REVA UNIVERSITY
Bengaluru, India

SCHOOL OF APPLIED SCIENCES

B.Sc. – BIOTECHNOLOGY, BIOCHEMISTRY, GENETICS

HANDBOOK: 2019-20

Rukmini Educational Charitable Trust

CONTENTS

Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is Power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of REVA University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries

have helped our students. REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr. S. Y. Kulkarni,
Vice-Chancellor, REVA University

Director's Message

Higher education across the globe is opening doors of its academic disciplines to the real-world experiences. The disciplinary legitimacy is under critical review. Trans-border mobility and practice learning are being fore-grounded as guiding principles. Interactive learning, bridging disciplines and facilitating learners to gain different competencies through judicious management of time is viewed as one of the greatest and fascinating priorities and challenges today.

Indian economy is experiencing an upward growth right from the beginning of 21st century necessitating well qualified science graduates to work as scientists, teachers, algorithm developers, computer programmers, professionals and often administrators. At present more than 400 million youth are below 18 years of age and government is committed to increase the GER to 30% by 2020, further necessitating more number of teachers and professors to work in schools and colleges. Research has also been given equal importance. Pivate sector and Corporates are also looking for smart science graduaes in a big way. The B.Sc. (B B G) degree program of REVA University is designed to prepare biotechnologist, biochemists, genetists, scientists, teachers, professionals & administrators who are motivated, enthuastics & creative thinkers to meet the challenges of growing economy as well as to fulfill the growing aspirations of the youth.

The program has been developed with an emphasis on knowledge assimilation, application, national and international job market and its social relevance. The outcome-based curriculum designed and followed imbibes required theoretical concepts and practical skills in the domain. Maximum number of courses are integrated with cross cutting issues, relevance to professional ethics, gender, human values, environment, and sustainability. The curriculum caters to and has relevance to local, national, regional and global developmental needs. By undergoing this program, you will develop critical, analytical thinking and problem-solving abilities for a smooth transition from academic to real-life work environment. The L: T: P structure of teaching and learning under Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) would certainly help our students learn and build competencies needed in this knowledge based society.

I am sure you will enjoythe curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance. We will strive to provide all needed comfort andcongenial environment for your studies. I wish you and allstudents' pleasant stay in REVA and grand success in your career.

Dr.Beena G
Director, School of Applied Science.

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 11,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette dated 7thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 15000+ students studying in various branches of knowledge at graduate and post graduate level and 410 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has

also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers. The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreignuniversities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director I.I.Sc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is **'Life Time Achievement Award'** to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the **"Founders' Day Celebration"** of REVA University on 6th January of every year in presence of dignitaries, faculty members and students gathering. The first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO, followed by Shri. Shekhar Gupta, renowned Journalist for the year 2016, Dr K J Yesudas, renowned play back singer for the year 2017. REVA also introduced "**REVA Award of Excellence"** in the year 2017 and the first Awardee of this prestigious award is Shri Ramesh Aravind, Actor, Producer, Director, Screen Writer and Speaker.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also

students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their

respective spheres of activities. During this occasion, the students who have achieved top ranks and wonmedals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honored with many more such honors and recognitions.

Vision

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards

Misson

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

ABOUT SCHOOL OF APPLIED SCIENCES

The School of Applied Sciences offers graduate and post graduate programs in Biotechnology, Biochemistry, Chemistry, Physics and Mathematics which are incredibly fascinating. It aims to attract talented youth and train them to acquire knowledge and skills useful to industrial sectors, research laboratories, and educational institutions. The School presently offers B.Sc. degree programs in Bio-Chemistry, Bio-Technology, Chemistry, Physics, Mathematics and B Sc with various combinations viz, Biotechnology, Biochemistry and Genetics, Physics Chemistry and Mathematics, Mathematics , Physics and Statistics, Mathematics Statistics and Computer Science, and Bioinformatics, Biology Mathematics & Computer Science and also Post Graduate Diploma in Clinical Research Management, Post Graduate Diploma in Functional Geneomics & Bioinformatics. The School also facilitates research leading to PhD in Biotechnology, Biochemistry, Physics, Chemistry, Mathematics and related areas of study.

The School of Applied Sciences is shouldered by well qualified, experienced and highly committed faculty. The state-of-the-art infrastructure digital classrooms, well equipped laboratories, conference rooms and the serene academic atmosphere at REVA University will enhance the transfer as well as creation of knowledge. The school provides an interactive, collaborative peer tutoring environment that encourages students to break down complex problems and develop strategies for finding solutions across a variety of situations and disciplines. The school aims to develop a learning community of critical thinkers who serves as models of innovative problems solving in the university environment to enrich their academic and professional careers.

Vision

To nurture intellect, creativity, character and professionalism among students and impart contemporary knowledge in various branches of Chemical, Biological, Physical and Mathematical Sciences that are socially relevant and transform them to become global citizens.

Mission

To achieve excellence in studies and research through pedagogy and support interface between industry and academia

BOS MEMBERS

Sl. No.	Panel Members
	Biotechnology
1	Dr.Geetha Hiremath Mendez Scientist I, Global Project Leader, Novozymes Southasia Pvt., Ltd., Bangalore
2	Dr.M.Narayanaswamy, Multiplex Scientist I, Global Project Leader, Novozymes Southasia Pvt., Ltd., Bangalore
3	Dr.Poornima D Assistant Prof, Department of Biotechnology Tumkur University, Tumakur

Sl. No.	Panel Members
	Genetics
1	Dr.Leena Alexander Associate Prof and Head Department of Genetics Jyothinivas College, Bengaluru
2	Dr.N.Vijaya Shankar Senior Scientist, Aurigene Discovery Technology, Bengaluru
3	Dr.S.Basavarajappa Associate Prof in Zoology University, Mysore

Sl. No.	Panel Members
	Biochemistry
1	Dr. U.V Babu, Head, Research and Development, Himalaya Drug Company, Yeshwantpur, Bangalore. dr.babu@himalayawellness.com
2	Dr. Senthil Duraisamy Founder- Managing Director Pharma Genica Healthcare Pvt Ltd senthildu@gmail.com

B. Sc - B B G
(Biotechnology, Biochemistry, Genetics)

Programme Overview

Biotechnology harnesses cellular and bio-molecular processes to develop technologies and products that help improve our lives and the health of our planet. The growing list of biotechnology products includes medicines, medical devices and diagnostics, more-resilient crops, bio-fuels, biomaterials, and pollution control. At present, there are more than 250 biotechnology health care products and vaccines available to patients, many for previously untreatable diseases. Millions of farmers around the world use agricultural biotechnology to increase yields, prevent damage from insects and pests and reduce farming impact on the environment. Hundreds of bio refineries are being built across world to test and refine technologies to produce bio-fuels and chemicals from renewable biomass, which can help reduce greenhouse gas emissions.

Government of India, cognizant of the fact that Biotechnology is an ever-growing technological field benefitting the whole society, established Department of Biotechnology (DBT) in the year 1986 with a mandate to promote large scale use of Biotechnology. Recent times have seen a surge in research related to innovation, invention, and product orientation. In fact, top experts have made it clear that innovation in biosciences can make it a bigger industry than information technology.

The Indian biotech industry holds about 2 percent share of the global biotechindustry. The biotechnology industry in India, comprising about 800 companies, is expected to be valued at US$ 11.6 billion in 2017. The government has to invest US$ 5 billion to develop human capital, infrastructure and research initiatives if it is to realize the dream of growing the sector into a US$100billionindustryby2025, as per Union Minister for Science and Technology. In the Union Budget 2017-18, the Department of Biotechnology (DBT) received Rs 2,222.11 crore (US$ 333.31 million), an increase of 22 per cent, to continue implementing the department's national biotech strategy and target increasing the turnover from the sector to $100 billion by 2025 from $7 billion in2016.

Biopharma is the largest sector contributing about 62 percent of the total revenue followed by bio-services (18 per cent), bio-agri (15 per cent), bio-industry (4 per cent), and bio-informatics contributing (1 per cent).The high demand for different biotech products has also opened up scope for the foreign companies to set up base in India. India has emerged as a leading destination for clinical trials, contract research and manufacturing activities owing to the growth in the bio-services sector.

In this context, University Programmes at undergraduate and postgraduate level in Biotechnology across the Country have become relevant.

B.Sc. (B.B.G) at REVA UNIVERSITY has been designed to meet the human resources needs of existing and futuristic biotech industries, biotech research organizations and academic institutions. The programme is designed to produce graduates with higher order critical, analytical, problem solving and research skills; ability to think rigorously and independently to meet higher level expectations of biotech industries, research organization and academic institutions. The programme also provides sufficient skills and training on entrepreneurship development in Biotechnology. The programme deals with courses on cell biology, micro biology, genetic engineering, biochemistry; medical, animal, forensic and environmental biotechnology, biochemical techniques and processes, entrepreneurship and many other related courses.

Programme Educational Objectives (PEOs)

PEO -1	Adopt strong foundation with skills, relevant training and education towards understanding life science.
PEO - 2	Apply appropriate tools and techniques for conducting scientific investigations to solve the problems in life science domain.
PEO – 3	Acquire higher degree of work in academics and research.
PEO – 4	Adapt lifelong learning with continuos improvement.

Programme Outcomes (POs)

1. Science knowledge: Apply the knowledge of life science for the solution of complex problems in various domains including healthcare considering public health & safety and the cultural societal & environmental concerns.

2. **Problem analysis**: Identify, formulate & analyse problems related to various domains of life sciences relevant to biotechnology, genetics and biochemistry.

3. **Conduct investigations of relevant problems**: Use basic knowledge including analysis and interpretation of data, and synthesis of the information to provide valid conclusions and also to carry out the research procedures.

4. **Modern tool usage: To** Create, select and apply appropriate techniques, resources and modern technology which in turn benefit the society.

5. Environment and sustainability: Understand and implement environmental friendly approaches in life sciences to support sustainable development.

6. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and norms in Life Sciences.

7. **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

8. **Communication**: Communicate effectively with the scientific community and with society at large. Be able to comprehend and document. Make effective presentations, and deduce clear instructions.

9. Project management and finance: Demonstrate knowledge and understanding of life sciences and management principles and apply these to one's own work, as a member and leader in a team.

10. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

After successful completion of the program, the graduates shall be able to

1. Develop knowledge and understanding of various subjects in biotechnology, biochemistry and genetics.

2. Explain, design and analyse field related problems in the domains of Biotechnology, Biochemistry and Genetics.

3. Plan manufacturing process, handle instruments and test products in the field of Life Sciences.

Regulations – Bachelor Degree Programs
Academic Year 2019-20 Batch

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – Bachelor Degree Programs 2019-20 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

2. The Programs:

These regulations cover the following Bachelor Degree Programs of REVA University offered during 2019-20:

B Com (Industry Integrated)
B Com (Honors)
BBA (Industry Integrated)
BBA (Honors)
BBA (Entrepreneurship)
BA - Journalism, English, Psychology
BA - Tourism, History & Journalism
BA - Political Science, Economics & Journalism
BA - Performing Arts, English Psychology
BCA
BSc (Honours) Cloud Computing & Big Data
BSc in Physics, Chemistry, Maths
BSc in Maths, Statistics, Comp Sci.
BSc in Bioinformatics Biology, Maths, Computer Science
BSc in Biotechnology, Biochemistry, Genetics
BSc in Medical Lab Technology
BSc in Physics, Maths, Computer Science

3. Duration and Medium of Instructions:

3.1 Duration: The Bachelor Degree program is of 6 Semesters duration. A candidate can avail a maximum of 12 semesters - 6 years as per double duration norm, in one stretch to complete the Bachelor Degree, including blank semesters, if any. Whenever a candidate opts for blank semester, s/he has to study the prevailing courses offered by the School when s/he resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both, listed under a program; Example: "Business Research Methodology" in BBA (Honors) program, "Auditing and Corporate Governance" in B Com (Industry Integrated) program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

L	**Lecture**
T	**Tutorial**
P	**Practice**

Where:

L stands for **Lecture** session consisting of classroom instruction.

T stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for **Practice** session and it consists of Hands on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much required skill component.

4.2 Classification of Courses

Courses offered are classified as: Foundation Courses, Core Courses, Hard Core Courses, Soft Core Courses, Open Elective Courses, Project work/Dissertation

4.2.1 **Foundation Course:** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study

4.2.2 **Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

4.2.3 **Hard Core Course (HC) simply core course:** The **Hard Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily

4.2.4 **Soft Core Course (SC) (also known as Professional Elective Course)**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study

4.2.5 Open Elective Course (OE):

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course**

4.2.6 Project Work / Dissertation:

School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally 26 hours of practical work/project work/dissertation work is considered to be equivalent to a credit. School can classify project as a minor or a major project depending on the credits allotted. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project.

4.2.7 "Program" means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma or such other degrees instituted and introduced in REVA University.

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to **Three Years Bachelor Degree** Programs (6 Semesters) is given below:

S	Program	Duration	Eligibility
1	Bachelor of Commerce (Industry Integrated)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 50% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
2	Bachelor of Commerce (Honours)		Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
3	Bachelor of Business Administration (Industry Integrated)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 50% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.

4	Bachelor of Business Administration (Honours)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
5	Bachelor of Business Administration (Entrepreneurship)	6 Semesters (3 years)	
6	Bachelor of Arts in a) Journalism, English & Psychology (JEP) b) Political Science, Economics, Journalism (PEJ) c) Tourism, Journalism & History (TJH)	6 Semesters (3 years)	Pass in PUC /10+2 of any recognized Board / Council or any other qualification recognized as equivalent there to.
7	Bachelor of Arts in Performing Arts, English & Psychology	6 Semesters (3 years)	
8	Bachelor of Computer Applications	6 Semesters (3 years)	Pass in PUC/10+2 with at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council of any other qualification recognized as equivalent there to.
9	Bachelor of Science (Hons.) in Computer Science (with specialization in Cloud Computing & Big Data)	6 Semesters (3 years)	Pass in PUC/10+2 examination with Mathematics / Computer Science / Statistics as compulsory subject along with other subjects and obtained minimum 45% marks (40% in case of candidates belonging to SC/ST category) in the above subjects taken together from any Board recognized by the respective State Government /Central Government/Union Territories or any other qualification recognized as equivalent thereto.
1	B Sc in a) Physics, Chemistry and Mathematics (PCM) b) Mathematics, Statistics and Computer Science (MStCs) c) Physics,Mathematics and Computer Science (PMCs)	6 Semesters (3 years)	Pass in PUC/10+2 with Mathematics as compulsory subjects and at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council or any other qualification recognized as equivalent there to.
1	B Sc in a) Bioinformatics – Biology, Computer Science &	6 Semesters (3 years)	Pass in PUC/10+2 with Biology as compulsory subject and at least 45% marks (40% in case of candidate belonging to SC/ST category) of any recognized Board/Council or any other

	Mathematics (BCsM) b) Biotechnology, Biochemistry, Genetics c) Medical Laboratory Technology (BMLT)		qualification recognized as equivalent there to.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, University from time to time.

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for IAs and final examination, evaluation and announcement of results.

6.3 The credit hours defined as below

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

1 credit = 13 credit hours spread over 16 weeks or spread over the semester

The total duration of a semester is 20 weeks inclusive of semester-end examination.

For Example: The following table describes credit pattern

2: Credit Pattern

Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total C ontact Hours
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

7. Different C**ourses of Study**:

Different C**ourses of Study** are labeled as follows:

a. Foundation Course (FC)
b. Core Course (CC)
c. Hard Core Course (HC)
d. Soft Core Course (SC)

e. Open Elective Course (OE)
f. Project Work / Dissertation: School can offer project work/dissertation as a course. Depending on the duration required for completing the project/dissertation work, credits can be assigned. Normally 26 hours of practical work/project work/dissertation work is considered to be equivalent to a credit. School can classify project as a minor or a major project depending on the credits allotted. Normally, a minor project carries 4-6 credits and a major project carries double the number of credits of a minor project.

These are defined under Section 4 of these regulations.

8. Credits and Credit Distribution

Registered candidates are required to earn the credits stated in the below table for the award of degree in the respective program:

Credits	Programs
120	**B.Com (Industry Integrated) degree, BBA (Industry Integrated) degree, and BCA**
140	**B.Com (Honors), BBA (Honors), BBA (Entrepreneurship) and B Sc (Honors)**
144	**BA - Journalism, English, Psychology, BA - Tourism, History & Journalism, BA - Political Science, Economics & Journalism, BA - Performing Arts, English Psychology, BSc in Physics, Chemistry, Maths, BSc in Maths, Statistics, Comp Sci., BSc in Bioinformatics Biology, Maths, Computer Science, BSc in Biotechnology, Biochemistry, Genetics, BSc in Medical Lab Technology, and BSc in Physics, Maths, Computer Science**

The following courses are foundation courses and they are mandatory courses. Students registering for any of the programs mentioned in the table above are required to successfully complete the courses for the award of the degree.

1. Communicative English
2. Languages K / H / Additional English
3. Indian Constitution
4. Human Rights

8.2. The concerned BoS shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self-study elective and classify the courses as **Foundation Course (FC), Hard Core (HC), Soft Core (SC) and Open Elective (OE).**

8.3. The concerned BoS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the

curriculum of a particular program.

8.4. A candidate can enrol during each semester for credits as prescribed in the scheme of the program.

8.5 Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VI semester and complete successfully prescribed number of credits for the award of the degree for three year program in 6 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

8.6 Add on Proficiency Diploma / Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree:, a candidate can opt to complete a minimum of 18-20 extra credits either in the same discipline /subject or in different discipline / subject in excess to prescribed number of credits for the award of 3 year degree in the registered program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so issued to the candidate contains the courses studied and grades earned.

9 Assessment and Evaluation

9.1 The Scheme of Assessment will have two parts, namely;

i. Internal Assessment (IA); and
ii. Semester End Examination (SEE)

9.2 Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of for 3 year programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

9.3 The 50 marks of internal assessment shall comprise:

Internal Test	30 marks
Assignments / Seminars / Quizzes / Presentations / Case Studies etc.	20 marks

9.4 There shall be **two Internal Tests** conducted as per the schedule announced below. **The Students' shall attend both the Tests compulsorily.**

- 1st test is conducted for 15 marks during **8th week** of the Semester;
- 2nd test is conducted for 15 marks during **16th week** of the of the Semester;
- Suitable number of Assignments/quizzes/presentations are set to assess the remaining 20 marks of IA at appropriate times during the semester

9.5 The coverage of syllabus for the said tests shall be as under:

- Question paper of the **1st test should be based on first 50% of the total syllabus**;
- Question paper of the **2nd test should be based on second 50% of the total syllabus**;

9.6 The Semester End Examination for 50 marks shall be held in the 18th and 19th week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.

9.7 A test paper is set for a maximum of 30 marks to be answered as per the pre-set time duration (1 hr / 1 hr 15 minutes / 1 hr 30 minutes). Test paper must be designed with School faculty members agreed pattern and students are assessed as per the instructions provided in the question paper. Questions must be set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document.

9.8 The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by School specific Question Paper Scrutiny Committee formed by the respective School Head /Director to bring in the uniformity in the question paper pattern and as well to maintain the necessary standards.

9.9 The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

9.10 Assignment/seminar/Project based learning/simulation based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An assignment / Quiz or combination thereof can be set for a maximum of 20 marks. Course instructor at his/her discretion can design the

questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and also self-study.

9.11 Internal assessment marks must be decided well before the commencement of Semester End examinations

9.12 Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 18th and 19th week of the semester and the entire course syllabus must be covered while setting the question paper.

9.13 Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have 3-4 sub questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's verbs. The questions must be set to assess the students outcomes described in the course document. (Please note question papers have to be set to test the course outcomes)

9.14 There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

9.15 There shall be single evaluation by the internal teachers who have taught the subject. However, there shall be moderation by the external examiner. In such cases where sufficient number of external examiners are not available to serve as moderators internal senior faculty member shall be appointed as moderators.

9.16 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

9.17 There shall also be an **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the

School. **Program Assessment Committee (PAC)** shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

9.18 The report provided by the **Program Assessment Committee (PAC)** shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program

9.19 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor

9.20 Online courses may be offered as per BACHELOR norms.

For online course assessment guidelines would be as follows:

1. If the assessment is done by the course provider, then the School can accept the marks awarded by the course provider and assign the grade as per REVA University norms.
2. If the assessment is not done by the course provider then the assessment is organized by the concerned school and the procedure explained in the regulation will apply
3. In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits

IAs for online courses could be avoided and will remain at the discretion of the School.

