts and applications of instruments applied in biochemical analysis. ➤ To learn the preparation of buffers and determination of pI values of amino acids ➤ Recognize the principles and procedures behind the chromatographic techniques ➤ Clear understanding the principles of spectrometric analysis and their practical application explored. ➤ Acquire the features of chromatography techniques and their biological applications | | | | |
| | <ul style="list-style-type: none"> • Principles and applications of pH meter, Colorimeter, Spectrophotometer, Centrifuge • Preparation of buffers • Derivation of Henderson-Hasselbach equation • Evaluation of pKa values in acid-base titrations • Determination of pI value of amino acids • Separation of amino acids and sugars by Paper chromatography • Identification of plant pigments by TLC • Separation of organic compounds by column chromatography • Demonstration of GC, HPLC, AAS,NMR,FTIR and Mass spectroscopy | | | | |
| Suggested Readings: | | | | | |
| Baynes, J. W., & Dominiczak, M. H. (2014). Medical Biochemistry (ed.,) Carr, J. J., & Brown, J. M. (1981). Introduction to biomedical equipment technology. (ed.,) Haven, M. C., Tetrault, G. A., & Schenken, J. R. (1994). Laboratory instrumentation (ed.,) Joseph J. Carr & Brown, J. M. (2001). Introduction to biomedical equipment technology. (ed.,) Khandpur, R. S. (1987). Handbook of biomedical instrumentation. (ed.,) Larson, M.T & Donna, D.L.M. (2016). Clinical chemistry: Fundamentals and Laboratory Techniques (1st ed.). | | | | | |
| Online Resources: Laboratory Manual of Biochemistry Joy P P, Surya S. and Aswathy C. https://prsvkm.kau.in/sites/default/files/documents/prsvkm_laboratory_manual_of_biochemistry.pdf . Practical Lab Manual Biochemistry. https://Jru.Edu.In/Studentcorner/Lab-Manual/Bpharm/2nd-Sem/Lab%20manual%20-%20biochemistry.Pdf | | | | | |
| Course Outcomes (CO) | CO1- Learn the principles and applications of pH meter CO2- Understand the role of buffers in biochemical reactions CO3- Hands on experience on the biochemical separation techniques CO4- Know the principle, instrumentation and application of chromatography CO5- Gain knowledge on the principle, instrumentation and application of spectroscopy | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | S(3) |
| CO-2 | S(3) | M(2) | S(3) | L(1) | L(1) | M(2) | M(2) | L(1) | M(2) | M(2) |
| CO-3 | S(3) | L(1) | L(1) | M(2) | M(2) | S(3) | L(1) | M(2) | L(1) | L(1) |
| CO-4 | S(3) | M(2) | M(2) | L(1) | L(1) | M(2) | L(1) | L(1) | M(2) | S(3) |
| CO-5 | S(3) | S(3) | L(1) | L(1) | M(2) | L(1) | S(3) | L(1) | L(1) | M(2) |
| W.AV | 3 | 2.2 | 1.8 | 1.4 | 1.6 | 2 | 1.8 | 1.4 | 1.6 | 2.2 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | M(2) | S(3) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | S(3) | L(1) |
| CO-3 | S(3) | L(1) | L(1) | S(3) | M(2) |
| CO-4 | S(3) | M(2) | M(2) | S(3) | L(1) |
| CO-5 | S(3) | S(3) | L(1) | S(3) | M(2) |
| W.AV | 3 | 2.2 | 1.8 | 3 | 1.6 |

1. Low, 2. Medium, 3. Strong



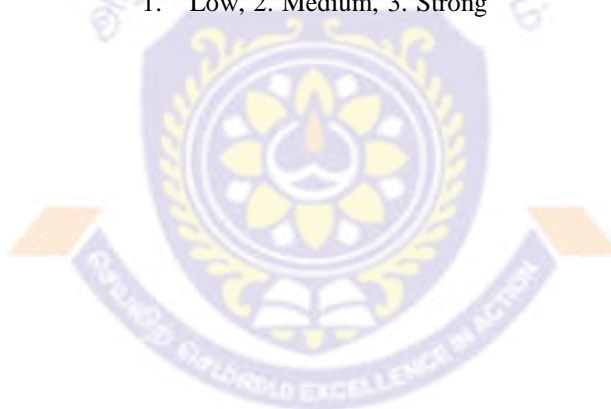
| Semester-II | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------|---|-----------|---------|
| DSE-2 | Course code: 508503 | Forensic Science | T | Credits:3 | Hours:3 |
| Unit-I | | | | | |
| Objective 1 | Understand the basic concepts of forensic science and their scope. | | | | |
| Definition and scope of forensic science, history and development of forensic science. Scope and development of forensic science in India, growth of core laboratories, set up in country | | | | | |
| Outcome 1 | Acquire knowledge on the forensic laboratories and development. | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Learn crime scene procedures and types of crimes. | | | | |
| Introduction to crime, sociological aspect in society, types of crimes, crimes in India, crime scene management, crime scene procedures, protection of crime scene physical evidence- scientific collection of physical evidence, crime scene management in manmade and natural disaster. | | | | | |
| Outcome 2 | Understand the duties of forensic scientists. | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Describe the various divisions of crime investigation | | | | |
| Duties of forensic scientist, various divisions of crime investigation – toxicology, biology, serology, chemistry, physics ballistics prohibition document and other divisions. | | | | | |
| Outcome 3 | Gain knowledge about research methods and ethical issues in Psychology | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Gain knowledge on the basic concepts of psychology | | | | |
| Specialised facilities offered by forensic science laboratory – DNA fingerprinting, polygraph, narco analysis, brain electrical oscillation signature proficiency (BEOSP); Cyber forensic- tape and video authentication, speaker identification etc. | | | | | |
| Outcome 4 | Know-how the methods of cyber forensics | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Familiarize the specialized facilities in national forensic laboratory | | | | |
| Concepts of psychology, history of psychology, modern perspectives, types of psychological professionals psychology; The science and research methods, professional and ethical issues in psychology. | | | | | |
| Outcome 5 | Learn the various divisions in forensic laboratories | | | K5 | |
| Suggested Readings: | | | | | |
| Barile, F. A. (2007). Principles of toxicology testing. (ed.,) | | | | | |
| Basu, R. (2009). Fundamentals of Forensic Medicine and Toxicology (2 nd ed.). | | | | | |
| Bertino, A. J. (2012). Forensic Science: Fundamentals and Investigations (ed.,) | | | | | |
| Leela Dubey (2018). Forensic Science. (1 st ed.,) | | | | | |
| Heath, W. (2018). Psychology Research Methods: Connecting Research to Students' Lives.(ed.,) | | | | | |
| Sharma, R.K. (2008). Practical and Viva in Forensic Medicine and Toxicology. (ed.,) | | | | | |
| Online resources | | | | | |
| Forensic Science: A Multidisciplinary Approach- https://onlinelibrary.wiley.com/doi/book/10.1002/9783527693535 | | | | | |
| Forensic Science Resources: Books/ebooks- https://guides.uflib.ufl.edu/c.php?g=147333&p=968747 | | | | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | S(3) |
| CO-2 | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) | L(1) | L(1) | M(2) | M(2) |
| CO-3 | M(2) | S(3) | L(1) | L(1) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | M(2) | L(1) | L(1) | L(1) | M(2) | S(3) |
| CO-5 | L(1) | S(3) | M(2) | L(1) | L(1) | S(3) | L(1) | M(2) | L(1) | M(2) |
| W.AV | 2 | 3 | 2.2 | 1.6 | 2 | 1.8 | 1.4 | 1.6 | 1.6 | 2.2 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | M(2) | M(2) |
| CO-2 | M(2) | S(3) | M(2) | M(2) | M(2) |
| CO-3 | M(2) | S(3) | L(1) | L(1) | S(3) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | M(2) |
| CO-5 | L(1) | S(3) | M(2) | L(1) | L(1) |
| W.AV | 2 | 3 | 2.2 | 1.6 | 2 |