9.21 The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

9.22 Utilization of one or two credit online courses would be:

4 week online course – 1 credit – 15 hours
8 week online course / MOOC – 2 credits – 30 hours
12 week online course / MOOC – 3 credits – 45 hours

9.23 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

S	Type of Assessment	when	Syllabus Covered	M	Reduced to	Date By which the process must be completed
1	Test-1	During 8th week	First 50%	30	15	8th week
2	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 8th week (10 marks)				
3	Test -2	During 16th Week	Second 50%	30	15	16th Week
4	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 16th Week (10 marks)				
5	SEE	19/20th Week	100%	10	50	20th Week

Note: 1. Examination and Evaluation shall take place concurrently and Final Grades shall be announced as per the notification from COE.

2. Practical examination wherever applicable shall be conducted after 2nd test and beforsecond test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of exe semester end examination. The calendar of practical examination shall be
decided by the respective School Boards and communicated well in advance to the Controller of Examination who will notify the same immediately

10 Assessment of Students Performance in Practical Courses

The performance in the practice tasks / experiments shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

10.1 The 50 marks meant for Internal Assessment (IA) of the performance in carrying out Practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting periment and write up about the experiment.	20 marks
	Total	**50 marks**

10.2 The 50 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conducting of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

The duration for semester-end practical examination shall be decided by the concerned School Board.

10.3For MOOC and Online Courses assessment shall be decided by the BOS of the School.

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

12. Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	**Grade, G**	**Grade Point (GP=V x G)**	**Letter Grade**
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks (P=[IA + SEE]) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

a. Computation of SGPA and CGPA

The Following examples describe computation of Semester Grade Point Average (SGPA).

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e : **SGPA (Si) = ∑(Ci x Gi) / ∑Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Examples on how SGPA and CGPA are computed

Example No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
	16			129

Thus, **SGPA = 129 ÷ 16 = 8.06**

Example No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
	20			141

Thus, **SGPA = 141 ÷ 20 = 7.05**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits for the respective programs are calculated taking into

account all the courses undergone by a student over all the semesters of a program, i. e :

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Example:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	20	6.83	20 x 6.83 = 136.6
2	19	7.29	19 x 7.29 = 138.51
3	21	8.11	21 x 8.11 = 170.31
4	20	7.40	20 x 7.40 = 148.00
5	22	8.29	22 x 8.29 = 182.38
6	18	8.58	18 x 8.58 = 154.44
Cumulative	**120**		**930.24**

Thus, **CGPA** = 930.24/120 = 7.75

c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Example: CGPA Earned 7.75 x 10=77.5

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

13. Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

a. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA).**

b. **Final Grade Card:** Upon successful completion of three year Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

14. Attendance Requirement:

14.1 All students must attend every lecture, tutorial and practical classes.

14.2 In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

14.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc., during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

15. Re-Registration and Re-Admission:

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and S/he shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and s/he shall seek re-admission to such dropped semester.

16. Absence during Internal Test:

In case a student has been absent from an internal tests due to the illness or other contingencies s/he may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective

semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), s/he can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. S/he can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if s/he is found guilty. The decision taken by the Grievance committee is final.

18. Grievance Committee:

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances. Grievance committees will be formed by CoE in consultation with VC.

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

19. Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

20. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s)

wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

21. Provision to Carry Forward the Failed Subjects / Courses:

A student who has failed in a given number of courses in odd and even semesters shall move to next semester of immediate succeeding year and final year of the study. However, s/he shall have to clear all courses of all semesters within the double duration, i.e., with six years of admission of the first semester failing which the student has to re-register to the entire program.

22. Challenge Valuation:

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. S/he can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Controller of Examinations within 10 days after the announcement of the results. This challenge valuation is only for semester end examination.

b. The answer scripts (in whatever form) for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

23. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

Mapping of PEOS with Respect to Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PE01	√	√	√	√	√	√	√	√	√	√
PE02	√	√	√	√	√	√	√	√	√	√
PE03	√	√	√	√	√	√	√	√	√	√
PE04	√	√	√	√	√	√	√	√	√	√

Attainment of CO (Course Outcome)

CO Attainment	Value
0.4 - 0.59	1
0.6 – 0.74	2
> 0.75	3

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
B19BG1011	CO1					2	3							
	CO2					2	3							
	CO3						3							
	CO4							3	2					

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG1012	CO1					2	3	2			
	CO2					2	2	3			
	CO3					3	3	3			
	CO4					3	2	3			
Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG1013	CO1					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		
Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG1013	CO1					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Mapping of Course Outcomes with programme Outcomes

Course Code	**POS/ COs**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1030	CO1	2		1					2		2	2	1	1
	CO2	1	1	1	1				2		2	2	2	1
	CO3	1		1		1			2		2	2	2	1
	CO4	1		1					2		2	2	3	1
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1040	CO1	3	2	3		2	2				3	3	2	
	CO2	3									3	3		
	CO3	3	3	3			3				3	3	2	
	CO4	3	3	2			3		2		3			
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1050	CO1	2	2		3		3			2		2	2	
	CO2	3		2		1		2		3	2	1	1	
	CO3	3		2		2				3		2	2	
	CO4	2	2		2		2		1		3	1		2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1070	CO1	2	3	3					2		3	2	3	2
	CO2	2	3	3	3				2		3	2	3	2

	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1080	CO1	3		3		2					3	3	2	
	CO2	3	3	3					3		3	3	2	
	CO3	3	3	3		1			3		3	3	2	
	CO4	3	3			3			3		3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG1090	CO1	1		2	1			1			3	1		
	CO2	1	2	2				2			2	1	1	
	CO3	2	1	1				1			2	1	1	
	CO4													
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2011	CO1					2	3							
	CO2					2	3							
	CO3						3							
	CO4							3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2012	CO1					2	3	2						
	CO2					2	2	3						
	CO3					3	3	3						
	CO4					3	2	3						
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2013	CO1					3	3	3	2					
	CO2					3	3	3	3					
	CO3					3	3	3	2					
	CO4					3	3	3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2020	CO1					3	3	3	1					
	CO2					3	3	3	2					
	CO3					3	3	3	1					
	CO4					3	3	3	1					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2030	CO1	1	1	1	2	1			1		2	2	2	1
	CO2	2	3	3	3	2			2		3	2	2	2
	CO3	2	3	3	3	2	2		3		3	2	3	2

	CO4	2	3	3	3	2	2		3		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2040	CO1	3	3	3	3				3		3	3	2	3
	CO2	3	3	3	3		2		2		3	3	2	3
	CO3	3	3								3	3	2	3
	CO4	3	3			3			3		3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2050	2		2	2		3		2	2	3	2		2	2
	3	3		2		2		1	1	1				3
	2		2	2	1	1	1		2	2	2	2		2
	3		3	2		2	2		3	1	1		1	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2060	CO1	1	2	1	1	1	2	3	1			1	1	
	CO2	1	3	1	1	1	3	3	1			1	1	
	CO3	2	3	2	1	3	3	3	1			1	1	
	CO4	1	2	1	1	1	2	3	1			1	1	
Course Code	**POS Cos**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2080	CO1	2	3	3					2		3	2	2	2
	CO2	2	3	3	3				2		3	2	2	2
	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2090	CO1	3		3	3						3	3	2	
	CO2	3	3								3	3	2	
	CO3	3				3					3	3		
	CO4	3	3			3					3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG2X10	CO1	2	1	1	2			1	1		3	2	1	
	CO2	1	2	2	1			1			2	1	1	
	CO3	1	2	2	1			1			2	1	1	
	CO4	1	1	2	2			2	1		2	2	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3011	CO1					2	3							
	CO2					2	3							
	CO3						3							

	CO4							3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3012	CO1					2	3	2						
	CO2					2	2	3						
	CO3					3	3	3						
	CO4					3	2	3						
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3013	CO1					3	3	3	2					
	CO2					3	3	3	3					
	CO3					3	3	3	2					
	CO4					3	3	3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3020	CO1					3	3	3	2					
	CO2					3	3	3	3					
	CO3					3	3	3	2					
	CO4					3	3	3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3030	CO1	2	3	3	3	2			2		3	2	3	2
	CO2	2	3	3	3	2			3		3	2	2	3
	CO3	2	3	3		2			3		3	2	3	3
	CO4	2	3	3	3	2			4		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3040	CO1	3	3				3		3		3	3	2	
	CO2	3	3	3	3	3	3		3		3	3	3	
	CO3	3	3	3		3	3				3	3	2	
	CO4	3	3	3	3		3		3		3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3050	CO1	3		3	2		2		2	3	2		2	1
	CO2	2		2		2	3		3		3	1	2	
	CO3	3	3		2	2		2	2	3		2		2
	CO4	1		3	3		2		2	2	1	2	2	1
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3061	CO1	2	3	3	2	2	2	2	3	1	3	2	3	1
	CO2	2	3	3	2	2	1	2	1	1	3	2	2	3
	CO3	2	3	3	2	1	1	2	1	1	3	2	2	2
	CO4	2	3	3	2	1	1	2	1	1	3	2	3	3

Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3062	CO1	2	1	1				1	2		3	1	1	
	CO2	1		2	1				1		3	2	1	
	CO3	2	1	1	2			2	1		3	2	1	
	CO4	2	1	1				1	1		3	2	1	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3070	CO1	2	3	3					2		3	2	3	3
	CO2	2	3	3	3				2		3	2	3	3
	CO3	2	3	3		2			2		3	2	2	3
	CO4	2	3	3					2		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3080	CO1	3	3	3	3			3	3		3	3	2	
	CO2	3	3	3				3			3	3	2	
	CO3	3	2	3	3			3			3	3	3	2
	CO4	3	3	3	3		3	3	3		3	3	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG3090	CO1	1		2	1			1	1		1	1	1	
	CO2	1	2	1	2			1			2	2	1	
	CO3	2	2	2	2			2	1		2	1	1	
	CO4	1	1	1	1			1	1		2	2	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4011	CO1					2	3							
	CO2					2	3							
	CO3						3							
	CO4							3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4012	CO1					2	3	2						
	CO2					2	2	3						
	CO3					3	3	3						
	CO4					3	2	3						
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4013	CO1					3	3	3	2					
	CO2					3	3	3	3					

	CO3					3	3	3	2					
	CO4					3	3	3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG402 0	CO1					3	3	3	2					
	CO2					3	3	3	3					
	CO3					3	3	3	2					
	CO4					3	3	3	2					
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4030	CO1	3	3	3	3	0	0	0	2	3	0	2	2	1
	CO2	3	2	3	3	0	0	0	3	3	0	2	2	1
	CO3	2	2	2	2	0	0	0	2	2	0	2	2	1
	CO4	3	3	3	3	0	0	0	3	3	0	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4040	CO1	3	3	3		3	2	2			3	3	2	
	CO2	3	3	2							3	3	2	
	CO3	3	3	3		3	2				3	3	2	
	CO4	3	3	3	3	3	2				3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4050	CO1	3		3		2		2		2	1	1	2	
	CO2	2	2		1	1		3			3		2	2
	CO3	1		2	2		2	3		3	2	2	1	
	CO4	3	2		2	2		3	3		1	1	2	2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4070	CO1	4	4	4	4	4	0	0	4	4	0	2	3	3
	CO2	3	3	3	3	1	0	0	3	3	0	2	3	3
	CO3	3	3	3	3	3	0	0	3	3	0	2	3	3
	CO4	2	2	2	2	2	0	0	2	2	0	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4080	CO1	3	3		3	3	2	3		3	3	3	2	
	CO2	3	3	3	3		3	3	2	3	3	3	2	

	CO3	3	3	3	3		3	3		3	3	2		
	CO4	3	3	3		3	3	3		2	3	3	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG4090	CO1	1	1	1				1	1		2	1	1	
	CO2	2	2	1	2			1	1		3	2	1	
	CO3	2	2	2	3			2	2		3	2	1	
	CO4													
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5010	CO1	1										1	1	1
	CO2	2	3									2	3	1
	CO3			2								2	3	1
	CO4			2	3		2					2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5020	CO1	3	3	3			3	3	3		3	3	2	3
	CO2	3	3	3	3		3	3	3		3	3	2	3
	CO3	3	3	3			2	2	2		3	3	2	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	2	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5030	CO1	3		2		2		3		3		2		1
	CO2	2		2		2	3		1		1		2	
	CO3	2	3			3	3			2	2		2	
	CO4	3	2		2	2		1	1	1	2	1	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5041	CO1	2	3	3	1	2	2	2	3	2	2	2	2	2
	CO2	2	3	3	1	2	2	3	4	2	2	2	2	2
	CO3	2	3	3	2	2	2	2	4	3	2	2	2	1
	CO4	2	3	3	2	2	2	2	4	3	2	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5042	CO1	2										2	3	1
	CO2		3	3	3	2						2	3	2
	CO3		3	3	3	2						2	3	2
	CO4			3	3	2		2			3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
	CO1	3	3	3			3		3		3	3	2	

B19BG5051	CO2	3	3	3			3		3		3	3	3	
	CO3	3	3	3	3		2				3	3	3	3
	CO4	3	3	3	3		3		3		3	3	3	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5052	CO1	3	3	3			3				3	3	3	3
	CO2	3	3	3	3		3	3			3	3	3	3
	CO3	3	3	3	3		3				3	3	2	3
	CO4	3	3	3	3		3	3	3		3	3	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5061	CO1	3		3		3		2		1	1	2	1	
	CO2	1		2	2		3	3		2	2	2		1
	CO3	2	2		1	1		2	2		1	1	2	
	CO4	3		2	2			1	1		1	2	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5062	CO1	3		2		2		1				2	2	1
	CO2	1			3		2		3		3	2	3	
	CO3	3		3					3		3	2		2
	CO4	2	3		3		2		3	2	2		1	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5090	CO1	2	3	3					2		3	2	1	1
	CO2	2	3	3	3				2		3	2	3	2
	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5X10	CO1	3	3	2			3	2	3		3	3	2	3
	CO2	3	2								2	2		3
	CO3	3	3	3	3		3		2		3	3	2	3
	CO4	3	3	3			3		3		3	3		3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG5X20	CO1	1		1				1	1		2	1	1	
	CO2	2	1	1	2			1	1		1	1	1	
	CO3	2	1	2	1			1	1		2	1	1	

	CO4	1	1	1					1		2	1	1	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6010	CO1	2	3	2	1	2	2	2	3	1	3	2	3	3
	CO2	2	3	2	1	2	1	2	1	1	3	2	2	3
	CO3	2	3	2	2	1	1	2	1	1	3	2	2	2
	CO4	2	3	2	2	1	1	2	1	1	3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6020	CO1	3	3	3		3	2	2			3	3	2	3
	CO2	3	3				2				3	3		3
	CO3	3	3	3	3	3	2				3	3	2	3
	CO4	3	3	3			3	3	2		3	3	2	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6030	CO1	2			2			2		3		2	1	
	CO2	3		2		3		3		2	3		2	2
	CO3	2		3		3		3	2		3	2		
	CO4	3		3		3		1		3	2	2	1	2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6041	CO1	2	3	3	2	2	2	2	1	2	3	2	3	2
	CO2	2	3	3	2	2	1	2	1	2	3	2	3	2
	CO3	2	3	3	2	2	1	2	1	2	3	2	3	2
	CO4	2	3	3	2	2	1	2	1	2	3	2	2	2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6042	CO1	2	3	3	3	1	2		3		3	2	3	3
	CO2	2	3	3	3	1	2		3		3	2	2	3
	CO3	2	3	3	3	1	2		3		3	2	2	2
	CO4	2	3	3	3	2	2		4		3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6051	CO1	3	3	3	3	2	3	3	2		3	3	3	3
	CO2	3	3	3	3	3	3	2	2		3	3	3	3
	CO3	3	3	3		2	2				3	3	2	3
	CO4	3					3	3	3		3	3		
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03

B19BG6052	CO1	3		3					3		3	3	3	3
	CO2	3	3	3	3	2	2				3	3	2	3
	CO3	3	3	3	3	3	3		3		3	3	2	3
	CO4	3	3	3	3	3	3				3	3	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6061	CO1	3		3		2	2		3		3	1		1
	CO2	2		2	3		2		2		2		2	2
	CO3	1	3		2		3	2		2	3	3		1
	CO4	3		3		3		2		3	3	2	2	2
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6062	CO1	3		3				2		2	3	1	2	
	CO2	2		2					3			1		2
	CO3	3	2	2	2	3	3	2		2	3		1	2
	CO4	2		3		3		2		2	3	1	2	
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6080	CO1	2	3	3	2	2	2	2	1	1	3	2	3	3
	CO2	2	3	3	2	2	1	2	1	1	3	2	3	3
	CO3	2	3	3	2	1	1	2	1	1	3	2	3	3
	CO4	2	3	3	2	1	1	2	1	1	3	2	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6090	CO1	3	3			3	2				3	3	2	
	CO2	3	3			3					3	2	2	
	CO3	3	3			3					3	3		
	CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
Course Code	**POS / COS**	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS02	PS03
B19BG6X10	CO1	2		3		2		3		2	2	2	2	
	CO2	2		2	3				2			2		1
	CO3	3	2			2	2	3	3		3	2	2	
	CO4	3		2	3			2	2	3		2	2	1

B. Sc (Biotechnology) – B B G
(Biotechnology, Biochemistry, Genetics)
Scheme of Instruction and Detailed Syllabus
(Effective from the Academic Year 2019-20)

Scheme of Instruction **Duration: 6 Semesters (3 Years)**

Sl. No	Course Code	Course Title	Course Type	Credit Pattern & Value				Weekly Contact Hours	Teaching School/Dept.
				L	T	P	C		
FIRST SEMESTER									
1	B19BG1011	Language – II: Kannada	CC	2	1	0	3	4	Arts & Humanities
2	B19BG1012	Language – II: Hindi							
3	B19BG1013	Language – II: Additional							
4	B19BG1020	Functional English – I	CC	2	1	0	3	4	
5	B19BG1030	Cell Biology	HC	2	1	0	3	4	Biotechnolog
6	B19BG1040	Classical Genetics	HC	2	1	0	3	4	Genetics
7	B19BG1050	General Biochemistry - I	HC	2	1	0	3	4	Biochemistry
8	B19BG1060	Constitution of India	FC	2	0	0	2	2	Legal studies
		Practicals							
9	B19BG1070	Cell Biology Lab	HC	0	0	2	2	3	Biotechnolog
10	B19BG1080	Classical Genetics Lab	HC	0	0	2	2	3	Genetics
11	B19BG1090	General Biochemistry –	HC	0	0	2	2	3	Biochemistry
Total Credits				**12**	**5**	**6**	**2**	**31**	
SECOND SEMESTER									
1	B19BG2011	Language – II: Kannada		2	1	0	3	4	Arts & Humanities
2	B19BG2012	Language – II: Hindi							
3	B19BG2013	Language – II: Additional							
4	B19BG2020	Functional English – II	C	2	1	0	3	4	
5	B19BG2030	General Microbiology	H	2	1	0	3	4	Biotechnolog
6	B19BG2040	Cytogenetics	H	2	1	0	3	4	Genetics
7	B19BG2050	**Biochemical**	H	2	1	0	3	4	Biochemistry
8	B19BG2060	Environmental Science	F	2	0	0	2	2	Chemistry
8	B19BG2070	Sports/Yoga/music/dance/theatre	R	2	0	0	2	2	Physical Education & Performing Arts
		Practicals							
10	B19BG2080	General Microbiology	H	0	0	2	2	3	Biotechnolog
11	B19BG2090	Cytogenetics Lab	H	0	0	2	2	3	Genetics
12	B19BG2X10	**Laboratory Course -**	H	0	0	2	2	3	Biochemistry
		Total Credits		**14**	**5**	**6**	**25**	**33**	

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Value				Weely Contact Hours	Teaching School / Department
				L	T	P	C		
THIRD SEMESTER									
1	B19BG3011	Language – II:	CC	2	1	0	3	4	Arts & Humanities
2	B19BG3012	Language – II: Hindi	CC						
3	B19BG3013	Language – II:	CC						
4	B19BG3020	Communicative	CC	2	1	0	3	4	
5	B19BG3030	Environmental Biotechnology	HC	2	1	0	3	4	Biotechnology
6	B19BG3040	Molecular Genetics	HC	2	1	0	3	4	Genetics
7	B19BG3050	Biomolecules	HC	2	1	0	3	4	Biochemistry
8	B19BG3061	Health & Hygiene	OE	4	0	0	4	4	Biotechnology
10	B19BG3062	Biochemistry in Daily	OE						Biochemistry
		Practicals							
11	B19BG3070	Environmental	HC	0	0	2	2	3	Biotechnology
12	B19BG3080	Molecular Genetics	HC	0	0	2	2	3	Genetics
13	B19BG3090	Laboratory Course – III	HC	0	0	2	2	3	Biochemistry
Total Credits				**14**	**5**	**6**	**25**	**33`**	
FOURTH SEMESTER									
1	B19BG4011	Language – II: Kannada	CC	2	1	0	3	4	Arts & Humanities
2	B19BG4012	Language – II: Hindi	CC						
3	B19BG4013	Language – II: Additional English	CC						
4	B19BG4020	Communicative English - II	CC	2	1	0	3	4	
5	B19BG4030	Molecular Biology &GeneticEngineering	HC	2	1	0	3	4	Biotechnology
6	B19BG4040	Evolutionary & Biometrical Genetics	HC	2	1	0	3	4	Genetics
7	B19BG4050	Human Physiology	HC	2	1	0	3	4	Biochemistry
8	B19BG4060	Soft Skill Training	RULO	1	1	0	2	3	Training & Placement
		Practicals							
9	B19BG4070	Molecular Biology & Genetic Engineering	HC	0	0	2	2	3	Biotechnology
10	B19BG4080	Evolutionary & Biometrical Genetics	HC	0	0	2	2	3	Genetics
11	B19BG4090	Laboratory Course - IV (Biochemistry)	HC	0	0	2	2	3	Biochemistry
		Total Credits		**11**	**6**	**6**	**23**	**32**	
FIFTH SEMESTER									
1	B19BG5010	Immunology	HC	1	1	0	2	3	Biotechnology
2	B19BG5020	Human Genetics	HC	1	1	0	2	3	Genetics
3	B19BG5030	Metabolism – I	HC	1	1	0	2	3	Biochemistry
4	B19BG5041	Bioethics & IPR	SC	2	0	0	2	2	Biotechnology
5	B19BG5042	Industrial							

6	B19BG5051	Medical Genetics	SC	2	0	0	2	2	Genetics
7	B19BG5052	Forensic Biology							
8	B19BG5061	Nutritional Biochemistry	SC	2	0	0	2	2	Biochemistry
9	B19BG5062	Harmonial Biochemistry							
10	B19BG5070	Soft Skill Training	RULO	1	1	0	2	3	Training & Placement
11	B19BG5080	MOOC/SWAYAM	RULO	0	0	4	4	6	
		Practicals							
12	B19BG5090	Immunology Lab	HC	0	0	2	2	3	Biotechnology
13	B19BG5X10	Human Genetics Lab	HC	0	0	2	2	3	Genetics
14	B19BG5X20	Laboratory Course – V (Biochemistry)	HC	0	0	2	2	3	Biochemisrty
		Total Credits		**10**	**4**	**10**	**24**	**33**	

SIXTH SEMESTER									
1	B19BG6010	Plant Biotechnology	HC	1	1	0	2	3	Biotechnology
2	B19BG6020	Developmental Genetics	HC	1	1	0	2	3	Genetics
3	B19BG6030	Metabolism - II	HC	1	1	0	2	3	Biochemisrty
4	B19BG6041	Animal Biotechnology	SC	2	0	0	2	2	Biotechnology
	B19BG6042	Bioinformatics & Biostatistics							
5	B19BG6051	Genotoxicity	SC	2	0	0	2	2	Genetics
	B19BG6052	Applicative Genetics							
6	B19BG6061	Biochemistry of Plant Sciences	SC	2	0	0	2	2	Biochemisrty
	B19BG6062	Biochemistry of Animal Sciences							
7	B19BG6070	Skill Development Courses	RULO	1	1	0	2	3	Training & Placement
		Practicals							
8	B19BG6080	Plant Biotechnology Lab	HC	0	0	2	2	3	Biotechnology
9	B19BG6090	Developmental Genetics Lab	HC	0	0	2	2	3	Genetics
10	B19BG6X10	Laboratory Course – VI	HC	0	0	2	2	3	Biochemistry
11	B19BG6X20	Project	HC	0	0	4	4	6	
		Total Credits		**11**	**4**	**10**	**24**	**33**	

		Total Credits of all Semesters		**71**	**29**	**44**	**144**	**195**	

Semester-wise Summary of Credit Distribution

Semester	L	T	P	Total	Total Hours
I	12	5	6	23	**31**
II	14	5	6	25	**33**
III	14	5	6	25	**33**
IV	11	6	6	23	**32**
V	10	4	10	24	**33**
VI	10	4	10	24	**33**
Total Credits	**711**	**299**	**444**	**144**	**195**

B. Sc (Biotechnology, Biochemistry, Genetics) – B BG

Detailed Syllabus

(Effective from the Academic Year 2019-20)

FIRST SEMESTER

B19BG1011	Language-II: Kannada	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಮೊದಲನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಜನಪದ, ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
    - ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Pedagogy:

- Direct method
- ICT and Digital support (Links attached)
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

Course Outcomes:

ಜನಪದ, ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

1. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.

2. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
3. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ
4. ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2
B19BG1011	CO1	0	0	0	0	2	3	0	0	0	0
	CO2	0	0	0	0	2	3	0	0	0	0
	CO3	0	0	0	0	0	3	0	0	0	0
	CO4	0	0	0	0	0	0	3	2	0	0

Course Contents:

Unit I ಜನಪದ ಮತ್ತು ಪ್ರಾಚೀನ ಕಾವ್ಯ **10 Hours**

1. ಸತ್ಯವಂತೆ ಹಡೆದವ್ವ — ಜನಪದ ಗೀತೆ
2. ನೆಲಸುಗೆ ನಿನ್ನ ವಕ್ಷದೊಳೆ — ಪಂಪ
3. ನೆಲಕಿರಿವೆನೆಂದು ಬಗೆವಿರೆ ಛಲಕಿರಿವೆಂ — ರನ್ನ
4. ಚಿತ್ರಮಪಾತ್ರೆ ರಮತೆ ನಾರಿ — ಜನ್ನ

Unit II ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ **10 Hours**

1. ಅಬ್ಧಿಯುಮೊರ್ಮೆ ಕಾಲವಶದಿಂ ಮರ್ಯಾದೆಯಂ ದಾಂಟದೇ.... — ನಾಗಚಂದ್ರ
2. ವಚನಗಳು — ಅಕ್ಕಮಹಾದೇವಿ
3. ವಚನಗಳು — ಬಸವಣ್ಣ
4. ತಿರುನೀಲಕಂಠರ ರಗಳೆ — ಹರಿಹರ

Unit III ಸಣ್ಣ ಕಥೆಗಳು **10 Hours**

1. ಮೊಲಂ ಸಿಂಹಮಂ ಕೊಂದ ಕಥೆ — ದುರ್ಗಸಿಂಹ
2. ಕಲ್ಲಾಡಿಯ ಕೋಣ — ಮಾಸ್ತಿ
3. ಯಾರೂ ಅರಿಯದ ವೀರ — ಕುವೆಂಪು
4. ಸಮಸ್ಯೆಯ ಮಗು — ತ್ರಿವೇಣಿ

Unit IV ನಾಟಕ **09 Hours**

1. ಟೊಳ್ಳುಗಟ್ಟಿ — ಟಿ.ಪಿ. ಕೈಲಾಸಂ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಚಾರಿತ್ರಿಕ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2008
3. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
4. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಕನ್ನಡ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2007
5. ಹಂಪ ನಾಗರಾಜಯ್ಯ, ಸಾಂಗತ್ಯ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010

6. ನಾರಾಯಣ ಪಿ.ವಿ, ಚಂಪೂ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
7. ಕಾಳೇಗೌಡ ನಾಗವಾರ, ತ್ರಿಪದಿ, ರಗಳೆ ಮತ್ತು ಜಾನಪದ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
8. ಸಂ. ಬೆನಗಲ್ ರಾಮ ರಾವ್ ಮತ್ತು ಪಾನ್ಯಂ ಸುಂದರ ಶಾಸ್ತ್ರೀ, ಪುರಾಣ ನಾಮ ಚೂಡಾಮಣಿ, ಪ್ರಕಾಶಕರು ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ. 2010

9. ಡಾ. ಚಿದಾನಂದ ಮೂರ್ತಿ, ವಚನ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013
10. ಸಂ. ಬಸವರಾಜು ಎಲ್. ಸರ್ವಜ್ಞನ ವಚನಗಳು, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2012
11. ಸಂ. ಬಸವರಾಜು ಎಲ್. ಅಕ್ಕನ ವಚನಗಳು, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 1997
12. ಸಂ ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ನಾಗರಾಜ ಕಿ.ರಂ. ವಚನ ಕಮ್ಮಟ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016

ನರಸಿಂಹಾಚಾರ್. ಡಿ.ಎಲ್., ಪಂಪ ಭಾರತ ದೀಪಿಕೆ, ಪ್ರಕಾಶಕರು ಡಿ.ವಿ.ಕೆ ಮೂರ್ತಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು. 2012

B19BG1012	Language-II: Hindi	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

पूर्वापेक्षा:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरुरी है|

Course Objectives:

पाठ्यक्रम उद्देश्य :

- संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
- साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
- छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
- अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

Course Outcomes:

अधिगम परिणाम :

अध्ययन की समाप्ति पर अध्येता –

- सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
- साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

Pedagogy:

ICT and Digital support, Collaborative and Cooperative learning, Flipped Classroom

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
B19BG1012	CO1	0	0	0	0	2	3	2	0	0	0
	CO2	0	0	0	0	2	2	3	0	0	0
	CO3	0	0	0	0	3	3	3	0	0	0
	CO4	0	0	0	0	3	2	3	0	0	0

Course Contents:

अध्ययन विषय सूची / पाठ्यक्रम

इकाई –1 :कहानी , संस्मरण **(10 hrs)**

1.कहानी – नशा – प्रेमचंद

2.कहानी – सुखमय जीवन – चंद्रधर शर्मा गुलेरी

3.संस्मरण – शरत के साथ बिताया कुछ समय – अमृतलाल नागर

इकाई –2 :कहानी, आत्मकथा **(10 hrs)**

4.कहानी – मरने से पहले – भीष्म साहनी

5.कहानी – लाल हवेली – शिवानी

6. रेखाचित्र – घीसा – महादेवी वर्मा

इकाई –3 :एकांकी, व्यंग्य रचना **(10 hrs)**

7. एकांकी – आवाज का नीलाम – धर्मवीर भारती

8.व्यंग्य रचना – भेड़े और भेडियें – हरिशंकर परसाई

इकाई –4 :अनुवाद, संक्षेपण **(09 hrs)**

अनुवाद : अंग्रेज़ी – हिन्दी (शब्द एवं अनुच्छेद)

संक्षेपण : परिच्छेद का एक तिहाई भाग में |

सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

d) Suggested Text Books and References

Text book/s: पाठ्य पुस्तक :

1. हिन्दी पाठ्य पुस्तक – रेवा विश्वविद्यालय |

References: सन्दर्भ ग्रन् :

1. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
2. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका

संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग

B19BG1013	Language-II: Additional English	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must possess fundamentals of language skills and be aware of social issues.

Course Objectives:

- To develop linguistic prowess of the students.
- To appraise different genres of literature.
- To illustrate the fundamentals of creative language.
- To enhance consistent reading habits.

Course Outcomes:

- Demonstrate a thorough understanding of sensitive and critical social issues.
- Develop reading skills and a wide range of vocabulary.
- Critically analyze a piece of prose or poetry.
- Explain their opinion in a coherent and communicable manner

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG1013	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	3	0	0
	CO3	0	0	0	0	3	3	3	2	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Theory of Matrices **12 Hrs**

Unit-I: Values & Ethics **[9 hours]**

Literature: Rabindranath Tagore - Where the Mind is Without Fear
William Wordsworth – Three Years She Grew in Sun and Shower
Saki – The Lumber-room
William Shakespeare – Extract from Julius Caesar (Mark Antony's Speech)
Language: Vocabulary Building

Unit-II: Natural & Supernatural **[10 hours]**

Literature: John Keats – La Belle Dame Sans Merci
Charles Dickens – The Signal Man
Hans Christian Anderson - The Fir Tree
William Shakespeare – An Excerpt from The Tempest
Language: Collective Nouns

Unit-III: Travel & Adventure **[10 hours]**

Literature: R.L. Stevenson – Travel
Elizabeth Bishop - The Question of Travel
H.G. Wells – The Magic Shop
Jonathan Swift – Excerpt from Gulliver's Travels Book – I
Writing Skills: Travelogue

Unit-IV: Success Stories **[10 hours]**

Literature: Emily Dickinson – Success is Counted Sweetest
Rupert Brooke – Success
Dr. Martin Luther King - I Have a Dream
Helen Keller – Excerpt from The Story of My Life
Writing Skills: Brochure &Leaflet

Reference Books:

- Tagore, Rabindranath. Gitanjali. Rupa Publications, 2002.
- Wordsworth, William. The Complete Works of William Wordsworth. Andesite Press, 2017.
- Munro, Hector Hugh. The Complete Works of Saki. Rupa Publications, 2000.
- Shakespeare, William. The Complete Works of William Shakespeare. Sagwan Press, 2015.
- Chindhade, Shirish. Five Indian English Poets: Nissim Ezekiel, A.K. Ramanujan, ArunKolatkar, DilipChitre, R. Parthasarathy. Atlantic Publications, 2011.
- Dickens, Charles. The Signalman and Other Horrors: The Best Victorian Ghost Stories of Charles Dickens: Volume 2. Createspace Independent Publications, 2015.
- Anderson, Hans Christian. The Fir Tree. Dreamland Publications, 2011.
- Colvin, Sidney (ed). The Works of R. L. Stevenson. (Edinburgh Edition). British Library, Historical Prints Edition, 2011.
- Bishop, Elizabeth. Poems. Farrar, Straus and Giroux, 2011.
- Swift, Jonathan. Gulliver's Travels. Penguin, 2003.
- Dickinson, Emily. The Complete Poems of Emily Dickinson. Createspace Independent Publications, 2016.
- Brooke, Rupert. The Complete Poems of Rupert Brooke. Andesite Press, 2017.
- King, Martin Luther Jr. &James M. Washington. I Have a Dream: Writings And Speeches That Changed The World. Harper Collins, 1992.

- Keller, Helen. The Story of My Life. Fingerprint Publishing, 2016.
- Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 2010.
- Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 2012.
- Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.
- Murphy, Raymond. Murphy's English Grammar with CD. Cambridge University Press, 2004.

B19BG1020	Functional English-I	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

Knowledge of Intermediate English Grammar and LSRW skills

Course Objectives:

1. To develop effective communication skills in English with correct usage of grammar and vocabulary.
2. To emphasize on the development of speaking skills in different scenario.
3. Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

Course Outcomes:

On completion of the course, learners will be able to:

1. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents
2. Demonstrate speaking ability with clarity, confidence and comprehension with appropriate communicative strategies
3. Make use of reading skills in different genres of texts adopting various strategies.
4. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing skills.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG1020	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	3	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Theory of Matrices **12 Hrs**

Unit-I: Functional English **[9 Hours]**

Grammar: Prepositions; Modal Auxiliaries
Listening: Listening to audio (verbal & sounds)
Speaking: Debating Skills
Reading: Skimming a reading passage; Scanning for specific information
Writing: Email communication

Unit-II: Interpersonal Skills **[10 Hours]**

Grammar: Tenses; Wh-questions
Listening& Speaking: Listening and responding to video lectures / talks
Reading: Reading Comprehension; Critical Reading; Finding key information in a given text
Writing: Process descriptions (general/specific); Recommendations

Unit-III- Multitasking Skills **[10 Hours]**

Grammar: Conditional Sentences
Listening & Speaking: Listening to specific task; focused audio tracks and responding
Reading: Reading and interpreting visual material
Writing: Channel conversion (flowchart into process); Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making

Unit-IV: Communication Skills **[10 Hours]**

Grammar: Directand indirect speech
Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays
Reading: Making inference from the reading passage; predicting the content of a reading passage
Writing: Interpreting visual materials (line graphs, pie charts etc.); Different types of Essay Writing

Reference Books:

1. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
2. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
3. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
4. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
5. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
6. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
7. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.

Course Code	Cell Biology	Course Type	L	T	P	C	CH
B19BG1030		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

The student should be familiar with the basic biology and various forms of cellular structures.

Course Objectives:

1. Provide students the ability to recognize and identify the function(s) of cell features and distinguish between: prokaryotic and eukaryotic cells; and between the two types of eukaryotic cells: animal cells and plants cells
2. Provide students with the understanding of major events of the cell organelles
3. Provide students with an understanding of the cell division
4. Provide information about cell signaling and its mechanism.

Course Outcomes:

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

1. Understand the various forms of cell, their structures
2. Understand the basics of the cellular energetics and functions related to plasma membrane
3. Able to describe the mechanism of cell divisions, inheritance and organization at cellular and organism level
4. Illustrate the membrane transport and membrane models of various cells.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG1030	CO	2		1					2		2	2	1	1
	CO	1	1	1	1				2		2	2	2	1
	CO	1		1		1			2		2	2	2	1
	CO	1		1					2		2	2	3	1

Course Contents:

UNIT I: **12 Hrs**

Historical perspectives of cell, cell theory,Prokaryotic and Eukaryotic cells; Ultrastructure of eukaryotic cells (Plant and animal), different types of cells; Plasma membrane Ultrastructure, chemical composition , models of plasma membrane; Specializations of plasma membrane, functions of plasma membrane.

UNIT II: **12 Hrs**

Structure and functions of cell organelles: (a) Mitochondria (b) Ribosomes (c) Lysosomes (d) Centrioles (e) Golgi Complex (f) Endoplasmic reticulum. Structure and functions of Nucleus and nucleolus, Lysosomes, peroxisomes, cytoskeleton elements

UNIT III: **12 Hrs**

Cell division – (a) Mitosis (Process and stages of mitosis and significance of mitosis), (b) Meiosis (Process of meiosis, structure and functions of synaptonemal complex, significance of meiosis), (c) Cell cycle, check points, regulation of cell cycle, achromatic apparatus Apoptosis and necrosis

UNIT IV: **12 Hrs**

Cell interaction and motility: Cell signaling, cell junctions-septate, tight and gap junctions, cell motility, flagellar and ciliary motion, Structure and functions of muscle cells, muscle contraction,

nerve cell structure and functions. Special cells: Blood cells, identification- structure and different types of blood cells, Cancer cells. Concept of chromosome structure. Structure and functions of polytene and lampbrush chromosomes, barr body

Reference Books:

1. Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd. Kumar P. and Mina U. (2018) Life
2. Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication. p.608.
3. Hardin J. and Bertoni G. (2017) Becker's World of the Cell. 9th Edn (Global Edition). Pearson Education Ltd., p. 923
4. Karp G., Iwasa J. and Masall W. (2015) Karp's Cell and Molecular Biology – Concepts and experiments. 8th Edn. John Wiley and Sons. p.832.
5. Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014)
6. Campbell Biology in Focus. Pearson Education. p.1080.
7. Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018)
8. Essential Cell Biology 5th Edn.,(paper back) W.W. Norton & Company p.864.
9. Cooper G.M. and Hausman R.E. (2016) The Cell – A Molecular Approach, 7th Edn., Sinauer Associates Inc., p.832.
10. Mason K.A., Losos J.B. and Singer S.R. (2011) Raven and Johnson's Biology. 9th Edn.
11. Mc Graw Hill Publications. p.1406.
12. Alberts B., Johnson B., Lewis J., Morgan D., Raff M., Roberts K. and Walter P. (2015)
13. Molecular Biology of cell, 6th edn., Garland Science, Taylor and Francis, p. 1465
14. Challoner J. (2015) The Cell: A visual tour of the building block of life, The University of
15. Chicago Press and Ivy Press Ltd., p.193

Course Code	Classical Genetics	Course Type	L	T	P	C	CH
B19BG1040		**HC**	**2**	**1**	**0**	**3**	**4**

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of the cell types.

2. They should have prior idea about the classification of organisms.

Course Objectives:

The objective of this Course is to:

1. To explore the world of research using model organisms.
2. To understand the inheritance pattern of Mendelism
3. To analyze the different gene interactions and inheritance
4. To discuss the involvement of chromosomes in sex determination.

Course Outcomes:

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

1. Compare the different model organisms used for research and its significance.
2. List out the milestones in the evolution of genetics.
3. Outline the inheritance patterns of traits and the interaction of genes.
4. Illustrate the involvement of chromosomes in sex determination and the mechanisms involved in sex differentiation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG1040	CO1	3	2	3		2	2				3	3	2	
	CO2	3									3	3		
	CO3	3	3	3			3				3	3	2	
	CO4	3	3	2			3		2		3			

Course Content:

UNIT I **12 hrs**

Scope of Genetics.