1. Low, 2. Medium, 3. Strong



| Semester-II | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------|---|-----------|---------|
| DSE 2 | Course code: 508504 | Artificial Organs | T | Credits:3 | Hours:3 |
| Unit-I | | | | | |
| Objective 1 | Understand the substitutive medicine and organ replacement. | | | | |
| Design of artificial organs-substitutive medicine, biomaterial concentration, outlook for organ replacement, design consideration, evaluation of artificial organs. | | | | | |
| Outcome 1 | Understand the artificial organs and their mechanisms | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | To learn the artificial heart and circulatory assist devices. | | | | |
| Artificial heart and circulatory assist devices- design of artificial heart, history of artificial heart, types of valve prostheses, thrombus deposition, durability, mechanical circulatory assistance, two main categories, intra- aortic balloon pump, percutaneous cardiopulmonary bypass. | | | | | |
| Outcome 2 | Acquire knowledge about artificial lungs and blood gas exchange devices | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Acquire artificial lung and cardio pulmonary bypass. | | | | |
| Artificial lungs and blood gas exchange devices- artificial lung ventilation, gas exchange systems, cardio pulmonary bypass, ECMO, comparison of artificial lungs and natural lungs, oxygen transport, carbon-di-oxide transport. | | | | | |
| Outcome 3 | Comprehend the imaging concepts that characterize the quality of imaging techniques | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Describe the renal transplantation and dialysis. | | | | |
| Artificial kidney and artificial pancreas- Artificial kidney: renal transplantation, mass transfer in dialysis, membranes, hemofiltration, peritoneal dialysis equipment. Artificial pancreas: insulin therapy, therapeutic options in diabetes, insulin administration system, insulin production system. | | | | | |
| Outcome 4 | Versed in the principles of image formation, capture and display of ultrasound and X-ray | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Know-how the artificial blood and liver | | | | |
| Artificial blood and artificial liver- Artificial blood: plasmapheresis, blood substitutes, hemodilution, classification, characterisation of substitutes. Artificial liver: liver support systems, global liver function replacement, hybrid liver function replacement. | | | | | |
| Outcome 5 | Learn about the artificial lung and cardio pulmonary bypass | | | K5 | |
| Suggested Readings: | | | | | |
| Basu, B. (2017). Biomaterials science and tissue engineering: principles and methods. Ed., Miller, E. G. (2006). Artificial Organs. (ed.) Ong, J. L., Appleford, M. R., & Mani, G. (2014). Introduction to biomaterials: basic theory with engineering applications. (ed.) Poole, D. L., & Mackworth, A. K. (2010). Artificial Intelligence: foundations of computational agents. (ed.,) Cromwell, L., Weibell, F. J., Pfeiffer, E. A., & Usselman, L. B. (1973). Biomedical instrumentation and measurements (ed.,) Drexler, W., & Fujimoto, J. G. (2008). Optical coherence tomography: technology and applications. (ed.,) | | | | | |
| Online resources | | | | | |
| Artificial Organs- https://link.springer.com/book/10.1007/978-3-031-01611-0 | | | | | |
| Tissue Engineering for Artificial Organs: Regenerative Medicine, Smart Diagnostics and Personalized Medicine- https://onlinelibrary.wiley.com/doi/book/10.1002/9783527689934 | | | | | |
| Artificial Organs- https://www.kobo.com/us/en/ebook/artificial-organs-1 | | | | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | M(2) | M(2) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | L(1) | L(1) | M(2) | S(3) | M(2) | M(2) | L(1) | L(1) |
| CO-3 | S(3) | L(1) | M(2) | M(2) | L(1) | S(3) | S(3) | L(1) | M(2) | M(2) |
| CO-4 | S(3) | L(1) | L(1) | L(1) | L(1) | S(3) | M(2) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | M(2) | M(2) | M(2) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) |
| W.AV | 2.8 | 1.8 | 1.6 | 1.6 | 1.8 | 3 | 2 | 1.8 | 1.4 | 1.6 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | M(2) | M(2) | S(3) |
| CO-2 | S(3) | M(2) | L(1) | L(1) | S(3) |
| CO-3 | S(3) | L(1) | M(2) | M(2) | S(3) |
| CO-4 | S(3) | L(1) | L(1) | L(1) | S(3) |
| CO-5 | S(3) | M(2) | M(2) | M(2) | S(3) |
| W.AV | 2.8 | 1.8 | 1.6 | 1.6 | 3 |