Model organisms - (Structure, life cycle, genetic and industrial applications)

Prokaryotes –Bacteriophage, TMV, *Escherichia coli*
Eukaryotes – *Coenorhabditis elegans, Drosophila melanogaster, Arabidopsis thaliana,* Zebrafish, Rattus species ,*Saccharomyces cerevisiae, Pichia pastoris*

History of Genetics – Pre- Mendelian genetic concepts: Preformation, Epigenesis, Inheritance of acquired characters and Mutation theory.

UNIT II **12 hrs**

Biography of Mendel and his experiments on pea plants.
Principle of dominance.
Law of Segregation: Monohybrid cross, Back cross and Test cross, Problems related.
Law of Independent Assortment: Dihybrid cross in pea plant, Back cross and Test cross,.

UNIT III **12 hrs**

Multiple Alleles: Definition, ABO blood groups and Rh factor in Human, **Gene Interactions**
Inter allelic:-
Complementary gene interaction (9:7) Ex: *Lathyrus odoratus*
Supplementary gene interaction (9:3:4) Ex: Grain color in Maize.
Epistasis - Dominant Ex.: Fruit color in *Cucurbita pepo,* Recessive - Ex.: Coat color in *Mice.*
Non- Epistasis - Ex.: Comb pattern in Poultry. Related problems

UNIT IV **12 hrs**

Sex Determination

Chromosome theory of Sex determination: XX- XY, XX-XO, ZZ-ZW, Genic Balance theory of Bridges, Intersexes and Super sexes in *Drosophila*, Y chromosome in sex determination of *Melandrium*.

Environment and sex determination; Hormonal control of Sex determination (Free martins).

Gynandromorphs. Sex differentiation. Dosage compensation.

Deviations from Mendelism: Incomplete inheritance and Co-dominance.

Related problems

Reference Books:

1. Biology: The Dynamic Science, 2nd Edition, Peter J. Russell, Paul E. Hertz.. Beverly Mc Millan publications. 2012
2. Cell and Molecular Biology, 4th Edition, P.K. Gupta. 2014
3. Cytogenetics, 1st Edition, P.K. Gupta. 2013
4. Microbiology, 3rd Edition, P.D. Sharma. 2012.
5. Gardner/Simmons/Snustad. (2006). Principles of Genetics. 8th edition, John Wiley and sons.

Course Code	General Biochemistry - I	Course Type	L	T	P	C	CH
B19BG1050		HC	2	1	0	3	4

Prerequisites:

Requires knowledge of pre-university chemistry and biology.

Course Objectives:

The objective of the course is to

1. To understand the concepts of chemical bonding and its applications.
2. To familiarize with liquids and its biophysiological applications in various diseased state
3. To understand the basics of biochemical equilibrium with catalytic reaction kinetics
4. To understand environmental bioinorganic chemistry.

Course Outcomes:

After completing the course the student shall be able to:

1. Apply the knowledge of chemical bonding and molecular interactions in biologicalsystems.
2. Apply knowledge on preparation of buffers solutions.
3. Understand the relationship between kinetics and equilibrium.
4. Apply knowledge on understanding of catalysis

Mapping of Course Outcomes with program me Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG1050	CO1	2	2		3		3			2		2	2	
	CO2	3		2		1		2		3	2	1	1	

	CO3	3		2		2				3		2	2	
	CO4	2	2		2		2		1		3	1		2

Course Content:

UNIT I **12 hrs**

Chemicalbonding: Nature and types of chemical bonding: Ionic bonding; Born-Haber cycle. Characteristicsof ionic bonding, covalentbonding, types, Hybridization in Boron, Carbon, Nitrogen and oxygen containg compounds. Electron affinity or electro negativity, polar and non-polar covalent bonds, bondlength,bond angle, bond energy, Coordinate bond; Ligands, Non covalent interactions; Hydrogenbonds; types , Hydrophobicornon-polarinteractions.Vander Waalsinteractions.

Water: Physical and chemical properties of water, Structure of water. Hydrogen bonding between water molecules, water and solute molecules. Role of non covalent interactions in water,Role of water in life.

UNIT II **12 hrs**

Liquids: Properties of liquids – vapour pressure, viscosity and surface tension. Relationship between vapour pressure and boiling point, freezing point-heat of fusion. Viscosity-Definition, units, experimental determination using Ostwalds viscometer. Viscosity and shape/size of molecules.

Surface tension:- Definition, units, experimental determination using stalagmometer. Surfactants – effect of surfactants on surface tension. Viscosity and Surface tension in everyday life.

pH and Buffers: Lewis concept of acids and bases. Ionic product of water, pH scale, weak acids and bases, Ionization of weak acids, Titration of a weak acid by a strong base. Henderson-Hasselbalch equation and its applications, types of buffers, buffer capacity, Buffer action.

Biological buffer systems: Mechanism of action of Phosphate, Bicarbonate, protein and hemoglobin buffer systems in human body.

UNIT III **12 hrs**

Chemical Equilibrium: Definition and examples of Reversiblereactions.Lawofmass action, Chemical equilibrium – definition and characterstics.Relationship between $K_p$and K_c.Homogeneous and heterogeneous systems with examples. Le Chatlier's principle, Equilibrium constant and free energy change. Biological applications of ATP and itsrole in bio-energetics and binding of oxygen by myoglobin and haemoglobin. Redox equilibria with example Fe^{2+} ,Fe^{3+}System.

Reaction Kinetics &Catalysis: Definition of Molecularity, Order and rate of reactions. Factors influencing rate of reaction. Ratelaw or Rate equation, rate constant andhalf- life period expressions for zero, first and second order reactions. Theories of reaction rates – Arrhenius equation, transition state theory. Experimental methods of studying kinetics of reactions. Pseudo unimolecular reaction,

Characteristicsofcatalysts,Typesofcatalysis–Homogeneousandheterogeneouswith both biological and non-biological examples. Theories ofcatalysis.

UNIT IV **12 hrs**

Bio-inorganic and Environmental Chemistry: Metal ions in biological systems. Types of ligands with examples; Role of iron in Myoglobin, Haemoglobin and cytochromes. Copper in Hemocyanin. Magnesium in chlorophyll. Cobalt in vitamin B-12 and Molybdenum in nitrogenase. Metal activated enzymes.

Toxicology- toxicity and detoxification of Pb, Hg, Cd. LD and ED values of major toxicants. Water pollution: Treatment of sewage and industrial effluents (tanningand electroplating); Pesticides hazards – DDT, Malathion, lindane and 2,4-D. Brief Introduction to Bioremediation and Phytoremediation with applications.

Introduction to Biochemistry: History, scope and applications of Biochemistry, Biochemistryasmolecularlogicoflivingorganisms.Contributionsofvariousscientistsinthefield ofBiochemistry.

Reference Books:

1. Physical Chemistry R. P. Verma, PradeepPublication
2. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistry8thEd.,OxfordUniversity Press(2006).
3. Ball, D. W. Physical Chemistry Thomson Press, India(2007).
4. Kinetics of Chemical Reactions S. K. Jain Vishal publications, Jalandhar New Delhi

5 Physical Chemistry M. Kundan & S. K. Jain S. Chand & Company
6 Text book of Physical Chemistry K. K. Sharma & C. K. Sharma Vani Educational Books
7 Principles of physical chemistry Puri, Sharma&Pathania
8 Essentials of physical chemistry B. S. Bahl, Arun Bahl & G. D.Tuli
9 Lee, J.D. Concise Inorganic Chemistry ELBS,1991.
10Cotton,F.A.,Wilkinson,G.&Gaus,P.L.BasicInorganicChemistry,3rded.,Wiley.
11 Text book of Chemical Kinetics Laidier New AgePublication
12 Principles and Applications of Catalysis B. Vishwanath Narosa Publishing House.
13 Casarett and Doull's Essentials of Toxicology by Curtis Klaassen 3rd Edition
14 Principles and Practice of Toxicology in Public Health by Ira S.Richards2nd Edition
15 Principles of Toxicology by Karen E. Stine and Thomas M. Brown 3rd Edition 16 Biochemistry by Satyanarayana, 5th Edition 2017

Course Code	Indian Constitution & Professional Ethics	Course Type	L	T	P	C	CH
B19BG1060		FC	2	0	0	2	2

Course Objectives:

1. To provide and gain knowledge on Constitution of India.
2. To know and understand about the Fundamental Rights, Duties and other Rights which is been given by our law.
3. To prepare students in the understanding of Constitution perspective and make them face the world as a bonafide citizen.

4. To attain knowledge about ethics and also know about professional ethics.
5. Explore ethical standards followed by different companies.

Course Outcomes:

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

1. Strengthen the knowledge on Indian constitutional law and make the practical implementation.
2. Understand the fundamental rights and human rights.
3. Get the knowledge to explain the duties and more importantly practice it in a right way.
4. Adopt the habit of raising their voice against aunconstitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.
5. Get exposed about professional ethics and know about etiquettes about it.
6. Know about ethical standards of different companies which will increase their professional ability.

Course Content:

UNIT -I: **6 Hrs**

Constitution of India: Making of Indian Constitution, features of Indian Constitution Preamble to the Constitution of India, Fundamental Rights under Part III; Rights to Equality, Right to Freedom, Right against Exploitation, Rights to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Characteristics. Elements of National Significance; National Flag, National Anthem, National Emblem.

UNIT -II: Legislature and Executive **6 Hrs**

Organs of the Government; Legislature, Executive and Judiciary. Union and State Executives: President, Vice President, Prime Minister, Cabinet, Governor, Council of Ministers, Electoral process, Election Commission.

UNIT -III: Judiciary **6 Hrs**

Supreme Court of Indian, High Court, Right to Information Act 2005, Consumer Protection- Consumer Rights- Caveat Emptor and Caveat Venditor.

Unit-IV: Professional Ethics **6 Hrs**

Definition Scope and need of Ethics for professional, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees. Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics.Best Ethical Companiesin India and Abroad; Corporate Social Responsibilities,Code of Conduct and Ethical Excellence.

Text Books:

1. M V Pylee, An introduction to Constitution of India
2. M Govindarajan, S Natarajan, V S Senthil Kumar, Engineering Ethics.
3. Dr.Durga Das Basu, Introduction to constitution of India.

Course Code	Cell Biology Lab	Course Type	L	T	P	C	CH
B19BG1070		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

The student should basic have knowledge of basic biology, basic microscopy techniques and cellular structures.

Course Objectives:

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

1. Explore the different stages of mitosis and meiosis.
2. Provide the information about the different staining techniques.
3. Study the usage of microscope and the caliberation to analyse the size of cells.
4. Illustrate different cell organelles and its enzyme activity.

Course outcomes:

1. Determination of cell division of eukaryotes
2. Qualitative and quantitative examination of cells
3. Staining procedure of cell organelles cell counting.
4. Enzyme catalytic action of enzymes using enzyme markers.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG1070	CO1	2	3	3					2		3	2	3	2
	CO2	2	3	3	3				2		3	2	3	2
	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	2

Course Contents:

1. Temporary preparation of Stained samples for Mitosis (onion root tips)
2. Temporary preparation of Stained samples for Meiosis (grass hopper testis/ pollen)
3. Barr body preparation
4. Vital staining of Mitochnodria
5. Cell counting methods; haemocytometer
6. Measurements with the help of light microscope Calibration of ocular micrometer Finding out average cell size

7. Separation of cell organelles by differential centrifugation and assay of marker enzymes
8. Blood smear preparation and identification of blood cells.

Reference Books:

1. J Sambrook & DW Russell (2001). Molecular cloning: a laboratory manual Vol 1, 2 & 3, CSHL Press.
2. Cell and Molecular Biology , S. C. Rastogi
3. Cytology, T. S. Verma and V. K. Agarwal
4. Cell Biology, C. B. Pawar
5. Cell and Molecular Biology, P. K. Gupta
6. Fundamentals of Molecular Biology, Veer Bala Rastogi
7. Fundamentals of Molecular Biology, G. K. Pal and Ghaskadabi
8. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology, Verma and Agarwal
9. Cell and Molecular Biology, Robertis and DeRobertis
10. Molecular Cell Biology, 4th Edition, Lodish S. Baltimore
11. Molecular Biology of Gene, Watson J. D.
12. Biochemistry and Molecular Biology of Plants, Buchanan B. B.
13. Molecular and Cell Biology, Wolfe S.L.

Course Code	Classical Genetics Lab	Course Type	L	T	P	C	CH
B19BG1080		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

Requires theoretical knowledge of chemicals and biotechniques.

Course Objectives ::

The objective of this Course is to

1. Apply basic techniques in the organic laboratory for preparation, purification and Identification of organic compounds.
2. To develop the skills among students to understand the theory and practice of bio analytical techniques
3. To provide among students the scientific understanding of analytical techniques and detail interpretation of results.

Course Outcomes:

After completing the course, the student shall be able to:

1. Elucidate structures of unknown compounds using qualitative organic analysis.
2. Identify the amino acids given in the sample.
3. Identify the carbohydrates given in the sample.
4. To determine the extent of pollution in water.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG 1080	CO1	2	1	1	2			1	1		3	2	1	
	CO2	1	2	2	1			1			2	1	1	
	CO3	1	2	2	1			1			2	1	1	
	CO4	1	1	2	2			2	1		2	2	2	

Course Contents:

1. Study of Model organisms and their genetic significance
   Prokaryotes – Bacteriophage, TMV, *Escherichia coli*
2. Study of Model organisms and their genetic significance **Eukaryotes –** *Coenorhabditis elegans, Saccharomyces cerevisiae, Drosophila melanogaster, Arabidopsis thaliana,* Zebrafish.
3. Staining technique:
   Gram Staining – *Lactobacillus* and *E.coli*
4. Blood grouping .
5. Genetic problems on: Multiple alleles
6. Genetic problems on Gene Interactions (Complemetary/ Supplementary/ Dominant Epistasis gene interactions)
7. Study of Barr body in buccal epithelial cells.
8. Study of mitochondria using Janus green.

Reference Books:

1. Biology: The Dynamic Science, 2nd Edition, Peter J. Russell, Paul E. Hertz.. Beverly Mc Millan publications. 2012
2. Cell and Molecular Biology, 4th Edition, P.K. Gupta. 2014
3. Cytogenetics, 1st Edition, P.K. Gupta. 2013
4. Microbiology, 3rd Edition, P.D. Sharma. 2012.
5. Gardner/Simmons/Snustad. (2006). Principles of Genetics. 8th edition, John Wiley and sons.

Course Code	Laboratory course I (Biochemistry)	Course Type	L	T	P	C	CH
B19BG1090		HC	0	0	2	2	3

Prerequisites:

Requires knowledge of pre-university chemistry, physics and biology

Course Objectives:

The objective of this Course is to:

1 Understand the preparation of various chemical components.
2. Know the analysis and quantification of chemical compositions.

Course Outcomes:

After completing the course, the student shall be able to:

1. Prepare standard solutions and solvents
2. Determine the physical parameters of the solvents
3. Determine the concentration of various compounds using titrimetry.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PS01	PS0 2	PS0 3
B19BG1090	CO1	1		2	1			1			3	1		
	CO2	1	2	2				2			2	1	1	
	CO3	2	1	1				1			2	1	1	
	CO4													

Course Contents:

1. Estimation of NaoH using Potasium hydrogen phthalate.
2. Estimation of potassium permanganate using standard sodium oxalatesolution.
3. Estimation of hardness of water using EDTA (Standard EDTA to beprovided)
4. Preparation of organic compound-
   a) Preparation of m-nitrobenzene from Nitrobenzene

   b) Preparation of p-nitroacetanilide from Acetanilide
5. Determination of density and viscosity of the given organic liquid using Ostwald's viscometer
6. Determination of density and surface tension of the given liquid using Stalagmometer.
7. Preparation of Buffers (Acetate, Phosphate and Citrate) by bothmethods.
8. pH metric titration of amino acid against NaOH.
9. pH metric titration of amino acid against HCl.

Reference Books:

1. An Introduction to practical Biochemistry—PlummerD.T,Tata Mc GrawHill
2. Biochemical Calculations, Irwin H.Segel (1976) 2 nd Ed. Jhon Wiley and Sons.
3. Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.
4. Analytical Biochemistry; D.J.Holme and H. Pick Longman (1983).
5. Experimental Biochemistry: A Student **Publisher:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
6. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
7. Introductory practical Biochemistry, Sawhney, Randhir singh, 11th Edition (2015)

SECOND SEMESTER

B19BG2011	Language-II: Kannada	L	T	P	C

Duration:14 Wks		2	1	0	3

Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಎರಡನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಲೇಖನಗಳು ಹಾಗು ಪ್ರವಾಸ ಕಥನ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Course Outcomes:

ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಲೇಖನಗಳು ಹಾಗು ಪ್ರವಾಸ ಕಥನ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

1. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
2. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
3. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ

1. ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG2011	CO1					2	3				
	CO2					2	3				
	CO3						3				
	CO4							3	2		

Course Contents:

Unit-I ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ **10 Hours**

1. ಚಂದ್ರಮತಿ ವಿಲಾಪ — ರಾಘವಾಂಕ
2. ಹಗೆಗಳನು ಹಿಂಡಿದನು ಮನದೊಳಗೆ — ಕುಮಾರವ್ಯಾಸ
3. ಬಿರುಗಾಳಿ ಪೊಡೆಯಲೆ — ಲಕ್ಷ್ಮೀಶ
4. ಗೋರಕ್ಷ ಪ್ರಸಂಗ — ಚಾಮರಸ

Unit II ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ — **10 Hours**

1. ತ್ರಿಪದಿಗಳು — ಸರ್ವಜ್ಞ
2. ಮುಂದಕ್ಕೆ ಲೇಸುಂಟು ನಮಗೆ — ಹೆಳವನ ಕಟ್ಟೆ ಗಿರಿಯಮ್ಮ
3. ಗಿಳಿಯು ಪಂಜರದೊಳಿಲ್ಲ — ಪುರಂದರ ದಾಸರು
4. ಕರೆದು ಕೊಟ್ಟನು ಶಾಪವನು — ಕನಕದಾಸರು

Unit III ಲೇಖನಗಳು — **10 Hours**

1. ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ — ಪಿ. ಲಂಕೇಶ
2. ನಿರಂಕುಶಮತಿಯಿಂದ ಆತ್ಮಶ್ರೀ — ಕುವೆಂಪು
3. ಮಾನವೀಯತೆ ಅಂತಾರಲ್ಲಾ — ದೇವನೂರು ಮಹಾದೇವ
4. ಭೂತಾಯಿ ಮುನಿದಾಳು — ಮುರಾರಿ ಬಲ್ಲಾಳ

Unit IV ಪ್ರವಾಸ ಕಥನ — **09 Hours**

1. ನನ್ನೊಳಗಿನ ಹಾಡು ಕ್ಯೂಬಾ — ಜಿ.ಎನ್. ಮೋಹನ್

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
3. ಹಂಪ ನಾಗರಾಜಯ್ಯ, ಸಾಂಗತ್ಯ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
4. ಕಾಳೇಗೌಡ ನಾಗವಾರ, ತ್ರಿಪದಿ, ರಗಳೆ ಮತ್ತು ಜಾನಪದ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
5. ಸಂ. ಬೆನಗಲ್ ರಾಮ ರಾವ್ ಮತ್ತು ಪಾನ್ಯಂ ಸುಂದರ ಶಾಸ್ತ್ರೀ, ಪುರಾಣ ನಾಮ ಚೂಡಾಮಣಿ, ಪ್ರಕಾಶಕರು ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ. 2010
6. ಸಂ. ಬಸವರಾಜು ಎಲ್. ಸರ್ವಜ್ಞನ ವಚನಗಳು, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2012
7. ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ಷಟ್ಪದಿ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
8. ಸಂ. ಸೇತುರಾಮ ರಾವ್ ಅ.ರಾ., ಶ್ರೀ ಲಕ್ಷ್ಮೀಶನ ಜೈಮಿನಿ ಭಾರತ(ಮೂಲ–ತಾತ್ಪರ್ಯ–ಸಚಿತ್ರ), ಪ್ರಕಾಶಕರು ಕಾಮಧೇನು ಪುಸ್ತಕ ಭವನ, ಬೆಂಗಳೂರು. 2010
9. ಸಂ. ಜಿ.ಎಸ್.ಭಟ್., ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ ಪ್ರವೇಶ, ಪ್ರಕಾಶಕರು ಅಕ್ಷರ ಪ್ರಕಾಶನ, ಹೆಗ್ಗೋಡು, ಸಾಗರ. 2006
10. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
11. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು – 2014
12. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು.

B19BG2012	Language-II: Hindi	L	T	P	C
Duration:14 Wks		2	1	0	2

Prerequisites:

पूर्वापेक्षा:

- अध्येता, पी.यु.सी के स्तर पर द्वितीय भाषा के रूप में हिन्दी का अध्ययन करना चाहिए |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरुरी है|

Pedagogy:

ICT and Digital support, Collaborative and Cooperative learning, Flipped Classroom

LTP: L:2 T:1 P:0

Course type:Theory
Contact Hours:39

Course Objectives:

पाठ्यक्रम उद्देश्य :

- संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
- साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
- छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
- अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

Course Outcomes:

अधिगम परिणाम :

अध्ययन की समाप्ति पर अध्येता –

- सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- समाज में अंतर्निहित पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
- साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
B19BG2012	CO1	0	0	0	0	2	3	2	0	0	0
	CO2	0	0	0	0	2	2	3	0	0	0
	CO3	0	0	0	0	3	3	3	0	0	0
	CO4	0	0	0	0	3	2	3	0	0	0

Course Contents:

इकाई – 1 कविता: प्राचीन एवं आधुनिक **(10 hrs)**

1.कबीर के दोहे

2.कविता – जलियाँवाला बाग में बसंत- सुभद्राकुमारी चौहान

3.कविता – सुभाष की मृत्यु पर - धर्मवीर भारती

इकाई – 2 कविता: प्राचीन एवं आधुनिक **(10 hrs)**

4.तुलसीदस के पद

5.कविता – पाषाणी – नागार्जुन

6.कविता – चलना हमारा काम है- शिवमंगल सिंह सुमन

इकाई – 3 कविता: प्राचीन एवं आधुनिक **(10 hrs)**

7.मीराबाई के पद

8.कविता – मेरे सपने बहुत नहीं हैं- गिरिराज कुमार माथुर

9.कविता – अभी न होगा मेरा अंत – निराला

इकाई – 4 **(09 hrs)**

अनुवाद : शब्द एवं अनुच्छेद (हिन्दी से अंग्रेज़ी)

मीडिया लेखन

सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

d) Suggested Text Books and References

Text book/s: पाठ्य पुस्तक :

1. हिन्दी पाठ्य पुस्तक – रेवा विश्वविद्यालय |

References: सन्दर्भ ग्रन्थ :

1. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
2. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. संक्षेपण एवं पल्लवन

B19BG2013	Language-II: Additional English	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must possess fair knowledge of language and literature.

Course Objectives:

- To assess ecological and environmental concerns through literature.
- To identify the inequal structures of power in society.
- To compare the position of men and women in society.
- To interpret the representation of society in popular culture.

Course Outcomes:

On completion of the course, learners will be able to:

- Demonstrate a thorough understanding of sensitive and critical ecological and environmental issues.
- Analyze the rigid structure of center and margin in our society.
- To criticize the subordinate position of women in society.
- To justify the depiction of society in popular culture

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG2013	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	2	0	0
	CO4	0	0	0	0	3	3	3	2	0	0

Course Contents:

Unit-I: Ecology & Environment **[9 hours]**

Literature: Toru Dutt - Casuarina Tree
Robert Frost – Stopping by Woods on a Snowy Evening
Tomas Rivera –The Harvest
C.V. Raman – Water – The Elixir of Life
Language: Degrees of Comparison

Unit-II: Voices from the Margin **[10 hours]**

Literature: Tadeusz Rozewicz – Pigtail
Jyoti Lanjewar – Mother
Sowvendra Shekhar Hansda – The Adivasi Will Not Dance
Harriet Jacobs – Excerpt from Incidents in the Life of a Slave Girl
Language: Prefix and Suffix

Unit-III: Women & Society **[10 hours]**

Literature: Kamala Das – An Introduction
Usha Navrathnaram – To Mother
Rabindranath Tagore – The Exercise Book
Jamaica Kincaid – Girl
Writing Skills: Dialogue Writing

Unit-IV: Popular Culture **[10 hours]**

Literature: Rudyard Kipling – The Absent-minded Beggar
Sir Arthur Conan Doyle – The Hound of the Baskervilles
Aldous Huxley – The Beauty Industry
Writing Skills: Story Writing

Reference Books:

- Agrawal, K.A. *Toru Dutt the Pioneer Spirit of Indian English Poetry - A Critical Study*. Atlantic Publications, 2009.
- Latham, Edward Connery (ed). *The Poetry of Robert Frost*. Holt Paperbacks, 2002.
- Gale, Cengage Learning. *A Study Guide for Tomas Rivera's The Harvest*. Gale, Study Guides, 2017.
- Basu, Tejan Kumar. *The Life and Times of C.V. Ram*an. PrabhatPrakashan, 2016.
- Rozewicz, Tadeusz. *New Poems*. Archipelago, 2007.
- Manohar, Murli. *Critical Essays on Dalit Literature*. Atlantic Publishers, 2013.
- Hansda, SowvendraShekhar. *The Adivasi Will Not Dance: Stories*. Speaking Tiger Publishing Private Limited, 2017.
- Jacobs, Harriet. *Incidents in the Life of a Slave Girl*. Createspace Independent Publication, 2014.
- Das, Kamala. *Selected Poems*. Penguin Books India, 2014.
- Tagore, Rabindranath. *Selected Short Stories of Rabindranath Tagore*. Maple Press, 2012.
- Gale, Cengage Learning.*A Study Guide for Jamaica Kincaid's Girl*. Gale, Study Guides, 2017.
- Kipling, Rudyard. *The Absent-Minded Beggar*. Hardpress Publishing, 2013.
- Doyle, Arthur Conan. *The Hound of the Baskervilles*. General Press, 2017.
- Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
- Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
- Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
- Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.

B19BG2020	Functional English-II	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

Knowledge of intermediate English Grammar and LSRW skills.

Course Objectives:

1. To demonstrate the utilization of using language skills effectively in real-life scenario.
2. To build competence in employability skills.
3. To improve the habit of writing, leading to effective and efficient communication.
4. To prioritize development of technical reading and speaking skills.

Course Outcomes:

On completion of the course, learners will be able to:

1. Make use of the language skills to communicate effectively in real-life scenario.
2. Develop competence in employability skills.
3. Build the habit of writing, leading to effective and efficient communication.
4. Improve and develop technical reading and speaking skills

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG2020	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	3	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Language Acquisition **[9 Hours]**

Grammar: Active and passive voice
Listening & Speaking: Listening to informal conversations and interacting
Reading: Developing analytical skills; Deductive and inductive reasoning
Writing: Giving Instructions; Dialogue Writing

Unit-II: Persuasive Skills **[10 Hours]**

Grammar: Compound words; Phrasal verbs
Listening: Listening to situation based dialogues
Speaking: Group Discussions
Reading: Reading a short story or an article from newspaper; Critical reading
Writing: Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives)

Unit-III: Cognitive Skills **[10 Hours]**

Grammar: Homonyms; Homophones
Listening: Listening to conversations; Understanding the structure of conversations
Speaking: Presentation Skills
Reading: Extensive reading
Writing: Report Writing (Feasibility/ Project report - report format – recommendations/ suggestions - interpretation of data using charts, PPT); Precis Writing

Unit-IV: Employability Skills **[10 Hours]**

Grammar: Idioms; Single Word Substitutes
Listening: Listening to a telephone conversation; Viewing model interviews (face-to-face, telephonic and video conferencing)
Speaking: Interview Skills, Mock Interviews Reading: Reading job advertisements and the profile of the company concerned
Writing: Applying for a job; Writing a cover letter with résumé / CV

Reference Books:

1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.

5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
6. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.

Course Code	General Microbiology	Course Type	L	T	P	C	CH
B19BG2030		**HC**	**2**	**1**	**0**	**3**	**4**

Prerequisites/Pre reading for the course:

The student should have the basic knowledge of biology and microscopy.

Course Objectives:

1. To understand the origin and concepts of microorganisms as science
2. To explore the various types of microorgamism and their signifinance
3. To familiarize the students in cultural methods involved in microbiology
4. To exploit the microbial physiology for the benefit of society

Course Outcome:

By the end of the course the students will be able to:

1. Understand the scope and importance of microbiology in biotechnology
2. Handle microorganisms and utilize for other purpose
3. Exploit various methodologies involved in microbiology
4. Illustrate the microbial metabolism

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG2030	CO1	1	1	1	2	1			1		2	2	2	1
	CO2	2	3	3	3	2			2		3	2	2	2
	CO3	2	3	3	3	2	2		3		3	2	3	2
	CO4	2	3	3	3	2	2		3		3	2	3	3

Course Content:

Unit-I Introduction to microbiology **12 Hrs**

Origin and historical development of MB, contribution of microbiologist- Leeuwenhoek, Robert hook, Koch, Pasteur, Lister & Fleming; Biogenesis & abiogenesis theory, Microbiology as interdisciplinary science, importance and scope. Kingdom of classifications-two, three & four kingdom classification, classification criteria in the microbes-Bergeys' classification & phylogentic analysis, Binomial nomenclature, classification systems in different microbial classes and commission for the naming the organism

Unit-II Prokaryotic and Eukaryotic Microbes **12 Hrs**

Brief history of bacteriology, general characteristics of bacterium, classification of bacteria based on the morphology, flagella and nutritional aspects, ultrastructure of bacterial cells-cell wall composition, cell membrane, flagella, cell surface appendages, genomes & extra chromosomal DNA and functions of bacterial structure. Mycoplasma. Euakryotic microbes general characteristics, classification and importances of fungi, algae and protozoa's.

Unit-III Microbiological techniques **12 Hrs**

Microscopy-properties of light, Resolution, numerical aperature, Principle of light miceroscope-bright field, dark field, phase contrast, fluorescent & electron microscopy-scanning & transmission; Staining techniques in microbiology-simple, differential & structural; microbial medium & Sterilisation techniques-physical, chemical (including antibiotics) & filtration techniques. Nutritional basis for classification of microbes-phototrophs, autotrophs, heterotrops, oxygen, pH and temperature, growth curve-phases & their importance, reproduction in microbes, isolation-pour, streak & spread plating and enumeration of microbes-indirect & direct methods.

Unit-IV Microbial physiology **12 Hrs**

Metabolism, anabolism & catabolism, Aerobic and anaerobic respiration-fermentation process, glycolysis, TCA cycle, Entner Duodruffs pathway, pentose phosphate pathway, electron transport chain and energetic at each steps; entry of other carbohydrates and its significance. Bacterial photosynthesis (green and purple bacteria)-oxygenic & anoxygenic photosynthesis, role of photosystem and accessory pigments in the photosynthesis, biochemical nitrogen fixation–non-symbiotic and symbiotic bacteria

Reference Books:

1. M J Pelzer Jr, ECS Chan, NR Krieg, Microbiology, TMH Publishing Co Ltd, 5th Edition, 2007.
2. Starrier, Ingraham and Wheeler, General Microbiology, McMillan Publisher, 5th Edition, 1998.
3. Atlas R.M. Microbiology: Fundamentals and applications 4th Edition, Singapore: Pearson Asia, 2000.
4. Prescott L.M, Harley T.P and Klein D.A. Microbiology, 9th Edition, WMC. Brown publishers, 2012.

Course Code	Cytogenetics	Course Type	L	T	P	C	CH
B19BG2040		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of cell organelles.
2. They should have idea about cell cycle.

Course Objectives:

The objective of this Course is to

1. To equip with the knowledge of microscopy.
2. To explore cell biology and its characteristics.
3. To define the structure and organization of eukaryotic chromosomes.
4. To study the mechanism of linkage and recombination.

Course Outcomes:

After the end of the Course students will be able to:

1. Describe the structure and organization of eukaryotic chromosomes.
2. Diagnose the syndromes depending on karyotypic data.
3. Understand the mechanism of linkage and recombination.
4. Explain the inheritance followed by non-nuclear genes

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG2040	CO1	3	3	3	3				3		3	3	2	
	CO2	3	3	3	3		2		2		3	3	2	2
	CO3	3	3								3	3	2	
	CO4	3	3			3			3		3	3	2	

Course Contents:

UNIT I **12 hrs**

Microscopy: Magnification, Resolving power, Principles and Applications of Simple, Compound, Stereozoom, Phase contrast, Fluorescent and Electron microscopes, confocal microscopy. **Cell organelles:** Ultrastructure, Chemical composition and Functions of Cytoplasmic organelles: Plasma membrane, Endoplasmic reticulum, Ribosomes, Lysosomes, Golgi bodies and Nucleus. Cell cycle and cell division. Apoptosis (extrinsic and intrinsic mechanisms).

UNIT II **12 hrs**

Chromosome theory of inheritance.
Eukaryotic Chromosome: Macro-molecular organization. Primary and Secondary constriction, Sat-bodies, Telomeres, Heterochromatin and Euchromatin and its significance.

Ultra structure of Chromosome - Histones, DNA, Nucleosome model, solenoid, scaffold, domains.

Special types of Chromosomes: Structure and Significance of: Polytene Chromosome - Salivary gland chromosome in *Drosophila*, Lampbrush chromosome in amphibian Oocyte. B Chromosome.

UNIT III **12 hrs**

Linkage: Definition of Linkage, Coupling and Repulsion hypothesis, Linkage group- *Drosophila*, maize and man, Types of linkage-complete linkage and incomplete linkage, Factors affecting linkage- distance between genes, age, temperature, radiation, sex, chemicals and nutrition, Significance of linkage.

Crossing over: Crossing over- definition and types of crossing over: Germinal and Somatic crossing over. Crossing over in *Drosophila.* Cytological basis of crossing over: Stern's experiments in *Drosophila,* Creighton and Mc Clintock experiment in maize. Mechanism of crossing over: Chiasma type theory, Breakage first theory, Contact first theory, Strain or torsion theory. Molecular mechanism of crossing over - Holliday model, Interference and coincidence, Steps in Construction of genetic map *(Drosophila).*

UNIT IV **12hrs**

Sex linkage: Definition of sex linkage; Sex linkage in Drosophila. Sex linked genes in poultry, moths and man. Sex linked inheritance in man (Colour-blindness, Haemophilia).
Meiotic behavior of chromosome and non - disjunction. Bridges theory of non-disjunction. Attached X-chromosome.

Extra Chromosomal Inheritance / Cytoplasmic Inheritance: Characteristic features of Cytoplasmic Inheritance. Maternal effect inheritance.Structure and organization of Mitochondria and Chloroplast Inheritance of: Mitochondrial DNA, Chloroplast DNA, Kappa articles in *Paramecium*, Sigma factor in *Drosophila*, Shell coiling in snail. Cytoplasmic Male Sterility (CMS) in maize.

Reference Books:

1. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha , Vikas Publishing House Private, Limited, 1998.
2. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.
3. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.
4. Genetic Maps, 6th edition by O'Brien, S (1993) Book 3: Lower Eukaryotes. Book 4: Nonhuman Vertebrates. Book 5: The Human maps. Book 6: Plants. Cold Spring Harbor Lab press New York.
5. Genetics, 2nd Edition, by Weaver, R.F. and Hendrick, P.W. (1992). W.C. Brown.
6. Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.
7. Principles of Genetics by E.J.Gardener, M.J.Simmons and D.P.Snustad.J.Wiley and Sons pubs (1998).

Course Code	Biochemical Techniques	Course Type	L	T	P	C	CH
B19BG2050		HC	2	1	0	3	4

Prerequisites:

Requires knowledge of pre-university physics, mathematics, chemistry and biology.

Course Objective:

1. To understand the use of various biochemical techniques for the study of subcellular organelles
2. To familiarize with principle, instrumentation and applications of separation techniques
3. To understand the basics of spectroscopic method and its biological applications
4. To understand radio isotope use and instrumentations for biological applications.

Course Outcomes:

After completing the course the student shall be able to:

1. Develop knowledge about the isolation, separation and characterization of various biological samples
2. Apply knowledge about the interaction of electromagnetic radiations
3. Understand the analytical techniques to determine elements of biological samples
4. Apply knowledge on biomedical importance of radio isotopes

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG2050	2		2	2		3		2	2	3	2		2	2
	3	3	-	2		2		1	1	1				3
	2		2	2	1	1	1		2	2	2	2		2
	3		3	2		2	2		3	1	1		1	3

Course Content

UNIT I **12 hrs**

Overview of Biochemical Investigations: Outline of strategies in biochemical investigations, employing whole animal studies, isolated organs, tissues, and cell cultures. Specific investigations with isolated organelles; mitochondria and ER. Types of animal cells and their characteristics in culture, culture media and common animal cell lines for laboratory investigation. Plant cell culture, media for plant cell culture, and potential of plant cell culture in biochemical investigations.

Microscopic Techniques:

Review of light microscope, resolution of microscopes, phase contrast, and dark field microscopy, preparation of specimen for biochemical investigations. Electron microscopy; Working principle and applications, specimens for electron microscopy.

UNIT II **12 hrs**

Centrifugation- Principle of centrifugation, types of centrifuges and rotors. Density gradient centrifugation- Cesium chloride and sucrose density gradients and applications. Principle, procedure and applications of differential centrifugation and ultracentrifugation. Sub-cellular fractionation.

Ultra-filtration: Principle, instrumentation and application. Dialysis, principle and uses of equilibrium dialysis. Precipitation: methods and applications

Electrophoresis: Principle of electrophoresis, Paper and gel electrophoresis (AgaroseandSDS PAGE).

UNIT III **12 hrs**

Chromatography: General Principles of chromatography,Classification, principle, operation procedure and applications of paper chromatography, thin layer chromatography, ion exchange chromatography, molecular sieve chromatography, affinity chromatography. Column chromatography – Principle, procedure and applications of Gel filtration, HPLC and GLC

UNIT IV **12 hrs**

Radio isotopic techniques

Atomic structure, radiation, type of radioactive decay, half-life, units of radio activity, detection and measurement of radio activity – methods based on ionization (GM- counter) application of isotope dilution technique. Biological hazards of radiation and safety measures in handling radio isotopes.

Spectroscopic methods-

Principle, instrumentation and applications of UV- Visible, IR, AAS, Flame emission, HRMS and GC-MS, ESR and NMR spectroscopy

Reference Books:

1. Biophysical Chemistry, Principles & Techniques –Himalaya Publ. House.
2. Principles & Techniques of Practical Biochemistry – Wilson, Walker Cambridge Univ. Press.
3. G. Abbott - Chromatography.
4. Friefelder D. WH Freeman and Company. Physical Biochemistry- Application to Biochemistry and Molecular Biology.

B19BG2060	Environmental Studies	L	T	P	C
Duration:14 Wks		2	0	0	2

Prerequisites:

Basic knowledge of Environmental Science studied at higher secondary & school level.

Course Objectives:

1. Discuss Foster clear awareness and concern about economic, social, political and ecological interdependence in urban and rural area
2. Influence the new patterns of behaviors of individuals, groups and society as a whole towards the environment
3. List the knowledge values, attitudes, commitment and skills needed to protect and improve the environment
4. Elaborate the evaluation of the environmental measures and education programs.

Course Outcomes:

On successful completion of this course, the student will be able to:

1. Adapt the environmental conditions and protect it
2. Estimate the role of individual, government and NGO in environmental protection.
3. Interpret the new renewable energy resources with high efficiency through active research.
4. Analyze the ecological imbalances and protect it.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG2060	CO1	1	2	1	1	1	2	3	1	1	1
	CO2	1	3	1	1	1	3	3	1	1	1
	CO3	2	3	2	1	3	3	3	1	1	1
	CO4	1	2	1	1	1	2	3	1	1	1

Course Contents:

Unit-I **6 Hrs**

Multidisciplinary Nature Of Environmental Studies: Introduction to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

Environmental protection – Role of Government-Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Initiative and Role of Non-government organizations in India and world.

Self study: Need for public awareness on the environment, Gaia Hypothesis.

Unit-II **6 Hrs**

Environmental pollution, degradation & Waste management:

Environmental Pollution – Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures.

Self study: Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes.

Environmental degradation – Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Solid Waste management – Municipal solid waste, Biomedical waste, Industrial solid waste and Electronic waste (E-Waste).

Self study: Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

Unit-III **6 Hrs**

Energy & Natural resources:

Energy – Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based(Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind,hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy.

Self study: Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.

Natural resources –water resource (Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance), Mineral resources (Types of minerals, Methods of mining & impacts of mining activities), Forest wealth (Importance's, Deforestation-Causes, effects and controlling measures)

Self study: Hydrology & modern methods adopted for mining activities.