1. Low, 2. Medium, 3. Strong



| Semester-III | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------|---|-----------|---------|
| Core | Course code: 508301 | Toxicology | T | Credits:5 | Hours:5 |
| Unit-I | | | | | |
| Objective 1 Understand the basics underlying toxicology | | | | | |
| History, scope of toxicology, principles of toxicology, mechanisms and risk assessment, toxicants, toxin and poison, types of toxicity and its measurement: acute, sub-acute, chronic and developmental toxicity. Routes of exposure of toxicants (oral, inhalation, dermal, parenteral). Disposition: absorption, sites of absorption, distribution, excretion; metabolism: types of metabolic change phase I reactions; Phase 2 reactions; control of metabolism. Dose-response relationship. Toxication vs. Detoxication. Biochemical basis of toxicity: mechanism of toxicity: Disturbance of excitable membrane function, factors influencing toxic effects. | | | | | |
| Outcome 1 | Imparts descriptive idea over the fundamentals of toxic substances and mechanism of action | | | K2 | |
| Unit-II | | | | | |
| Objective 2 Describe the category of toxins and its effects | | | | | |
| Bio-Toxins: mycotoxins, bacterial toxins and animal toxins. Synthetic organic compounds: chemical additives in food, chemicals in the work place, solvents, vapors, cosmetics, environmental toxicants : air pollution, ecotoxicology, food toxicology. Toxic responses of the blood, immune system, liver, kidney, nervous system, endocrine system, heart and vascular system. Biochemical basis of toxicity: mechanism of toxicity: Disturbance of excitable membrane function, altered calcium homeostasis, covalent binding to cellular macromolecules. | | | | | |
| Outcome 2 | Understanding the kinds of naturally occurring and synthetic toxic substances with our different biological systems | | | K4 | |
| Unit III | | | | | |
| Objective 3 Elicit the threats possessed by the carcinogenic and xenobiotic agents | | | | | |
| Classification of carcinogens (known and suspected carcinogens), types of carcinogens (chemical, physical and onco-genic). Categorization of carcinogens (Category 1A, 1B and 2). Multistage carcinogenesis, mechanisms of action of chemical carcinogens (genotoxic, non genotoxic, mutagenesis, industrial and inorganic carcinogens (arsenic, beryllium, cadmium, chromium, nickel, lead). Mutagenesis: definitions, types, mutagenic agents and effects. Chromosomal alterations, DNA damage, teratogenicity and mutagenicity. Xenobiotics: Introduction, classification and environmental impacts, toxic responses to foreign compounds: Direct toxic action: tissue lesions; mechanism and response in cellular toxicity, pharmacological, physiological and biochemical effects | | | | | |
| Outcome 3 | Acquire knowledge over the several carcinogenic substances to the mankind | | | K4 | |
| Unit IV | | | | | |
| Objective4 Acquire knowledge over the several poisons and its elimination methods | | | | | |
| Types of poison, clinical signs and symptoms, diagnosis, management and medicolegal aspects of corrosive poisons; irritant poisons; neural poisons; somniferous; inebriant; delirium; spinal; peripheral; cardiac poisons; asphyxiants; drug abuse. Treatment of poisoning due to heavy metals, insecticides, opioids and other addict forming drugs. Incidence of acute poisoning, prevention and treatment of poisoning. Clinical symptoms and management of barbiturates, morphine and organophosphorus compound and lead, mercury and arsenic poisoning. Biomarkers criteria of toxicity new technologies evaluation of toxicity interactions | | | | | |
| Outcome 4 | Reveal the clinical status of variety of poisons and therapeutic approaches to exposed poisoning | | | K2 | |

| Unit V | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------|
| Objective 5 | Learn about the multiple toxicity evaluation methodologies | |
| Evaluation of toxicity, median effective dose, median toxic dose, median lethal dose, therapeutic index and therapeutic window. Toxicity testing : Short-term tests for mutagenicity, genetic toxicity and mutagenesis assay: bacterial mutation tests-reversion test, ames test, fluctuation test, and eukaryotic mutation test. Biochemical mechanisms of tissue toxicity, organ, neurotoxicity; gastro-intestinal toxicity, skin toxicity/ photosensitivity, genetic toxicology, reproduction toxicity, carcinogenicity studies ,exaggerated and unwanted toxicological effects, single dose, repeat dose toxicity studies, safety pharmacology, studies (including segment I, II, and III). | | |
| Outcome 5 | Learn the key concept's in testing methodologies of toxicants and mutagens | K5 |
| Suggested Readings: Parikh C.K. Parikh 's (2007) Textbook of Medical Jurisprudence and Toxicology, 6th ed., Franklin, C.A (2020). Modi's medical Jurisprudence and Toxicology .21st ed., H.P. Rang, M.M. Dale, J.M. Ritter & P.K. Moore (2012). Pharmacology. (ed.,) Bertram G. Katzung. (2008). Basic and Clinical Pharmacology. (ed.,) W. C. Bowman, M. J. Rand.(2016). Text book of Pharmacology (ed.,) | | |
| Online resources A Textbook Of Modern Toxicology- http://pustaka.unp.ac.id/file/abstrak_kki/EBOOKS/A%20textbook%20of%20Modern%20Toxicology.pdf?utm_medium=email&utm_source=transaction A Textbook of Modern Toxicology- https://onlinelibrary.wiley.com/doi/book/10.1002/0471646776 | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | M(2) | M(2) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | M(2) | L(1) | L(1) | M(2) | L(1) | S(3) | M(2) | L(1) | L(1) | M(2) |
| CO-3 | L(1) | M(2) | S(3) | L(1) | M(2) | S(3) | L(1) | M(2) | M(2) | L(1) |
| CO-4 | M(2) | L(1) | S(3) | L(1) | L(1) | S(3) | L(1) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | S(3) | S(3) | S(3) | L(1) | S(3) | S(3) | L(1) | M(2) | S(3) |
| W.AV | 2.2 | 1.8 | 2.4 | 1.8 | 1.4 | 3 | 1.8 | 1.4 | 1.6 | 1.8 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) |
| CO-2 | M(2) | S(3) | L(1) | M(2) | L(1) |
| CO-3 | L(1) | S(3) | S(3) | L(1) | M(2) |
| CO-4 | M(2) | S(3) | S(3) | L(1) | L(1) |
| CO-5 | S(3) | S(3) | S(3) | S(3) | L(1) |
| W.AV | 2.2 | 3 | 2.4 | 1.8 | 1.4 |