Unit-IV **6 Hrs**

Ecology and ecosystem:

Ecology-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem-Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity. Biogeochemical cycles and its environmental significance – Carbon, nitrogen and phosphorus cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

Self study: Need for balanced ecosystem and restoration of degraded ecosystems.

Reference Books

1. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2017),
2. Wiley India Private Ltd., New Delhi, Co-authored &Customised by Dr. M. S. Reddy & Chandrashekar, REVA University.
3. "Environmental Studies", by R.J. Ranjit Daniels and JagadishKrishnaswamy, (2009), Wiley India Private Ltd., New Delhi.
4. "Environmental Studies" by Benny Joseph, Tata McGraw – Hill Publishing Company Limited.
5. Environmental Studies by Dr. S. M. Prakash, Elite Publishers Mangalore, 2007
6. Rajagopalan R. 2005, "Environmental Studies – from Crisis to cure", Oxford University Press.
7. Environmental Science by Arvind walia, Kalyani Publications, 2009.
8. Environmental Studies by AnilkumarDey and Arnab kumarDey.

Course Code	Sports/Yoga/Music/Dance/ Theatre	Course Type	L	T	P	C	CH
B19BG2070		RULO	2	0	0	2	2

Note: Music, Dance, and Theater courses are offered by the School of Performing Arts, whereas the Sports and Yoga courses are offered by the Department of Physical Education. The students have to choose any **ONE** of these courses.

A. YOGA FOR HEALTH

Course Objectives:

Following are the Course Objectives.

- To prepare the students for the integration of their physical, mental and spiritual faculties;
- To enable the students to maintain good health;
- To practice mental hygiene and to attain higher level of consciousness;
- To possess emotional stability, self control and concentration; and
- To inculcate among students self discipline, moral and ethical values.

Course Outcomes:

On completion of the course learners will be able to:

- Practice yoga for strength, flexibility, and relaxation.

- Learn techniques for increasing concentration and decreasing anxiety
- Become self disciplined and self-controlled
- Improve physical fitness and perform better in studies
- Gain self confidence to face the challenges in the society with commitment to serve the society

Course Content:

Unit-I:

Yoga: Introduction ,**Surya Namaskara:-** 12 counts

Unit-II:

Asanas: Sitting-Vajrasana, Dandasana, Padmasana, Matsyasana, Paschimottasana, Shirasasana.

Asanas: Standing-Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana.

Unit-III:

Asanas:Prone Position-Bhujangasana, Dhanurasana.

Asanas: Supine Position-Sarvangasana, Halasana.

Mudras- Dhyana mudra, , Namaste mudra, Nasika mudra

Unit-IV:

Pranayams:- Anuloma – Viloma, Basthrika, Bhramari.

Dhyana & its types: Competition format, Rules and their interpretations

B. VOLLEYBALL

Course Objectives:

To learn the rules, fundamental skills, and strategies of volleyball

1. To develop skills in passing, setting, serving, spiking, and blocking.
2. To learn basic offensive and defensive patterns of play.
3. To develop a positive attitude towards volleyball as a lifetime sport and to improve physical fitness through participation in volleyball.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with volleyball.
2. Apply these skills while playing volleyball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Content:

Unit-I

- Introduction about Volleyball
- Players Stance, Receiving and passing
- The Volley (Overhead pass), The Dig (Underhand pass), Service Reception

Unit-II

- Service- Under Arm Service, Tennis Service, Side Arm Spin Service, Round Arm Service, High spin service, Asian serve / American serve (floating)
- Setting the ball- Set for attack, Back set, Jump set

Unit-III

- Smash/Spike- Straight smash, Body turn smash, Wrist outward smash, Wrist inward smash
- Block- Single block, Double block, Three-man block
- Rolls- Overhead pass & back rolling, One hand underhand pass with side rolling, Forward dive

Unit-IV

- Attack Combination, Defense Systems, Libero play
- Court marking, Rules and their interpretations and Duties of officials

C. **BASKETBALL**

Course Objectives:

1. To learn the rules, fundamental skills, and strategies of Basketball
2. To develop technical skills in passing, in ball handling, individual offense, individual defense, rebounding, screen, team offense, team defense and fast break.
3. To learn basic offensive and defensive strategies of play.
4. To develop a positive attitude towards Basketball as a lifetime sport and to improve physical fitness through participation in Basketball.
5. To develop positive understanding and appreciation of the basketball game.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with basketball.
2. Apply these skills while playing basketball and exhibit improved performance
3. Improve physical fitness and practice positive personal and lifestyle.
4. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Content:

Unit-I

- Basketball: Introduction
- Grip; Player stance- Triple threat stance and Ball handling exercises

- Passing (Two hand/one hand)- Chest pass, Bounce Pass, Over head pass, Underhand pass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running.
- Receiving-Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving while jumping, Receiving while running.

Unit-II

- Dribbling- How to start dribble, How to stop dribble, High / Low dribble with variations
- Shooting- Layup shot and its variations, One hand set shot, One hand jump shot, Free throw, Hook shot, Tip-in shot.
- Stopping- Stride/Scoot, Pivoting and Faking /Feinting footwork.

Unit-III

- Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.
- Individual Defensive- Guarding the man with the ball and without the ball.
- Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

Unit-IV

- Court marking, Rules and their interpretations

D. **FOOTBALL**

Course Objectives:

1. To learn the rules, fundamental skills, and strategies of football.
2. To develop skills in passing, receiving, controlling the ball, dribbling, shielding, shooting, tackling, beating a defender and heading in football.
3. To learn basic offensive and defensive patterns of play
4. To use different parts of the body in utilizing the above skills while playing football
5. To develop a positive attitude towards football as a lifetime sport and to improve physical fitness through participation in football.

Course Outcomes:

On completion of the course learners will be able to:

1. Learn basic skills and knowledge associated with football.
2. Apply these skills while playing football and exhibit improved performance
3. Use the knowledge and understanding to perform, refine and adapt the above skills and related skills with precision, accuracy, fluency and clarity in any situation.
4. Improve physical fitness and practice positive personal and lifestyle.
5. Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Content:

Unit-I

1. **Football: Introduction**
   - Kicks- Inside kick, Instep kick, Outer instep kick, Lofted kick, Chipping, Volley, Half Volley
   - Trapping- Trapping rolling the ball, Trapping bouncing ball with sole

Unit-II

- Dribbling- With instep and outer instep of the foot.
- Heading- From standing, running and jumping.
- Feinting- With the lower limb and upper part of the body.

Unit-III

- Tackling- Simple tackling, Slide tackling.
- Throw-in- Standing and Sliding
- Goal Keeping- Collection of balls, Ball clearance, throwing and deflecting.

Unit-IV

- Ground marking, Rules and their interpretations

E. ATHLETICS (TRACK AND FIELD)

Course Objectives:

1. To teach students the skilled techniques in sprints, relay running, hurdles, long jump, high jump, and shot put and practice them.
2. To develop competence among students in demonstrating all the techniques covered in the course.
3. To make students understand some of the scientific and empirical principles and their rationale underlying the development of skilled performance.
4. To inculcate among students the habit of team work and cooperative learning and develop competence in detecting / correcting technique errors.
5. To develop a positive attitude towards sports in general and athletics in particular and to improve physical fitness through participation in various athletic games / sports activities.

Course Outcomes:

On completion of the course learners will be able to:

1. Display competencies in executing basic techniques and skills associated with select track and field events.
2. Develop basic skills and techniques to improve one's running posture and take-off position for different jumps.
3. Learn regular practice of select track and field events and improve physical fitness
4. Appreciate track and field events by applying sports science knowledge to explain the execution of the events.

Course Content:

Unit-I

- Athletics: Introduction
- Track Events - Steeple Chase, Race Walking, Middle and Long distance races
- Race walking - Technique, Faults and Officiating.
- Middle and Long distance races – Technique and Training

Unit-II

- Jumping Events - High Jump and Triple Jump: Basic Skills and techniques
- High Jump - Straddle Roll & Flop Technique, Approach, Take-off, Technique in the air, Clearance over the bar & Landing
- Triple Jump – Hop, Step and Jump Technique, Approach, Take-off & Landing

Unit-III

- Throwing Events - Discus Throw and Hammer Throw: Basic Skills and techniques
- Discus Throw -Standing and Rotatory techniques,Grip, Stance, Rotation Technique, Power stance, Release and Reverse (Follow through)
- Hammer Throw - Grip, Swings, Rotation foot work, Release and Follow through

Unit-IV

- Rules, Officiating and Marking - Ground / Sector Marking, Interpretation of Rules.

Reference Books

1. Arthur E. Ellison (ed) (1994). Athletic Training and Sports Medicine.
2. Ballisteros, J.M. (1998). Hurdles Basic Coaching Manual, IAAF.
3. Bosen K.O. (1993). Teaching Athletics Skills and Technique.
4. Bosen K.O. (1990). Study Material on Hurdles for the Regular Course Students.
5. Doherty K. (1995). Track and Field Omni book.
6. Martin, David E. Peter N. Coe (1991). Training Distance Runner.
7. Howard S. (1981). Science of Track and Field Athletics.
8. Briggs Graeme (1987). "Track and field coaching Manual", Australian Track and Field Coaches Association. Rothmans Foundation National Sports Division.
9. Carr, Gerry (1999). "Fundamentals of Track and Field. Track Athletics Title G.V. 1060 5.e.368.
10. I.A.A.F. Level-II (2001). Text Book on Jumping Event.
11. Jarver, Jesse (1987). "The Jumps", Track and Field Coaching Manual Australia.

F. DRAMATICS

Pre-requisites: Students with background in Theatre Arts/ Keen interest in Dramatics.

Course Objectives:

1. To imbibe the acting skills.
2. To understand the broader applications of theatre studies in allied arts forms.
3. To be able to use body language for better communication.
4. Students shall also be able to understand voice modulation and Navarasas.

Course Outcomes:

On successful completion of this course, students should be able to:

1. Freely express improvisation in non-verbal communication.
2. Shall hone good acting skills and be able to emote better.
3. Be able to put up a theatre act and play a key role.
4. Be able to differentiate good acting and understand the importance of good lyrics, stage crafting, music, dance, costume and lighting.

Course Content:

UNIT – 1

Working on Body:

Body and its analysis. Understanding physical abilities (Anga, Pratyanga and Upanga). Challenges of the body. Using body as metaphor and language. The class's bodies as a collective, an ensemble, a collaborative team.

UNIT – 2

Sound and Movement:

Awareness of creating sound patterns, voice modulations, rhythm in speech and diaologues. Understanding the rhythm and patterns of movements like walking, framing, shaping, primitive and animal movements.

UNIT – 3

Characterization and Improvisation:

Observation of people around. Getting into the role and living it. Developing a character from establishment (pace and rhythm). Improvisation techniques of body and mind.

UNIT – 4

Group work and Production:

Develop a theme, concept or a play and include all the theatre skills, stage craft, costuming and put up an act. Choosing theme and characters.

Reference Books:

1. All about Theatre – Off stage – Chris Hogget.
2. Rangadalli Anataranga – K V Subbanna
3. The Indian Theatre – Hemendranath Das Gupta.
4. A Practical handbook for an Actor – Milisa Bruder, ee Milchel Cohn, Madeleine Oliek et al, Zigler Publisher.

G. **INDIAN CLASSICAL DANCE FORMS (**Bharatanatyam, Kuchipudi ,Mohiniyattam)

Prerequisites: Background of classical dance training or any other dance forms.

Note: Non-classical dancers can also join.

Course Objectives:

- To develop an understanding about the Indian classical dance forms and its universal application.
- To be able to understand the fine nuances of Classical dance.
- To understand the importance of health through Indian classical dance, strengthen the body capacity.
- To understand mythology and its characters in Indian classical dance form through lessons of Abhinaya.

Course Outcomes:

- To be able to identify and appreciate the classical dance forms.
- To be able to execute basics of Adavus with finesse.
- To be able to express through abhinaya.
- To be able to perform to perform the fundamentals in the chosen dance form.

Course Content:

UNIT 1

An introduction to Indian classical dance forms

Bharatanatyam, Kuchipudi, Mohiniyattam

UNIT 2

Learning of Fundamentals

Exercises and Adavus- I (Bharathanatyam , Kuchipudi, Mohiniyattam)

UNIT 3

Adavus –II (Bharathanatyam , Kuchipudi, Mohiniyattam)

UNIT 4

Learn a basic composition in the chosen dance form.

Reference Books

1. *Indian classical dance forms –U S Krishna Rao,U K Chandrabhaga Devi*
2. *Classical Dances –Sonal Mansingh, Avinash Parischa*
3. *Kuchipudi – Sunil Kothari*
4. *Bharatanatyam An in depth study- Saroja vydyanathan*
5. *Mohiniyattam – Bharathi Shivaji*

H. PERCUSSION INSTRUMENT (TABLA AND MRIDANGAM)

Pre-requisites: Students with background in Percussion instruments and knowledge of Rhythm/ Keen interest in studying Mridagam / Tabala.

Course Objectives:

1. To understand the Rhythmology.
2. To understand the importance of Laya, Taala.
3. To be able to understand the fine finger techniques of playing the instrument.

Course Outcomes:

On successful completion of this course, students should be able to:

1. To be able to set instrument to Sruthi.
2. To be able to play the fundamentals on instrument.
3. To be able to learn and perform a particular taala.

Course Content:

UNIT- 1

1. Introduction to Musical Instruments
2. Percussion Instruments
3. Mridangam and its History

UNIT -2

1. Introduction to Tala System
2. Definitions of 5 jaathis and their recitation
3. Adi Talam and its various forms
4. Definitions and recitation of different gathis

UNIT- 3

1. Tisra Jaathi, 2. Khanda Jaathi, 3. Misra jaathi, 4. Sankeerna Jaathi

UNIT - 4

1. Learning of Jathi Formation, 2. Basic jathis, 3. Jathis for Dance forms

4. Some Basic Definitions of Korvai, Teermanam etc.,

Reference Books:

1. Mridangam- An Indian Classical Percussion Drum – Shreejayanthi Gopal
2. Theory and practice of Tabala – Sadanand Naimpally.
3. Theory and practice of Mridangam – Dharmala Rama Murthy
4. The Art of the Indian Tabala – Srdjan Beronja.

Course Code	General Microbiology Lab	Course Type	L	T	P	C	CH
B19BG2080		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

The student should have basic knowledge of microscopy & biology.

Course Objectives:

The objective of this Course is to:

1. To understand the working conditions in microbiology lab.
2. To explore the microbial cultural techniques.
3. To handle the microbial samples and their maintenance.
4. To exploit the microbiology for the benefit of mankind.

Course Outcomes:

After the end of the Course students will be able to:

1. Handle the microscopes and observe the live and fixed specimens.
2. Understand the stages of meiosis and mitosis.
3. Culture and maintain the Drosophila in laboratory.
4. Familiarize the structure of polytene chromosomes.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG2080	CO1	2	3	3					2		3	2	2	2
	CO2	2	3	3	3				2		3	2	2	2
	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	3

Course Content:

1. Microbiological media preparation-NA, NB & MRBA
2. Sterilisation of medium and aseptic techniques
3. Isolation of MOs from air and soil and identification.
4. Pure culture methods-pour, spread & streak plate methods
5. Staining methods-Simple, Gram, endospore and negative staining
6. Biochemical test-oxidase, starch hydrolysis, catalase
7. Antimicrobial Susceptibility Test.
8. Cell count by haemocytometer

Reference Books:

1. Samuel Singer, Experiments in Applied Microbiology. Academic Press, 2001.
2. Collins, C.H., Tatrica M. Lyne and Grange, J.M, Microbiological methods, 8th edition, Hodder Arnold publishers, 2004.
3. Alexander N. Glazer, Hiroshi Nikaido, Microbial Biotechnology, 2nd Edition, Freeman Publishers. 2007.
4. Keith Wilson and John walker, Principles and techniques of Biochemistry and Molecular biology, 7th edition. 2009

CourseCode	Cytogenetics Lab	Course Type	L	T	P	C	CH
B19BG2090		HC	0	0	2	2	3

Course Objectives:

1. To enable students to handle the microscopes.
2. To familiarize the cell division processes.
3. To learn the culturing of *Drosophila*
4. To study the structure of chromosomes.

Course Outcomes:

After the end of the Course students will be able to:

1. Handle the microscopes and observe the live and fixed specimens.
2. Understand the stages of meiosis and mitosis.
3. Culture and maintain the *Drosophila* in laboratory.
4. Familiarize the structure of polytene chromomsomes.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG2090	CO1	3		3	3						3	3	2	3
	CO2	3	3								3	3	2	
	CO3	3				3					3	3		
	CO4	3	3			3					3	3	2	

Course Contents

1. Microscopy: Handling of Dissection& Simple Microscope.
2. Stereozoom and Compound Microscopes.
3. Temporary squash preparation of onion root tips for mitosis.
4.. Temporary squash preparation of onion flower buds for meiosis.
5. Culturing and Handling of *Drosophila*:
    a) Media Preparation
    b) Cleaning and Sterilization of bottles
    c) Handling of *Drosophila*
6. Morphology and Sexual dimorphism
7.Salivary gland Chromosome-
   Dissection of Salivary glands and Preparation of Polytene chromosome.
8. Problems on:
    a. Sex linkage

b. Genetic map

Reference Books:

1. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha , Vikas Publishing House Private, Limited, 1998.
2. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.
3. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.
4. Genetic Maps, 6th edition by O'Brien, S (1993) Book 3: Lower Eukaryotes. Book 4: Nonhuman Vertebrates. Book 5: The Human maps. Book 6: Plants. Cold Spring Harbor Lab press New York.
5. Genetics, 2nd Edition, by Weaver, R.F. and Hendrick, P.W. (1992). W.C. Brown.
6. Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.
7. Principles of Genetics by E.J.Gardener, M.J.Simmons and D.P.Snustad.J.Wiley and Sons pubs (1998).

Course Code	Laboratory Course II (Biochemistry)	Course Type	L	T	P	C	CH
B19BG2X10		HC	0	0	2	2	3

Prerequisites:

Requires theoretical knowledge of chemicals and biotechniques.

Course Objective:

1. Apply basic techniques in the organic laboratory for preparation, purification and Identification of organic compounds.
2. To develop the skills among students to understand the theory and practice of bio analytical techniques
3. To provide among students the scientific understanding of analytical techniques and detail interpretation of results.

Course Outcomes:

1. Apply basic techniques in the organic laboratory for preparation, purification and Identification of organic compounds.
2. To develop the skills among students to understand the theory and practice of bio analytical techniques
3. To provide among students the scientific understanding of analytical techniques and detail interpretation of results.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG2X10	CO1	2	1	1	2			1	1		3	2	1	
	CO2	1	2	2	1			1			2	1	1	
	CO3	1	2	2	1			1			2	1	1	
	CO4	1	1	2	2			2	1		2	2	2	

Course Contents:

1. Partition Coefficient of benzoic acid between toluene and water.
2. Kinetics of iodination of acetone by colorimetric method
3. Effect of surfactants on surface tension of water.
4. Systematic Qualitative Analysis of organic compound: Amides, Carboxylic acids, alcohol, aldehydes, ketones, Esters
5. Determination of BOD & COD.
6. Estimation of amino acids by formal titration.
7. Separation and identification of amino acids by paper chromatography.
8. Separation and identification of Sugars/lipids by TLC.
9. Estimation of ascorbic acid from biological samples by titrimetric method.

Reference Books:

1. An Introduction to practical Biochemistry—PlummerD.T,Tata Mc GrawHill
2. Biochemical Calculations, Irwin H.Segel (1976) 2 nd Ed. Jhon Wiley and Sons.
3. Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.
4. Analytical Biochemistry; D.J.Holme and H. Pick Longman (1983).
5. Experimental Biochemistry: A Student Publisher**:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
6. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
7. Introductory practical Biochemistry, Sawhney, Randhir singh, 11th Edition (2015)
8. Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.