1. Low , 2. Medium, 3. Strong

| Semester-III | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------|---|------------|---------|
| Core | Course code: 508302 | Medical Oncology | T | Credits: 5 | Hours:5 |
| Unit-I | | | | | |
| Objective 1 | Understand the cell cycle ligands and receptors & cell – cell interactions. | | | | |
| Modulations of Cell- Cell cycle- ligands and receptors, cell- cell interactions, integrins, invasions by cancerous cells, angiogenesis, morphogens, mechanism of deregulation of cell cycle during cancer, Apoptosis. | | | | | |
| Outcome 1 | Understand the mechanism of deregulation of cell cycle during cancer. | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Know the degree of malignancy and types of chromosomal translocations | | | | |
| Types of tumor-benign and malignant tumor, localized and metastasis disease, tumor classification- WHO classification, staging and grading, degree of malignancy, types of chromosomal translocations, Relationship between oncogene products and growth factors- Src, Wnt, GAP | | | | | |
| Outcome 2 | To learn the relationship between oncogene products and growth factors | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Learn the oncogenic mutations in growth promoting proteins | | | | |
| Carcinogenesis-oncogenic mutations in growth promoting proteins, Mutations causing loss of cell cycle control, evasion of growth inhibitory signals, cancer genes (oncogenes and tumor suppressor genes), necrosis. | | | | | |
| Outcome 3 | Know-how the mutations causing loss of cell cycle control | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Have an understanding of targeted delivery of anticancer agents | | | | |
| Cancer Diagnosis-Cancer Imaging Techniques, Drug targeting and anti cancer delivery system, Targeted delivery of anticancer agents using nanoparticles, colloidal systems for the delivery of anticancer agents | | | | | |
| Outcome 4 | Gain knowledge the critical analysis of cancer therapy and vaccines | | | K2 | |
| Unit V | | | | | |
| Objective 5 | To learn the various types of therapy in cancer treatment | | | | |
| Cancer therapy-Modulations of immune response, immunotherapy, Conventional chemotherapy, photodynamic therapy of cancer, Critical analysis of cancer therapy, Cancer vaccines. | | | | | |
| Outcome 5 | Acquire the cancer diagnosis and treatment | | | K5 | |
| Suggested Readings: | | | | | |
| David J. Kerr, Daniel G. Haller, Cornelis J. H. van de Velde and Michael Baumann, (2022). Oxford textbook of oncology (3 rd ed.,) | | | | | |
| Leonidas C. Plataniias, (2022). Advances in oncology, 1 st ed., | | | | | |
| Paul M. (2022). Silverman, Oncologic Imaging: A Multidisciplinary Approach, (2nd ed.,). | | | | | |
| Cavalli, F., Kaye, B.K., Hansen, H.H., Armitage, O.J., Piccart, J.M. & Gebhart. (2009). Cancer- Principles and practice of oncology (4 th ed.). | | | | | |
| Cavalli, F., Kaye, S. B., Hansen, H. H., Armitage, J. O., & Piccart-Gebhart, M. (2009). Textbook of medical oncology. (ed.,) | | | | | |
| Rudolph K Lenhard, Nanomaterials for cancer diagnosis Wang, E. (2010). Cancer systems biology. (ed.,) | | | | | |
| John E. Niederhuber, James O. Armitage, Joel E. Tepper, (2020). Clinical Oncology 6 th ed., | | | | | |
| Antonio Russo, Marc Peters, Lorena Incorvaia, Christian Rolfo, (2021). Practical Medical Oncology Text book. (ed.,) | | | | | |

Online resources

Textbook of Medical Oncology- <https://www.routledge.com/Textbook-of-Medical-Oncology/Cavalli-Kaye-Hansen-Armitage-Piccart-Gebhart/p/book/9780415477482>

Oncology/Cancer: Books- <https://uscmed.sc.libguides.com/c.php?g=377964&p=2558699>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

Mapping Course Outcome VS Programme Outcomes

| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
|------|------|------|------|------|------|------|------|------|------|-------|
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | L(1) | M(2) | L(1) | M(2) | M(2) | L(1) | L(1) | M(2) |
| CO-3 | S(3) | S(3) | S(3) | L(1) | M(2) | S(3) | L(1) | M(2) | M(2) | L(1) |
| CO-4 | S(3) | M(2) | S(3) | L(1) | L(1) | M(2) | L(1) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | L(1) | S(3) | S(3) | L(1) | L(1) | S(3) | L(1) | M(2) | S(3) |
| W.AV | 3 | 2.2 | 2.4 | 1.8 | 1.4 | 2 | 1.8 | 1.4 | 1.6 | 1.8 |

1. Low, 2. Medium, 3. Strong

Course Outcome VS Programme Specific Outcomes

| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
|------|-------|-------|-------|-------|-------|
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | L(1) | M(2) | L(1) |
| CO-3 | S(3) | S(3) | S(3) | L(1) | M(2) |
| CO-4 | S(3) | M(2) | S(3) | L(1) | L(1) |
| CO-5 | S(3) | L(1) | S(3) | S(3) | L(1) |
| W.AV | 3 | 2.2 | 2.4 | 1.8 | 1.4 |

1. Low, 2. Medium, 3. Strong

| Semester-III | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---|-----------|---------|
| Core | Course code: 508303 | Practical V- Toxicology, Medical Oncology | P | Credits:4 | Hours:8 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Learn the routes of administration in animal model. ➤ Understand the effect of drugs action and general anesthesia. ➤ Acquire the acute toxicity in given drugs. ➤ Gain knowledge on the study of cell culture techniques ➤ Know-how the study of the various biological and biochemical markers | | | | |
| | <ul style="list-style-type: none"> • Animal handling and precautions • Study the routes of administration • Topical application of atropine and pilocarpine on rabbit eye • Analgesic effect of diclofenac on mice or rat • Study the effect of general anaesthesia with ketamine • Determine the acute toxicity of a given drug • Determination and calculation of TD 50/ TC 50 and LD 50/ LC 50 value • Demonstration of the detection of organophosphorous pesticides in biological sample • Preparation of media, sera for primary cell culture • Preparation of established cell lines • Cell counting and viability • Preservation of cells • Demonstration of <ul style="list-style-type: none"> Culture of cell lines- MCF and VERO Cytotoxicity assay- MTT assay, apoptosis assay, neutral red assay DPPH radical scavenging assay LDH (Lactate dehydrogenase assay) DNA fragmentation assay Ultrasound imaging Principles and production of X-rays | | | | |
| Suggested Readings: | | | | | |
| <p>Barile, F. A. (2013). Principles of Toxicology Testing (2nd ed.).</p> <p>Katzung, B. G. (2017). Basic and clinical pharmacology. (ed.,)</p> <p>Reddy, K. N., & Murty, O. P. (2014). The essentials of forensic medicine and toxicology (ed.,)</p> <p>Cavalli, F., Kaye, S. B., Hansen, H. H., Armitage, J. O., & Piccart-Gebhart, M. (2009). Textbook of medical oncology.(ed.,)</p> <p>Rudolph K Lenhard, (2010). Nanomaterials for cancer diagnosis (ed.,)</p> <p>Basu, B. (2017). Biomaterials science and tissue engineering: principles and methods. (ed.,)</p> <p>Ong, J. L., Appleford, M. R., & Mani, G. (2014). Introduction to biomaterials: basic theory with engineering applications. (ed.,)</p> <p>Hendee, W. R., & Ritenour, E. R. (2003). Medical imaging physics. (ed.,)</p> | | | | | |
| Online Resources: Fundamental Techniques In Cell Culture. Laboratory Handbook 3rd Edition. https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/marketing/global/documents/425/663/fundamental-techniques-in-cell-culture.pdf . Animal Cell And Tissue Culture Manual. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BT%200312%20%20ANIMAL%20CELL%20AND%20TISSUE%20CULTURE%20LABORATORY.pdf . Surachai Unchern, Basic Techniques In Animal Cell Culture. http://www.uop.edu.pk/ocontents/Lec%20no%201(2).pdf . | | | | | |
| Course Outcomes (CO) | CO1- Understand the routes of administration of drugs CO2- Acquire the scientific validation of drugs CO3- Know –how the side of the drugs CO4- Understand the different kinds of bio imaging techniques CO5- Recognize the cell culture techniques for the evaluation of drugs | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) | M(2) |
| CO-3 | S(3) | M(2) | M(2) | S(3) | M(2) | S(3) | L(1) | M(2) | M(2) | L(1) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | L(1) | M(2) | L(1) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | S(3) | L(1) | S(3) | L(1) | L(1) | S(3) | L(1) | M(2) | S(3) |
| W.AV | 3 | 2 | 2.2 | 3 | 1.4 | 2 | 1.8 | 1.4 | 1.6 | 1.8 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | M(2) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | M(2) | S(3) | S(3) | L(1) |
| CO-3 | S(3) | M(2) | S(3) | S(3) | M(2) |
| CO-4 | S(3) | L(1) | S(3) | S(3) | L(1) |
| CO-5 | S(3) | S(3) | S(3) | S(3) | L(1) |
| W.AV | 3 | 2 | 3 | 3 | 1.4 |