THIRD SEMESTER

B19BG3011	Language: Kannada-III	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

Pedagogy:

- Direct method
- ICT and Digital support (Links attached)
- Collaborative and Cooperative learning

- Differentiated Instruction
- Flipped Classroom

Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ಮೂರನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವೋದಯ, ನವ್ಯ ಕಾವ್ಯ, ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Course Outcomes:

ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವೋದಯ, ನವ್ಯ ಕಾವ್ಯ, ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟ ಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

1. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
2. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
3. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ
4. ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2
B19BG3011	CO1	0	0	0	0	2	3	0	0	0	0
	CO2	0	0	0	0	2	3	0	0	0	0
	CO3	0	0	0	0	0	3	0	0	0	0
	CO4	0	0	0	0	0	0	3	2	0	0

Course Contents:

Unit I ನವೋದಯ ಕವಿತೆಗಳು **10 Hours**

1. ಬೆಳಗು — ದ.ರಾ. ಬೇಂದ್ರೆ
2. ಕಲ್ಕಿ — ಕುವೆಂಪು
3. ಕನ್ನಡ್ ಪದಗೊಳ್ — ಜಿ. ಪಿ. ರಾಜರತ್ನಂ

Unit II ನವೋದಯ ಹಾಗು ನವ್ಯ ಕವಿತೆಗಳು **10 Hours**

1. ಅವಧೂತ — ಸು.ರಂ.ಎಕ್ಕುಂಡಿ
2. ಮನೆಯಿಂದ ಮನೆಗೆ — ಕೆ.ಎಸ್.ನ
3. ನನ್ನ ಹಣತೆ — ಜಿ.ಎಸ್.ಎಸ್.

Unit III ಸಣ್ಣ ಕಥೆಗಳು — **10 Hours**

1. ದಾಳಿ ನಡೆದಾವ ಅಣ್ಣಾ — ಅಮರೇಶ ನುಗಡೋಣಿ
2. ಕೊನೆಯ ಗಿರಾಕಿ — ನಿರಂಜನ
3. ಮಾನೀಟರ್ — ತೇಜಸ್ವಿ

Unit IV ನಾಟಕ — **09 Hours,**

1. ಮೀಡಿಯಾ — ಅನುವಾದ.: ಕೆ. ಮರುಳ ಸಿದ್ಧಪ್ಪ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
3. ಡಾ. ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಸಾಹಿತ್ಯ ಸಂಸ್ಕೃತಿ ಮತ್ತು ದಲಿತ ಪ್ರಜ್ಞೆ, ಪ್ರಕಾಶಕರು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2014
4. ಡಾ. ಈ.ಎಸ್. ಆಮೂರ, ಕನ್ನಡ ಕಥನ ಸಾಹಿತ್ಯ : ಕಾದಂಬರಿ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
5. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
6. ಸಂ. ಬಿ.ಎಸ್. ಕೇಶವರಾವ್. ಕೈಲಾಸಂ ಕನ್ನಡ ನಾಟಕಗಳು, ಪ್ರಕಾಶಕರು ಅಂಕಿತ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು. 2005
7. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು – 2014
8. ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ ಭಾಗ–2, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2004
9. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013

B19BG3012	Language – II: Hindi	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

पूर्वापेक्षा:

- अध्येता को, हिन्दी नाटक साहित्य का संक्षिप्त ज्ञान आवश्यक है |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- मीडिया लेखन की बुनियादी जानकारी चाहिए
- अंग्रेज़ी – हिन्दी अनुवाद से संबंधित जानकारी जरुरी है|

Pedagogy:

ICT and Digital support, Collaborative and Cooperative learning, Flipped Classroom

LTP: L:2 T:1 P:0

Course type:Theory
Contact Hours:39

Course Objectives:

पाठ्यक्रम उद्देश्य :

- संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
- साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
- छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
- अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

Course Outcomes:

अधिगम परिणाम :

अध्ययन की समाप्ति पर अध्येता –

- सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
- साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
B19BG3012	CO1	0	0	0	0	2	3	2	0	0	0
	CO2	0	0	0	0	2	2	3	0	0	0
	CO3	0	0	0	0	3	3	3	0	0	0
	CO4	0	0	0	0	3	2	3	0	0	0

Course Contents:

इकाई –1 :नाटक : एक और द्रोणाचार्य – डॉ. शंकर शेष **(10hrs)**
लेखक परिचय
प्रथम दृश्य
द्वितीय दृश्य

इकाई –2 :नाटक : एक और द्रोणाचार्य **(10hrs)**
तृतीय दृश्य
चतुर्थ दृश्य

इका ई –3 :नाटक : एक और द्रोणाचार्य **(10hrs)**
पंचम दृश्य
छठा दृश्य

इकाई –4: **(09hrs)**

अनुवाद : अंग्रेजी - हिन्दी - समाचार पत्र संबंध

हिन्दी - अंग्रेजी - समाचार पत्र संबंध

रिपोर्टिंग

सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

d) Suggested Text Books and References

Text book/s: पाठ्य पुस्तक :

1. एक और द्रोणाचार्य – डॉ. शंकर शेष

References: सन्दर्भ ग्रन्थ :

1. मीडिया लेखन एवं जनसंचार – डॉ संजीव कुमार.
2. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
3. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
4. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
5. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
6. कार्यालय अनुवाद निदेशिका
7. मीडिया विमर्श – रामशरण जोशी

B19BG3013	Language-II: Additional English	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must possess fair knowledge of language, literature and society.

Pedagogy:

Direct method / ICT / Collaborative Learning / Flipped Classroom.

Course Objectives:

- To outline the global and local concerns of gender and identity.
- To identify the complexities of human emotions through literature.
- To assess the struggles of human survival throughout history.
- To compare and contrast between the various dimensions of childhood.

Course Outcomes:

On completion of the course, learners will be able to:

- Evaluate the pressing gender issues within our society.
- Criticize human actions through a humane and tolerant approach.
- Perceive the human conflicts with an empathetic perspective.
- To disprove the assumption of a privileged childhood.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG3013	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	2	0	0
	CO4	0	0	0	0	3	3	3	2	0	0

Course Contents:

Unit-I: Gender & Identity **[9 hours]**
Anne Sexton – Consorting with Angels
Eugene Field – The Doll's Wooing
Vijay Dan Detha – Double Life
Charlotte Perkins Gilman – The Yellow Wallpaper 12 Hours

Unit-II: Love & Romance **[10 hours]**
Alfred Noyes – The Highway Man
William Shakespeare – Sonnet 116
Frank Richard Stockton – The Lady or the Tiger?
Oscar Wilde – The Nightingale and the Rose

Unit-III: War & Trauma **[10 hours]**
Lord Alfred Tennyson – The Charge of the Light Brigade
TaufiqRafat – The Medal
Guy de Maupassant – Two Friends
Sadaat Hasan Manto – Toba Tek Singh

Unit-IV: Children's Literature **[10 hours]**
William Blake – The Chimney Sweeper
D.H. Lawrence – Discord in Childhood
Anna Sewell – The Black Beauty (Extract)
Rudyard Kipling – The Jungle Book (Extract)

Reference Books:

- Sexton, Anne. *The Complete Poems*. Houghton Mifflin, 1999.
- Namjoshi, Suniti. *Feminist Fables*. Spinifex Press, 1998.
- Vanita, Ruth & SaleemKidwai (ed.) *Same Sex Love in India*. Penguin India, 2008.
- Gilman, Charlotte Perkins. *The Yellow Wallpaper*. Rockland Press, 2017.
- Gale, Cengage Learning. *A Study Guide for Alfred Noyes's "The Highwayman"*. Gale, Study Guides, 2017. (Kindle Edition Available)
- Shakespeare, William. *Poems and Sonnets of William Shakespeare*. Cosimo Classics, 2007.
- Stockton, Frank Richard. *The Lady, or the Tiger?* Create space Independent Publications, 2017.
- Wilde, Oscar. *The Collected Works of Oscar Wilde*. Wordsworth Editions Ltd., 1997.
- Tennyson, Lord Alfred. *The Complete Works of Alfred Tennyson*. Forgotten Books, 2017.
- Blake, William Erdman, David V. (ed.). *The Complete Poetry and Prose* (Newly revised ed.). Anchor Books, (1988).
- Maupassant, Guy de. *Guy de Maupassant-The Complete Short Stories*. Projapati, 2015.

- Manto, Sadaat Hasan. *Manto: Selected Short Stories*. RHI, 2012.
- Ricks, Christopher. *Metaphysical Poetry*. Penguin, 2006.
- Sewell, Anna. *The Black Beauty*. Maple Press, 2014.
- Kipling, Rudyard. *The Jungle Book*. Amazing Reads, 2018.

B19BG3020	Communicative English-I	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must have knowledge of intermediate English Grammar and LSRW skills

Course Objectives:

- To enhance functional communication skills.
- To develop functional use of language in professional contexts.
- To utilize oral presentations in multiple contexts.
- To apply effective written skills in formal communication.

Course Outcomes:

After the completion of the course, students will be able to:

- Identify pressing issues relating to society, environment and media.
- Develop a process-oriented approach to writing.
- Apply the grammatical skills developed during the course aptly.
- Demonstrate a good command over language usage and refined interpersonal skills.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B19BG3020	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	3	0	0
	CO3	0	0	0	0	3	3	3	3	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Functional English [9 Hours]
Remedial Grammar: Past Simple; Past Continuous; Irregular Verbs
Writing Skills: Paragraph Writing
Activities: Conversations; Leaving Phone Messages
Literature: Chief Seattle – The End of Leaving and Beginning of Survival

Unit-II: Interpersonal Skills [10 Hours]
Remedial Grammar: Present Simple & Present Continuous; Activity & State Verbs
Writing Skills: Official Letters
Activities: Making Apologies; Invitations & Making Arrangements
Literature: Ruskin Bond – Tiger in the Tunnel

Unit-III- Multitasking Skills [10 Hours]

Remedial Grammar: Present Perfect; For, Since & How Long; -ed & -ing adjectives; Prefix & Opposites of Adjectives
Writing Skills: Note Making
Activities: Agreeing & Disagreeing with Opinions
Literature: Jesse Owens - My Greatest Olympic Prize

Unit-IV: Communication Skills **[10 Hours]**
Remedial Grammar: Collocations; Prepositions
Writing Skills: Precise Writing
Activities: Offers, Suggestions & Requests
Literature: Avijit Pathak – Onscreen Magic

Reference Books:

8. Green, David. *Contemporary English Grammar Structures and Composition*. New Delhi: MacMillan Publishers, 2010.
9. Thorpe, Edgar and Showick Thorpe. *Basic Vocabulary*. Pearson Education India, 2012.
10. Leech, Geoffrey and Jan Svartvik. *A Communicative Grammar of English*. Longman, 2003.
11. Murphy, Raymond. *Murphy's English Grammar with CD*. Cambridge University Press, 2004.
12. Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw-Hill, 2005.
13. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
1. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.

Course Code	Enviromental Biotechnology	Course Type	L	T	P	C	CH
B19BG3030		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

The student should have knowledge of environment science and chemistry

Course Objectives:

The Objective of this Course is to:

1. To acquire the knowledge about environmental pollution sources, effect and control measures of environmental pollution, degradation and waste management.
2. To understand the importance about various types of energy i.e. conventional and non-conventional as well as natural resources.
3. To learn about the various strategies for the remediation of versatile forms pollutants and prevalent in environment.
4. Explore the ways for the management of different kinds of solid wastes.

Course Outcomes:

After completion of the course students will be able to:

1. Analyse the environmental issues and conditions and protect it.
2. List the causes of environmental pollution & find ways to overcome them.

3. Search of new renewable energy resources which can be efficiently replace the need to non-renewable energy consumption
4. Design of better remediation and waste management strategies.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO 6	PO 7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS03
B19BG3030	CO	2	3	3	3	2			2		3	2	3	2
	CO	2	3	3	3	2			3		3	2	2	3
	CO	2	3	3		2			3		3	2	3	3
	CO	2	3	3	3	2			4		3	2	3	3

Course Contents:

Unit-I

Energy Sources and Environmental hazards **12 Hrs**

Various forms of Energy sources, Pollution and its hazardous impact on environment, Role of biotechnology to solve the environmental problems.

Biotechnological methods of pollution detection: general bioassay, cell biological methods, immunoassays, DNA-based methods, use of biosensors.

Biotechnological methods in pollution abatement: Reduction of CO_2 emission. Waste water treatment – conventional wastewater treatment, use of algae, Bioreactors for waste-water treatment, eutrophication, concept of chlorination, application of cell immobilization.

Unit-II

Bioremediation **12 Hrs**

Bioremediation: Concepts and principles, bioremediation using microbes, in situ and ex situ bioremediation, biosorption and bioaccumulation of heavy metals.

Xenobiotics: Degradation by microorganisms with reference to pesticides, herbicides, polyaromatic hydrocarbons. Relevance of GMO to the environment.Current status of biotechnology in environment protection.

UNIT III

Solid waste Management **12 Hrs**

Solid waste management: Treatment of Industrial wastes: Dairy, pulp and paper, dye, leather, wood and pharmaceutical industries. Solid waste management. Genetically engineered microbes for waste treatment, anaerobic and aerobic composting, vermiculture.

Unit-IV

Eco-friendly bio-products **12 Hrs**

Biomass resources, Biogas, alcohol as fuel, biological hydrogen generation, Bio-plastics and Bio-plolymers. Biofertiliser and Biopesticides, Biofuels and Bio-diesel. Azola and Azotobacter, VAM,

Reference Books:

1. Analyse the environmental issues and conditions and protect it.

2. List the causes of environmental pollution & find ways to overcome them.
3. Search of new renewable energy resources which can be efficiently replace the need to non-renewable energy consumption
4. Designing of better remediation and waste management strategies.

Course Code	Molecular Genetics	Course Type	L	T	P	C	CH
B19BG3040		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of DNA structure and chromosomes.
2. They should know the concept of central dogma of molecular biology.

Course Objectives:

The objective of this Course is:

1. To study the discovery and structure of the genetic material.
2. To understand the processes of gene expression and gene regulation.
3. To facilitate students to understand the concept of microbial genetics.
4. To investigate the causes of genetic diseases.

Course Outcomes:

After the end of the Course students will be able to

1. Understand the characteristics of nucleic acids.
2. Illustrate the processes of gene expression and various stages of gene regulation.
3. Understand the inheritance pattern in bacteria.
4. Associate the mutations linked with several disorders.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG3040	CO1	3	3				3		3		3	3	2	
	CO2	3	3	3	3	3	3		3		3	3	3	
	CO3	3	3	3		3	3				3	3	2	
	CO4	3	3	3	3		3		3		3	3	2	

Course Contents:

UNIT I **12 hrs**

a.Chemical Basis of Heredity:
DNA as genetic material- Experiments of Griffith; Avery, Mc Leod and Mc Carty; Hershey and Chase. RNA as genetic material- Experiment of Fraenkel and Singer.

b. Nucleic acids:
Molecular structure of DNA, Chargaff's rule, Forms of DNA- A, B and Z forms.

RNA types and structure – mRNA, tRNA (clover leaf model), rRNA, and other types and their significance
Ribozymes

c. DNA Replication:
Meselson and Stahl Experiment.
DNA Replication in prokaryotes – Initiation, Continuous and discontinuous synthesis, Events at the replication fork, Termination, Enzymology of DNA replication. Rolling circle replication.
DNA Replication in eukaryotes.

UNIT II **12 hrs**

Gene expression:
Transcription: Prokaryotes and eukaryotes initiation, elongation and termination (rho- dependent and rho- independent).
Post transcriptional modifications: methylation, polyadenylation, RNA splicing.
Translation: Prokaryotes and eukaryotes, Genetic code and its properties; process of translation- Initiation, elongation and termination. Post-translational modifications of proteins.
Protein sorting

UNIT III **12 hrs**

a. Gene regulation:
Concept of operon, Inducible operon - Lac operon – structure and mechanism, Catabolite repression. Repressible operon - Tryptophan operon - structure and mechanism.

b. Bacterial Genetics:
Transformation, Transduction-Generalized and specialized;
Conjugation: F factor mediated, *Hfr* and Sexduction.

UNIT IV **12 hrs**

Mutations:
Introduction and Types of Gene mutations - Base substitution (Transition and transversion), Frame shift mutation, insertion, deletion, missense, nonsense, reverse, suppressor and lethal mutations).
Pleiotropy- definition and examples.
Mutagens – Physical (ionizing and non- ionizing radiations) and chemical (Base analogs, Alkylating agents, Acridine dyes, Deaminating agents, Hydroxylating agents, Tobacco carcinogens); Oncogenic Viruses.
DNA repair mechanisms (Mismatch repair, photoreactivation, excision and SOS repair).
Mutation as raw material for evolution.
Beneficial effects of mutation.

References Books:

1. Advanced Genetics by G.S.Miglani. 2002.
2. Advanced Molecular Biology by Twyman R.M (1998) Viva Books Ltd.
3. Cell Biology and Molecular Biology by EDP Robertis and EMF Robertis, Saunder College. 1980.
4. Genes- IX, 9th Ed., Benjamin Lewin. Jones and Bartlett Publishers, 2008.
5. Genetics – Analysis of Genes and genomes – VII edition - Daniel L. Hartl and Elizabeth W. Jones. 2011.
6. Genetics – from genes to genomics – Leland Hartwell, Leroy Hood, Charles (Chip) Aquadro, Michael L. Goldberg, Maria Papaconstantinou, Fischer, Janice, Jim Karagiannis. McGraw-Hill Education, 2017.
7. Genomes by T.A. Brown (2002) Viva Books.
8. Instant Notes in Molecular Biology by P.C.Turner etal (2002) Viva Books.
9. Molecular cell Biology, 2nd edition by Darnell.J, H.Lodish and D.Baltimore (1990), Scientific American Books, New York.
10. Molecular Genetics by D.N.Bharadwaj. Kalyani, 2008

Course Code	Biomolecules	Course Type	L	T	P	C	CH
B19BG3050		**HC**	**2**	**1**	**0**	**3**	**4**

Prerequisites

Requires knowledge of pre-university, chemistry and biology

Course Objectives:

1. To study the structures of carbohydrates.

2. To understand the structures of Amino acids and proteins.

3. To provide among students the scientific understanding of the structures of Lipids.

4. To study the structures of Nucleic acids, their Isolation and sequencing

Course Outcomes:

After completing the course the student shall be able to:

1. Correlate knowledge of carbohydrates to central Biochemical processes.
2. Compare and contrast the structural organization and functions of Amino acids and proteins.
3. Correlate knowledge of Lipids to central Biochemical processes.
4. Compare and contrast the structural organization and functions Nucleic acids.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03

B19BG3050	CO1	3		3	2		2		2	3	2		2	1
	CO2	2		2		2	3		3		3	1	2	
	CO3	3	3		2	2		2	2	3		2		2
	CO4	1		3	3		2		2	2	1	2	2	1

Course Contents

UNIT I **12 hrs**

Carbohydrates: Definition, empirical formulae, classification, biological importance.
Monosaccharides: Configuration and relationship of D-aldoses, D-ketoses. General properties of aldoses and ketoses. Oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation – phenyl hydrazine, addition – HCN. Interconversion of aldoses and ketoses by chemical method. Ascending and descending the series by chemical methods. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, and diastereoisomers.

Elucidation of open chain structure and ring structure of glucose. Conformation of pyranose and furanose rings: glucose and fructose, mutarotation. Structure of galactose, mannose, ribose and fructose. Structure and biological importance of amino sugars, deoxy sugars, sugar acids, neuraminic and muramic acid.

Disaccharides: Establishment of structures of Sucrose and Lactose, Biological Importance and structure of Isomaltose, Trehalose and Maltose.

Polysaccharides: Partial structure, occurrence and importance of Starch, Glycogen, Inulin, Cellulose, Chitin, and Pectin.

Glycosaminoglycans: Occurrence, importance and the structure of the repeatingunits of Heparin, Hyaluronic acid, Teichoic acid and Chondroitin sulphate Bacterial cell wall polysaccharide, peptidoglycans.

UNIT II **12 hrs**

Amino acids and proteins: Structure and classification of α-amino acids based on the polarity of R group; amino acids as **ampholytes**– zwitterions structure of amino acids, Isoelectric pH, titration curve of alanine; reactions of amino acids with ninhydrin ,FDNB, Edman's reagent and decarboxylation of amino acids; peptides: structure and conformation, biological importance of peptides;

Proteins: classification based on composition shape and function with examples; color reactions: ninhydrin, xanthoproteic, Lowry, Sakaguchi's and Biuret reaction;

Overview of structural organization of proteins: Primary structure-importance of restoration of primary structure by taking sickle cell anemia as example, Secondary structure-Types –α-helix, β-pleated structure, triple helix –example and characteristic features of each type; Tertiary structure and Quaternary structure-factors stabilizing both; Denaturation-Denaturating agents and mechanism of operation, renaturation of ribonuclease-Anfinsen's experiment.

UNIT III **12 hrs**

Lipids: Classification and biological role, Fatty acids – Nomenclature of saturated and unsaturated fatty acids. Properties of fatty acids:cis-trans isomerism, reaction with NaOH, alcohol, catalytic hydrogenation, Acid hydrolysis of triglycerides; Rancidity : definition,oxidative and hydrolytic rancidity**.**Acylglycerols**:**Mono, di and triglycerols .Saponification, Saponification value,Iodine value, Acid value and significance.