1. Low, 2. Medium, 3. Strong



| Semester-III | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------|------------------|----------------|
| Core | Course code: 508304 | Practical VI- Techniques in Biomedical sciences-III | P | Credits:4 | Hours:6 |
| Course Objectives | <ul style="list-style-type: none"> ➤ Understand the techniques in isolation, identification, extraction, structural and functional elucidation, of medicinal compounds. ➤ Comprehend the principles and applications of microscopes ➤ Know-how the principles and applications of chromatographic techniques ➤ Acquire the principles and applications of electrophoresis ➤ Have an understanding the methods of electrochemical methods of analysis | | | | |
| | <ul style="list-style-type: none"> • Extraction of bioactive compounds (hot and cold method) • Lyophilisation • Removal of solvent by rotary flash evaporator • Demonstration of Scanning Electron Microscope (SEM) Transmission Electron Microscope(TEM) Confocal Microscope • Sample preparation and histopathological examination • Tissue processing and sectioning • Gel electrophoresis • Protein fingerprinting • DNA isolation and quantification • PCR, RAPD, RELP and DNA sequencing | | | | |
| Suggested Readings: | | | | | |
| <p>Donald Voet & Judith G. Voet, (2004). Biochemistry (ed.,) Nelson, D.L. & Cox, M.M. W.H. (2006). Lehninger's Biochemistry (ed.,) Richard F. Venn, (2004). Principles and practice of bioanalysis (ed.) David L. Spector & Robert D. Goldman. (2006). Basic methods in microscopy: Protocols and concepts from cells: A laboratory manual (ed.,) Willard, H., Dean, S, Instrumental Methods of Analysis (1986) Irfan A. Khan, Atiya Khanm (1998). Role of Biotech Medicinal and Aromatic Plants- Vol 1, Dennis W. Ross, (2002). Introduction to molecular medicine, 3rd (ed.,) Trivedi, P.C. (2004). Herbal Drugs and Biotechnology (ed.,)</p> | | | | | |
| Online Resources: | | | | | |
| <p>Laboratory Manual for Bioinstrumentation, Biochemistry, Microbiology, Cell Biology and Enzyme Technology. https://www.researchgate.net/publication/329390135_Laboratory_Manual_for_Bioinstrumentation_Biochemistry_Microbiology_Cell_Biology_and_Enzyme_Technology_For_PG_and_UG_students. Laboratory Manual Instrumentations Standard Operating procedure, https://www.islamiahcollege.edu.in/download/downloads/1803201242057110.pdf</p> | | | | | |
| Course Outcomes (CO) | <p>CO1- Understand the extraction, isolation and identification of bioactive molecules from natural product CO2- Learn the various microscopic techniques involved in the drug discovery and development CO3- Acquire the separation of phytochemicals by using instruments CO4- Know the separation of macro molecules for the development bioactive peptides CO5- View the toxicity of drugs through histopathological studies</p> | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | S(3) | S(3) | M(2) | S(3) | M(2) | S(3) | M(2) | L(1) | L(1) | M(2) |
| CO-3 | S(3) | L(1) | L(1) | S(3) | S(3) | S(3) | L(1) | M(2) | M(2) | L(1) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | M(2) | S(3) | L(1) | L(1) | L(1) | L(1) |
| CO-5 | S(3) | M(2) | L(1) | S(3) | L(1) | S(3) | S(3) | L(1) | M(2) | S(3) |
| W.AV | 3 | 2 | 1.8 | 3 | 2 | 3 | 1.8 | 1.4 | 1.6 | 1.8 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) |
| CO-2 | S(3) | S(3) | M(2) | S(3) | M(2) |
| CO-3 | S(3) | L(1) | L(1) | S(3) | S(3) |
| CO-4 | S(3) | L(1) | M(2) | S(3) | M(2) |
| CO-5 | S(3) | M(2) | L(1) | S(3) | L(1) |
| W.AV | 3 | 2 | 1.8 | 3 | 2 |

1. Low, 2. Medium, 3. Strong



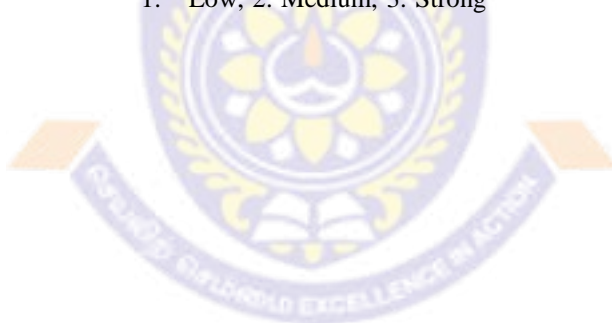
| Semester-III | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|---|-----------|---------|
| DSE 3 | Course code: 508505 | Biomaterials and Tissue Engineering | P | Credits 3 | Hours 3 |
| Unit-I | | | | | |
| Objective 1 | Understand the concepts of biomaterial implants and tissue interactions | | | | |
| Biomaterial types, advantages and disadvantages., Bio ceramics for implant coating, calcium phosphates, hydroxy apatites Ti6Al4V and other biomedical alloys, implant and tissue interaction | | | | | |
| Outcome 1 | Acquire knowledge on the biomaterials, implant and tissue engineering. | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Learn applications of nanomaterials in various body parts implant biomaterials | | | | |
| Advantages of nanomaterials use as implants, biological response of implanted materials, desirable and undesirable reactions of the body with implanted materials., Materials used for orthopaedic implants, bioceramics, modes of failure. | | | | | |
| Outcome 2 | Understand the desirable and undesirable reactions of the body with implanted materials. | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Know-how the advantages and disadvantages of implanted materials. | | | | |
| Materials used for dental, modes of dental implant failure, wear debris, materials used for cartilage and vascular, bladder, modes of cartilage implant, vascular implant, implant failure study, modes of bladder implant failure. | | | | | |
| Outcome 3 | Learn about tissue engineering and bioactive scaffold. | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Gain knowledge on the protein interactions with implanted materials | | | | |
| Protein interactions with implanted materials, cellular recognition of proteins adsorbed on material surfaces, adhesion, migration, differentiation, cellular extra cellular matrix deposition leading to tissue regeneration, foreign-body response, inflammatory response | | | | | |
| Outcome 4 | Recognize the protein interaction with the implanted materials | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Acquire the applications of natural and degradable polymers for tissue engineering. | | | | |
| Tissue engineering - stem cells, morphogenesis, generation of tissue in the embryo, tissue homeostasis, cellular signaling, extracellular matrix as a biologic scaffold for tissue engineering, scaffold fabrication, bioactive scaffold, natural polymers in tissue engineering applications, degradable polymers for tissue engineering. | | | | | |
| Outcome 5 | Clear in the role of applications of polymers in tissue engineering | | | K5 | |
| Suggested Readings: | | | | | |
| Basu, B. (2017). Biomaterials science and tissue engineering: principles and methods. (ed.,) | | | | | |
| Miller, E. G. (2006). Artificial Organs. (ed.,) | | | | | |
| Ong, J. L., Appleford, M. R., & Mani, G. (2014). Introduction to biomaterials: basic theory with engineering applications. (ed.,) | | | | | |
| Poole, D. L., & Mackworth, A. K. (2010). Artificial Intelligence: foundations of computational agents. (ed.,) | | | | | |
| Donglu Shi (2004). Biomaterial and Tissue engineering.(ed.,) | | | | | |
| Buddy D. Ratner et al., (2004). Biomaterial Science: An Introduction to materials in Medicine., (ed.,) | | | | | |
| Online resources | | | | | |
| Biomaterials and Tissue Engineering- https://link.springer.com/book/10.1007/978-3-662-06104-6 | | | | | |
| Frontiers in Biomaterials Biomaterials for Tissue Engineering- https://benthambooks.com/book/9781681085364/ | | | | | |
| Integrated Biomaterials in Tissue Engineering- https://www.wiley.com/en-us/Integrated+Biomaterials+in+Tissue+Engineering-p-9781118371213 | | | | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) |
| CO-2 | L(1) | M(2) | S(3) | M(2) | M(2) | L(1) | L(1) | L(1) | M(2) | M(2) |
| CO-3 | M(2) | L(1) | S(3) | S(3) | L(1) | M(2) | M(2) | M(2) | S(3) | L(1) |
| CO-4 | L(1) | L(1) | S(3) | M(2) | L(1) | L(1) | L(1) | M(2) | M(2) | L(1) |
| CO-5 | M(2) | M(2) | S(3) | L(1) | S(3) | L(1) | M(2) | S(3) | L(1) | S(3) |
| W.AV | 1.6 | 1.8 | 3 | 2 | 1.8 | 1.4 | 1.6 | 2 | 2 | 1.8 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-2 | L(1) | M(2) | S(3) | M(2) | S(3) |
| CO-3 | M(2) | L(1) | S(3) | S(3) | S(3) |
| CO-4 | L(1) | L(1) | S(3) | M(2) | S(3) |
| CO-5 | M(2) | M(2) | S(3) | L(1) | S(3) |
| W.AV | 1.6 | 1.8 | 3 | 2 | 3 |

1. Low, 2. Medium, 3. Strong



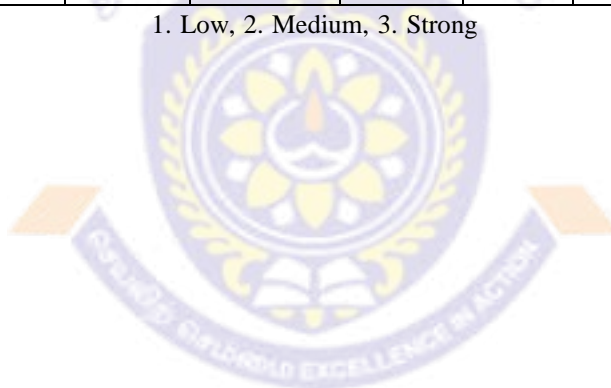
| Semester-III | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------|---|-----------|---------|
| DSE 3 | Course code: 508506 | Bio-Imaging Technology | T | Credits 3 | Hours 3 |
| Unit-I | | | | | |
| Objective 1 Learn the basic principles and applications of microscopy | | | | | |
| Introduction of Microscope, principles and applications of optical microscope, confocal microscope, fluorescens microscope, scanning electron microscope, transmission electron microscope, Live and dead assay with dyes. | | | | | |
| Outcome 1 | Learn about the principles and applications of microscopy | | | K2 | |
| Unit-II | | | | | |
| Objective 2 Gain knowledge on the ultrasound imaging systems | | | | | |
| Ultrasound imaging, physics of ultrasound- principles of image formation, capture and display- principles of A, B M Mode, scan converters- Doppler ultrasound- pulsed and continuous. | | | | | |
| Outcome 2 | Understand the imaging concepts that characterize the quality of imaging techniques | | | K4 | |
| Unit III | | | | | |
| Objective 3 Understand the principles and production of X-rays | | | | | |
| Principles and production of X-rays-soft and hard, radiographic and fluoroscopic images in X-Ray systems, screen-film and image intensifier systems, computed and digital radiography, flat panel detectors. | | | | | |
| Outcome 3 | Acquired knowledge about the principles of image formation, capture and display of ultrasound and X-ray. | | | K4 | |
| Unit IV | | | | | |
| Objective 4 To acquired knowledge of imaging system theory and their applications | | | | | |
| Introduction to emission tomography, mammography, transverse tomography, optical coherence tomography (OCT)- medical applications, CT Angiography basic physics of radioisotope imaging, Nuclear imaging, PET scanner principles, SPECT, Computer techniques in fast acquisition. | | | | | |
| Outcome 4 | Understand and describe the mechanisms of tomography, MRI and NMR spectroscopy | | | K2 | |
| Unit V | | | | | |
| Objective 5 Acquire the applications of image acquisition in magnetic resonance imaging | | | | | |
| Image acquisition in magnetic resonance imaging MRI-T1 MRI-T2 proton density weighted images spin-echo technique and spin relaxation technique- various types of pulse sequences for fast acquisition of imaging, NMR spectroscopy. | | | | | |
| Outcome 5 | Clear in the role of applications various types of pulse sequences for fast acquisition of imaging | | | K5 | |
| Suggested Readings: | | | | | |
| Cromwell, L., Weibell, F. J., Pfeiffer, E. A., & Usselman, L. B. (1973). Biomedical instrumentation and measurements (ed.,) | | | | | |
| Drexler, W., & Fujimoto, J. G. (Eds.). (2008). Optical coherence tomography: technology and applications. (ed.,) | | | | | |
| Hendee, W. R., & Ritenour, E. R. (2003). Medical imaging physics. (ed.,) | | | | | |
| Khandpur, R. S. (1987). Handbook of biomedical instrumentation. (ed.,) | | | | | |
| Ong, J. L., Appleford, M. R., & Mani, G. (2014). Introduction to biomaterials: basic theory with engineering applications. (ed.,) | | | | | |
| Poole, D. L., & Mackworth, A. K. (2010). Artificial Intelligence: foundations of computational agents. (ed.,) | | | | | |
| Online resources | | | | | |
| Bio-Imaging Principles, Techniques, and Applications- https://www.routledge.com/Bio-Imaging-Principles-Techniques-and-Applications/Vadivambal-Jayas/p/book/9781138749634 | | | | | |
| Biomedical Imaging: Principles and Applications- https://onlinelibrary.wiley.com/doi/book/10.1002/9781118271933 | | | | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | M(2) | S(3) | S(3) |
| CO-2 | M(2) | L(1) | L(1) | M(2) | M(2) | L(1) | L(1) | M(2) | M(2) | S(3) |
| CO-3 | S(3) | S(3) | S(3) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) | S(3) |
| CO-4 | M(2) | L(1) | S(3) | M(2) | L(1) | L(1) | L(1) | M(2) | S(3) | S(3) |
| CO-5 | S(3) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) | L(1) | M(2) | S(3) |
| W.AV | 2.6 | 2 | 2.4 | 2 | 1.8 | 1.4 | 1.6 | 1.6 | 2.2 | 3 |

1. Low, 2. Medium, 3. Strong

| Course Outcome VS Programme Outcomes | | | | | |
|---------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | M(2) | M(2) | M(2) |
| CO-2 | M(2) | S(3) | L(1) | M(2) | M(2) |
| CO-3 | S(3) | S(3) | S(3) | S(3) | L(1) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | L(1) |
| CO-5 | S(3) | S(3) | S(3) | L(1) | S(3) |
| W.AV | 2.6 | 3 | 2.4 | 2 | 1.8 |

1. Low, 2. Medium, 3. Strong



| Semester-IV | | | | |
|-------------|------------------------|-------------------|------------|---------|
| Core | Course code: 508999 | Dissertation Work | Credits 15 | Hours20 |



| Semester-IV | | | | |
|-------------|------------------------|-------------------|-----------|----------|
| Core | Course code: 508777 | Hospital Training | Credits 5 | Hours 10 |



Courses offer to other Departments

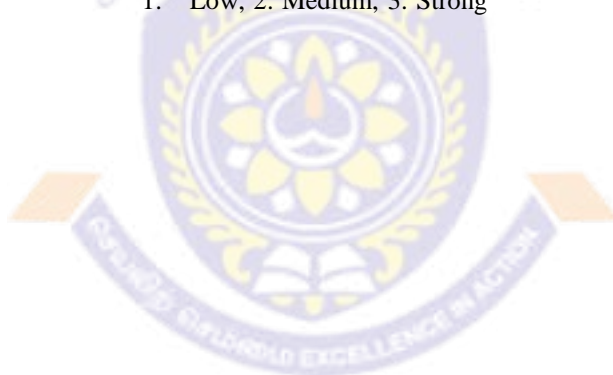
| Semester-II | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------|---|-----------|---------|
| NME | Course code: | Hospital Management and Biosafety | T | Credits 2 | Hours 3 |
| Unit-I | | | | | |
| Objective 1 | Understand the theories of management. | | | | |
| Introduction to management, Evolution of management, Definition and importance of management, Different bodies of management thought- overall support and utility services management, Medical record maintenance and computer applications. | | | | | |
| Outcome 1 | Understand the importance of management and different bodies of management | | | K2 | |
| Unit-II | | | | | |
| Objective 2 | Know Manage hospitals by understanding the complexity, levels and role of hospital administrator | | | | |
| Epidemiological basis for healthcare management, Management development-towards development of professional management of Indian hospitals, Management of Indian hospitals, challenges ,strategies, modern techniques of hospital management, Operation concept- use of models, Health services research & formalized managerial methods | | | | | |
| Outcome 2 | Acquire knowledge on the epidemiological basis for healthcare management | | | K4 | |
| Unit III | | | | | |
| Objective 3 | Describe the management process and integrated approach in management. | | | | |
| Hospital planning, guiding principles in planning hospital facilities, services, Planning the hospital building, finance, need assessment survey of community, factors determining site, legal requirements, design consideration, project management & implementation, planning the operational units, engineering, lighting etc. | | | | | |
| Outcome 3 | Recognise the organization of the hospital and functionaries | | | K4 | |
| Unit IV | | | | | |
| Objective 4 | Learn the current issues that have an implication in administration | | | | |
| Organization of the hospital, management structure, types of hospitals, governing body, hospital committee and hospital functionaries, duties and responsibilities of various positions hospital operational management, management of quality assured services of professional service units of hospital. | | | | | |
| Outcome 4 | Know the hospital infrastructure and factors determining legal requirements | | | K2 | |
| Unit V | | | | | |
| Objective 5 | Recognise the biosafety regulatory framework and its socio economic impact | | | | |
| Waste disposal management, hospital waste management, Biosafety- regulatory frame work for GMOs, bioethics and its socio economic impact. | | | | | |
| Outcome 5 | Learn opportunities in the hospital waste management | | | K5 | |
| Suggested Readings: | | | | | |
| <ol style="list-style-type: none"> 1. S.L Goel & R. Kumar,(1987). Management of Hospital (4 Vols), (ed.,). 2. M.K. Satheesh (1992). Bioethics and Biosafety (ed.,) 3. James A. William, McMillan (1991). Hospital Management. (ed.,) 4. Syed Amin Tabish (2004). Hospital and Health Services Administration – Principals and Practice (ed.,) 5. Nelson Thrones (2006). Management in Health Care, 2nd (ed.,) Subrahmanyam, B.V. (2018).Hospital Management and Administration. (ed.,) | | | | | |
| Online resources | | | | | |
| Biological Safety: Principles and Practices, 5th Edition- https://www.wiley.com/en-in/Biological+Safety%3A+Principles+and+Practices%2C+5th+Edition-p-9781683673132 | | | | | |
| Principles of Hospital Administration And Management- https://www.kobo.com/in/en/ebook/principles-of-hospital-administration-and-management | | | | | |
| K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create | | | | | |

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | S(3) | M(2) | M(2) | M(2) | M(2) | S(3) |
| CO-2 | L(1) | L(1) | M(2) | M(2) | S(3) | M(2) | L(1) | L(1) | M(2) | M(2) |
| CO-3 | M(2) | S(3) | S(3) | L(1) | S(3) | L(1) | M(2) | M(2) | L(1) | L(1) |
| CO-4 | M(2) | L(1) | M(2) | M(2) | S(3) | L(1) | L(1) | L(1) | M(2) | S(3) |
| CO-5 | M(2) | L(1) | L(1) | L(1) | S(3) | S(3) | L(1) | M(2) | L(1) | M(2) |
| W.AV | 1.8 | 1.8 | 2.2 | 1.6 | 3 | 1.8 | 1.4 | 1.6 | 1.6 | 2.2 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|------------------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | M(2) | S(3) | S(3) | M(2) | S(3) |
| CO-2 | L(1) | L(1) | M(2) | M(2) | S(3) |
| CO-3 | M(2) | S(3) | S(3) | L(1) | S(3) |
| CO-4 | M(2) | L(1) | M(2) | M(2) | S(3) |
| CO-5 | M(2) | L(1) | L(1) | L(1) | S(3) |
| W.AV | 1.8 | 1.8 | 2.2 | 1.6 | 3 |

1. Low, 2. Medium, 3. Strong



| Semester-III | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------|---|-------------------|
| NME | Course code: | Molecular Advanced Diagnostics | T | Credits 2 Hours 3 |
| Unit-I | | | | |
| Objective 1 | Understand the types of diseases and diagnosis | | | |
| Diseases- infectious, physiological and metabolic errors, genetic basis of diseases, inherited diseases. Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious diseases- bacterial, viral, fungal, protozoans and other parasites. Methods of clinical specimen collection, transport and processing of samples, interpretation of results. | | | | |
| Outcome 1 | Understand the causes of diseases due to metabolic disorders and infectious pathogens | | | K2 |
| Unit-II | | | | |
| Objective 2 | Know various methods of cytogenetic analysis | | | |
| Cytogenetics Karyotype analysis, blood , bone marrow, amniotic fluid, chorionic villus samples, products of conception Fluorescent in situ hybridization, Cytogenetic studies using microarrays or beads-on-beads. Molecular DNA isolation and quantification, Probe and primer designing, PCR - standard and various modifications, Real time PCR, MLPA analysis, SNP, SSCP, | | | | |
| Outcome 2 | Acquire knowledge on the cytogenetic studies | | | K4 |
| Unit III | | | | |
| Objective 3 | Acquire the knowledge on health informatics | | | |
| Introduction to pharmacy informatics, Medical Transcription, Role of informatics to enhance the services provided by pharmaceutical care givers. Health Information Architecture, Health Data Management, Medical Coding Systems Telemedicine and Telehealth, Ethics in medical informatics, Pharmacy systems and automation, Informatics applications in pharmacy, survey and evaluation of on-line resources. | | | | |
| Outcome 3 | Recognise the informatics application in pharmacy | | | K4 |
| Unit IV | | | | |
| Objective 4 | Describe various molecular methods of identification of human pathogens | | | |
| Molecular identifications of human bacterial pathogens- PCR, 16S rRNA sequences- Amplified Ribosomal DNA Restriction analysis (ARDRA)-Culture independent analysis of bacteria- DGGE and TRFLP. Molecular diagnosis of fungal pathogens based on 18SrRNA sequences- Detection of viral pathogens through PCR. RAPD for animal and plants. PCR in forensic science- AmpFLP, STR, Multiplex PCR- Determination of Paternity- Human identification and sex determination. Southern blotting, isotopic and nonisotopic methods, Western blotting, DNA Sequencing, including massively parallel sequencing and microarrays. | | | | |
| Outcome 4 | Learn the various methods identification of microbial pathogens | | | K2 |
| Unit V | | | | |
| Objective 5 | Learn the immunotechniques in disease diagnostics | | | |
| Overview of immune system , Antigens and antibodies , Antigen-antibody interactions, Major Histocompatibility Complex (MHC), HLA typing , Immunotherapy and immunodiagnostics. Immunodiagnostics - Introduction, antigen- antibody binding interactions and assays; antibodies- polyclonal and monoclonal antibodies, Immunoassays – types [RIA, ELISA, Chemiluminescent IA, FIA] and specific applications; Immunohistochemistry – principle and techniques. Good Laboratory Practices. Different Levels of Biosafety, Containment | | | | |
| Outcome 5 | Know the over view of immune system | | | K5 |

Suggested Readings:

Bailey & Scott's Diagnostic Microbiology (2002), Betty A. Forbes , Daniel F. Sahn, Alice S.Weissfeld , Ernest A. Trevino, Published by C.V. Mosby

Jawetz, Melnick, & Adelberg's Medical Microbiology (2004), Geo F. Brooks, Stephen Morse, Janet S. Butel.

Fundamentals of Molecular Diagnostics (2007). David E. Bruns, Edward R. Ashwood, Carl A. Burtis. Saunders Group.

Molecular Diagnostics: Fundamentals, Methods & Clinical applications (2007). Lele Buckingham and Maribeth L. Flaws.

Fundamentals of Molecular Diagnostics (2007). David E. Bruns, Edward R. Ashwood, Carl A. Burtis. Saunders Group.

Expert Review of Proteomics and Molecular Diagnostics (Journals) Basic Concepts of Molecular Pathology Series: Molecular Pathology Library, Vol. 2; Cagle, Philip T. Allen, Timothy C. (Eds.); Springer 2009

Online resources

Molecular Diagnostics- <https://link.springer.com/book/10.1385/1592599281>

Principles and Applications of Molecular Diagnostics- <https://shop.elsevier.com/books/principles-and-applications-of-molecular-diagnostics/rifai/978-0-12-816061-9>

K1-Remember, K2-Understand, K3- Apply K4- Analyze, K5-Evaluate, K6- Create

| Course Outcome VS Programme Outcomes | | | | | | | | | | |
|--------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| CO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 |
| CO-1 | S(3) | S(3) | S(3) | M(2) | M(2) | M(2) | M(2) | S(3) | M(2) | S(3) |
| CO-2 | M(2) | S(3) | S(3) | M(2) | M(2) | M(2) | L(1) | S(3) | M(2) | M(2) |
| CO-3 | L(1) | M(2) | M(2) | L(1) | S(3) | L(1) | M(2) | S(3) | L(1) | L(1) |
| CO-4 | M(2) | S(3) | S(3) | M(2) | M(2) | L(1) | L(1) | S(3) | M(2) | S(3) |
| CO-5 | L(1) | M(2) | S(3) | L(1) | L(1) | S(3) | L(1) | S(3) | L(1) | M(2) |
| W.AV | 1.8 | 2.6 | 2.8 | 1.6 | 2 | 1.8 | 1.4 | 3 | 1.6 | 2.2 |

1. Low , 2. Medium, 3. Strong

| Course Outcome VS Programme Specific Outcomes | | | | | |
|-----------------------------------------------|-------|-------|-------|-------|-------|
| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 |
| CO-1 | S(3) | S(3) | S(3) | S(3) | M(2) |
| CO-2 | M(2) | S(3) | S(3) | S(3) | M(2) |
| CO-3 | L(1) | M(2) | M(2) | S(3) | S(3) |
| CO-4 | M(2) | S(3) | S(3) | S(3) | M(2) |
| CO-5 | L(1) | M(2) | S(3) | S(3) | L(1) |
| W.AV | 1.8 | 2.6 | 2.8 | 3 | 2 |

1. Low, 2. Medium, 3. Strong



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