Phosphoglycerides:Structure and biological importance of phosphatidyl choline, phosphatidyl ethanolamine, Phosphatidyl inositol, Plasmalogens, and Cardiolipin.Sphingolipids:structure of 4- sphingenine, ceramides and sphingomyelin,Structure and importance of Sphingomyelin.
Glycosphingo lipids: Structure and importance of Gangliosides and Cerebrosides.Eicosanoids:Biological role of Prostaglandins, prostacyclins, Thromboxanesandleukotrienes. Structure of PGE_2, PGF_2 Alpha and TXA_2.

Plasma lipoproteins**:** Types – Chylomicrons, VLDL, LDL and HDL and theirsignificance.Biological Membrane**:** Composition of membrane, micelles and liposomes. FluidMosaic Model, functions of the plasma membrane. Endocytosis and phagocytosis. Membrane receptors and their functions.

UNIT IV **12 hrs**

Nucleic acids: Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico- chemical properties of nucleic acids - effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson - Crick Model), Nucleoproteins – histone and non histone. Isolation of nucleic acids and sequencing.

Reference Books:

1. Biochemistry; Voet , D. and Voet, J.G. [Eds.] 5 Ed. Jhon Wiley and sons.
2. Principles of Biochemistry; Lehninger et al., [Eds.] 7thEdn. Worth Publishers.
3. Principles of Biochemistry; Smith et al., [Ed.] 19thEdnMcGarw Hill.
4. Text Book of Biochemistry with Clinical correlations; Thomas Devlin [7th Ed.] , Wiley-Liss.
5. P.K. Stump, Outlines Of Biochemistry, 5th edn. , Wiley Eastern, New Delhi,
6. L. Stryer Biochemistry 8th Ed. W.H. Reeman Co., San Francisco, US

Course Code	Health & Hygiene	Course Type	L	T	P	C	CH
B19BG3061		**OE**	**4**	**0**	**0**	**4**	**4**

Prerequisites/Pre reading for the course:

The student should be familiar with the basic biology.

Course Objectives:

1. To acquire basic understanding about public health and importance in day to day life.
2. To understand the human dietary requirements and the nutritional diseases management.
3. To understand about various microbial diseases and their prevention.
4. To understand various genetic disorders and their implication in human health.

Course Outcomes:

After completing the course students should be able to:

1. Describe about the concept of public health importance and objectives of different healthcare systems.
2. Describe about the dietary requirements, nutritional deficiency diseases symptoms and diagnosis.
3. Apply knowledge about role of nutritionand health for disease prevention and diseases caused by various human pathogens..

4. Explain how genetic mutations cause disease in humans and modern prevention methods by gene therapy.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG3061	CO1	2	3	3	2	2	2	2	3	1	3	2	3	1
	CO2	2	3	3	2	2	1	2	1	1	3	2	2	3
	CO3	2	3	3	2	1	1	2	1	1	3	2	2	2
	CO4	2	3	3	2	1	1	2	1	1	3	2	3	3

Course Content:

UNIT-I **12 Hrs**

Social aspects of health

Health Determinants and Standards; Individual health parameters, Determinants of Health, Health status in India: Standards, Relevance to social aspects, Future challenges in public health. Role of agencies; Role of Public, Private and NGO in Health sector. Community Health Concept; Family health history, Life-style and Social cultural aspects.

UNIT-II **12 Hrs**

Nutritional aspects

Human dietary requirements and deficiency diseases; BMR (Basal Metabolic Rate), Daily nutritional requirements. Deficiency diseases (Malnutrition); Types, Symptoms and Diagnosis of nutritional deficiencies: Iron deficiencies (Anemia), Vitamin A deficiencies (Blindness), Vitamin B1 deficiencies (Beriberi), Vitamin B3 deficiencies (Pellagra)

UNIT-III **12 Hrs**

Microbial diseases and hygienic practices -Introduction to pathology, bacterial disease-typhoid, salmonellosis, TB, cholera, Fungal disease-Mycoses, Protozoan disease-Malaria and trypanomonasis, Viral diseases-HBV, HIV & rabies General diagnosis, prevention and treatment of microbial diseases

UNIT-IV **12 Hrs**

Genetic disease and their management-Gene disorder – sickle cell anemia, haemophila, Cystic fibrosis and chromosomal disorders-down syndrome, turner's syndrome cru di chat syndromes. Introduction to gene therapy

Reference Books:

1. Gordon Edlin and Eric Golanty (2010) Health & Wellness (10th Edn) Jones & Barlett Publisher.
2. Mary-Jane Schneider (2014) Introduction to Public Health (4th Edn,) Jones & Barlett
3. Adams MR and Moss MO (2008) Food Microbiology (3rd Edition) RSC publications, UK.
4. Geofferey Campbell-Platt (Editor) (2009) Food Science and Technology, Willey and Blackwell Publication, UK.
5. Lightfoot NF and Maier EA (Editor) (2003) Microbiological analysis of food and water, Elsevier Publication, Netherland.

6. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2010) Jawetz, Melnick and Adelberg's Medical Microbiology. 25th Edition. McGraw Hill Publication 7. Essential Medical Genetics Includes Desktop Edition, 6th Edition (2011) Edward S. Tobias, Michael Connor, Malcolm Ferguson-Smith, Wiley-Blackwell Publication.

Course Code	Biochemistry in Daily life	Course Type	L	T	P	C	CH
B19BG3062		OE	4	0	0	4	4

Prerequisites

Requires knowledge of micro and macronutrients and diseases.

Course Objectives

- To get the knowledge of microlevel nutrients and, importance of water in day today life
- To advance knowledge about deficiency of malnutrition and obesity
- To impart knowledge about different diseases
- To gain the knowledge of the interpretation and prevention of disease.

Course Outcomes

- Attain knowledge about importance of water, macro and micro nutrients
- Apply scientific knowledge to assess and solve problems of malnutrition deficiency and obesity.
- Analyze the causes, symptoms of various diseased conditions
- Apply critical thinking and interpretation knowledge to address the diagnosis of disease

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG3062	CO1	2	1	1				1	2		3	1	1	
	CO2	1		2	1				1		3	2	1	
	CO3	2	1	1	2			2	1		3	2	1	
	CO4	2	1	1				1	1		3	2	1	

Course Content:

UNIT-I

Nutrition

Water; General consideration, role of water in life Balanced diet. Nutritional importance of Energy giving, Body building and Protective foods (Vitamins and Minerals) Dietary fiber. Malnutrition diseases, Overweight and obesity.

UNIT-II

Diseases 1

Incidence, symptoms, Prevention and dietary management. of various Diseases: Diabetes, diseases of Liver, & Pancreas-Hepatitis: alcoholic liver diseases. Renal disease: Acute and Chronic renal failure. Dialysis, medical and nutrition therapy.

UNIT-III

Diseases 2

Incidence, symptoms, Prevention and dietary management. of various Diseases:
Gastrointestinal diseases, Gastritis, Peptic, stomach and duodenal ulcer, Diarrhea, constipation. Cancer and HIV/AIDS: Types, stages of cancer, and colon cancer. HIV infection and social issues.

UNIT-IV

Interpretation of Diagnostic Reports

Commonly used bio chemical tests for diagnosis of various diseases and their interpretation. Total blood count, Blood glucose and urea; serum lipid–cholesterol, LDL and HDL triglyceride, and serum proteins. Urine creatinine, Glucose and protein (albumin). Enzymes: SGPT, SGOT
Hands on training in BLS

Reference Books:

1. Physical Biochemistry. Kansal Edward Van Halde. Prentice Hall.
2. Practical Clinical Biochemistry, ed. Harold Varley, 4th edn. CBS Publishers (1988).
3. Practical Clinical Biochemistry: Methods and Interpretation, ed. Ranjna Chawla, Jaypee Brothers Medical Publishers (1996).
4. Practical and Clinical Biochemistry for Medical Students, ed. T.N. Pattabhiraman, Gajanna Publishers (1994).
5. Hawk's Physiological Chemistry, ed. Oser, 14th Edn.(1976), Tata-McGrawHill.
6. Kuby Immunology; Oven, Punt, Stranford, 7th Edn. W. H. Freeman (2013).
7. Hepatology- A clinical text book by k Mauss, Berg, Rockstroh, Sarrazin, Wedemeyer H (2017)
8. Hepatology: a Textbook of Liver Disease, 4th edition by Zakim, Boyer 2003.
9. Text book of Diabetes 5th edition by Richard I. G. Holt, Clive Cockram, Allan Flyvbjerg, Barry J. Goldstein John Wiley & Sons 2011.
10. Molecular Biology of the Cell; 6 th Edn. Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter; Garland Science (2014).

Course Code	Enviromental Biotechnology Lab	Course Type	L	T	P	C	CH
B19BG3070		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

The student should be familiar with the basic knowledge of environmental science and chemistry.

Course Objective:

1. To impart knowledge on the role of pollutants & their effect on environment & human health.

2. To learn techniques of controlling the environmental pollution.
3. To facilitate the understanding of the impact of industrial affluents of environments.
4. To understand the role of micro organisms in bio remediation process.

Course Outcomes:

After the completing the course, the student should be able to

1. Analyse the detrimental effect of the different pollutants biomagenefication in the environment.
2. Develop remedies to control pollution.
3. Categorise the pollutants depending on their hazardous effect.
4. Establish and practice vermicomposting.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO 6	PO 7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS03
B19BG3070	CO	2	3	3					2		3	2	3	3
	CO	2	3	3	3				2		3	2	3	3
	CO	2	3	3		2			2		3	2	2	3
	CO	2	3	3					2		3	2	3	3

Course Contents

1. Determination of DO and BOD of water sample
2. Determination of COD of water sample.
3. Determination of total dissolved solids.
4. Microbial analysis of water through MPN method.
5. Estimation of Hardness of water through calcium estimation.
6. Estimation of chromium in industrial effluents.
7. Biodegradation of industrial aromatic compounds.
8. Vermicomposting, Azolla production

Reference Books:

1. Biotechnology. KeshavTrehan, New Age International (P) Ltd, New Delhi, 2001.
2. Agricultural Biotechnology, Purohit
3. Environmental Biotechnology, Foster C.F., John Wae D.A., Ellis Horwood Limited.
4. Introduction to Environmental Biotechnology. A. K. Chatterji. Prentice-Hall of India Pvt.Ltd.New Delhi, 2002.

Course Code	Molecular Genetics Lab	Course Type	L	T	P	C	CH
B19BG3080		**HC**	**0**	**0**	**2**	**2**	**3**

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of centrifugation.
2. They should know the concept of quantification methods.

Course Objective:

1. To facilitate students to extract DNA and analyze them.
2. To characterize DNA and proteins using electrophoresis.
3. To understand the mechanism of mutations.

Course Outcomes:

1. Extract and estimate the DNA from different sources.
2. Estimate the DNA and RNA using standard protocols.
3. Characterize DNA and proteins using agarose gel electrophoresis and SDS PAGE.
4. Analyse the cause for the onset of genetic disorders.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS03
B19BG3080	CO1	3	3	3	3			3	3		3	3	2	3
	CO2	3	3	3				3			3	3	2	3
	CO3	3	2	3	3			3			3	3	3	3
	CO4	3	3	3	3		3	3	3		3	3	3	3

Course Contents

1. Genomic DNA isolation in plants – Cauliflower, Coconut endosperm
2. DNA isolation in bacteria
3. DNA isolation in animal - liver
4. Estimation of DNA by Diphenyl amine method
5. Estimation of RNA by Orcinol method
6. Agarose gel electrophoresis
7. SDS PAGE – Poly Acrylamide Gel Electrophoresis
8. Study of mutations:
   Sickle cell Anaemia- Mis – sense mutation.
   Thalassemia – frame shift mutation.
   Identification of point mutation types based on the given representation

Reference Books:

1. Advanced Genetics by G.S.Miglani. 2002.
2. Advanced Molecular Biology by Twyman R.M (1998) Viva Books Ltd.

3. Cell Biology and Molecular Biology by EDP Robertis and EMF Robertis, Saunder College. 1980.
4. Genes- IX, 9th Ed., Benjamin Lewin. Jones and Bartlett Publishers, 2008.
5. Genetics – Analysis of Genes and genomes – VII edition - Daniel L. Hartl and Elizabeth W. Jones. 2011.
6. Genetics – from genes to genomics – Leland Hartwell, Leroy Hood, Charles (Chip) Aquadro, Michael L. Goldberg, Maria Papaconstantinou, Fischer, Janice, Jim Karagiannis. McGraw-Hill Education, 2017.
7. Genomes by T.A. Brown (2002) Viva Books.
8. Instant Notes in Molecular Biology by P.C.Turner etal (2002) Viva Books.
9. Molecular cell Biology, 2nd edition by Darnell.J, H.Lodish and D.Baltimore (1990), Scientific American Books, New York.
10. Molecular Genetics by D.N.Bharadwaj. Kalyani, 2008

Course Code	Laboratory course III (Biochemistry)	Course Type	L	T	P	C	CH
B19BG3090		**HC**	**0**	**0**	**2**	**2**	**3**

Prerequisites

Requires knowledge of biomolecules like carbohydrates, amino acids, and proteins etc.

Course Objectives:

1.To gain practical knowledge on chemistry of biomolecules.
2. To analyse the contents of amino acids & proteins by qualitative methods
3. To analyse the contents of amino acids & proteins and quantitative methods.
3.To know the characterization of proteins from samples.

Course Outcomes:

After completing the course, the student shall be able to:

1. Analyze carbohydrates, proteins and lipids qualitatively
2. To get the ability to evaluate carbohydrates, proteins and lipids by quantitatively.
3. Isolate and separate and determine protein contents from biological samples.
4. To determine protein contents from biological samples

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG309 0	CO1	1		2	1			1	1		1	1	1	
	CO2	1	2	1	2			1			2	2	1	

	CO3	2	2	2	2			2	1		2	1	1	
	CO4	1	1	1	1			1	1		2	2	2	

Course Contents:

1. Qualitative tests for Carbohydrates, Lipids, Amino acids, Proteins, Nucleic acids
2. Mutarotation of sugars.
3. Preparation of casein from milk and determination of its isoelectric point.
4. Determination of iodine & saponification value of a lipid.
5. Estimation of Proteins by Biuret, Lowry and Bradford.
6. Estimation of amino acid (alanine/glycine) using ninhydrin by colorimetric method.
7. Separation of Amino acids by Ion- Exchange Chromatography /Gel Filtration Chromatography.
8. SDS-PAGE analysis of proteins.

Reference Books:

1. An Introduction to practical Biochemistry—PlummerD.T,Tata Mc GrawHill
2. Biochemical Calculations, Irwin H.Segel (1976) 2 nd Ed. Jhon Wiley and Sons.
3. Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.
4. Analytical Biochemistry; D.J.Holme and H. Pick Longman (1983).
5. Experimental Biochemistry: A Student Publisher**:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
6. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
7. Introductory practical Biochemistry, Sawhney, Randhir singh, 11th Edition (2015)
8. Lab manual of Biochemistry, Immunology and BioTechnology, Artinigam and Archana Ayyagiri -- Tata Mc GrawHill

FOURTH SEMESTER

B19BG4011	Language-II: Kannada	L	T	P	C
Duration:14 Wks		2	1	0	3

Course description

ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಕಲೆ ಮತ್ತು ವಿಜ್ಞಾನದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಮೂರು ಕ್ರೆಡಿಟ್ ಹೊಂದಿದೆ.

Prerequisites:

- ಕನ್ನಡ ಭಾಷೆಯ ಬಗೆಗೆ ಪ್ರಾಥಮಿಕ ತಿಳುವಳಿಕೆ ಅಗತ್ಯ..
- ಭಾಷೆಯನ್ನು ಓದಲು ಮತ್ತು ಬರೆಯಲು ತಿಳಿದಿರಬೇಕು.
- ಪದವಿ ಪೂರ್ವ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಓದಿರಬೇಕು.

Pedagogy:

- Direct method
- ICT and Digital support (Links attached)
- Collaborative and Cooperative learning
- Differentiated Instruction
- Flipped Classroom

Course Objectives:

ನಾಲ್ಕು ಸೆಮಿಸ್ಟರ್‌ಗಳಲ್ಲಿ ಸಮಗ್ರ ಕನ್ನಡ ಸಾಹಿತ್ಯವನ್ನು ಪರಿಚಯಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ ನಾಲ್ಕನೆಯ ಸೆಮಿಸ್ಟರ್‌ನಲ್ಲಿ ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವ್ಯ, ಸ್ತ್ರೀವಾದಿ ಹಾಗು ನವ್ಯೋತ್ತರ ಕಾವ್ಯ, ವಿವಿಧ ಲೇಖನಗಳು ಹಾಗು ಕಾದಂಬರಿ ಸಾಹಿತ್ಯವನ್ನು ಪಠ್ಯವನ್ನಾಗಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು, ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸದಭಿರುಚಿಯನ್ನು ಮೂಡಿಸಲಾಗುತ್ತದೆ. ಸಾಂಸ್ಕೃತಿಕ ತಿಳುವಳಿಕೆಯ ಜೊತೆಗೆ ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನದ ಕಡೆಗೆ ಗಮನ ನೀಡಲಾಗುತ್ತದೆ.

- ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
- ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
- ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Course Outcomes:

ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವ್ಯ–ನವ್ಯೋತ್ತರ ಕಾವ್ಯ, ವಿವಿಧ ಲೇಖನಗಳು ಹಾಗು ಕಾದಂಬರಿ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟ ಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.

1. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
2. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
3. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ.
4. ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2
B19BG4011	CO1	0	0	0	0	2	3	0	0	0	0

	CO2	0	0	0	0	2	3	0	0	0	0
	CO3	0	0	0	0	0	3	0	0	0	0
	CO4	0	0	0	0	0	0	3	2	0	0

Course Contents:

Unit I ನವ್ಯ–ಸ್ತ್ರೀವಾದಿ ಕವಿತೆಗಳು **10 Hours**

1. ಬುದ್ಧಿವಂತರಿಗೆ ಕನಸು ಬಿದ್ದರೆ — ಎ.ಕೆ.ರಾಮನುಜನ್
2. ಕುರಿಗಳು ಸಾರ್ ಕುರಿಗಳು — ನಿಸಾರ್ ಅಹಮದ್
3. ಅಕ್ಕ ಹೇಳಿದು — ಸ. ಉಷಾ

Unit II ದಲಿತ–ಬಂಡಾಯ **10 Hours**

1. ನನ್ನ ಕವನಗಳಲ್ಲಿ ಹುಡುಕದಿರು ನನ್ನ — ಚಂಪಾ
2. ದಲಿತರು ಬರುವರು ದಾರಿಬಿಡಿ — ಸಿದ್ಧಲಿಂಗಯ
3. ಕಟ್ಟಡದ ಕೆಲಸಗಾರರು — ಎಚ್ ಎಸ್ ಶಿವಪ್ರಕಾಶ

Unit III ಲೇಖನಗಳು **10 Hours**

1. ಹಸಿರು ಹೊಸಕುವ ಗಣಿಗಳು — ಯಲ್ಲಪ್ಪ ರೆಡ್ಡಿ
2. ಜಾಗತೀಕರಣದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಗಾಂಧೀಜಿಯ ಪ್ರಸ್ತುತತೆ — ಸಿ. ನಾಗಣ್ಣ
3. ಚಾರ್ವಾಕರು : ಒಂದು ಟಿಪ್ಪಣಿ — ಪಿ ಎನ್ ರಂಗನ್

Unit IV ಕಾದಂಬರಿ **09 Hours**

1. ಸಂಸ್ಕಾರ — ಯು.ಆರ್. ಅನಂತಮೂರ್ತಿ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
3. ಹಂಪ ನಾಗರಾಜಯ್ಯ, ಸಾಂಗತ್ಯ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
4. ರಂಜಾನ್ ದರ್ಗಾ, ಶರಣರ ಸಮಗ್ರ ಕ್ರಾಂತಿ, ಪ್ರಕಾಶಕರು. ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ. 2015
5. ವಸಿಷ್ಠ., ರತ್ನಾಕರವರ್ಣಿಯ ಭರತೇಶ ವೈಭವ, ಪ್ರಕಾಶಕರು ಚೇತನ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 1999
6. ಡಾ. ಅರವಿಂದ ಮಾಲಗತ್ತಿ, ಸಾಹಿತ್ಯ ಸಂಸ್ಕೃತಿ ಮತ್ತು ದಲಿತ ಪ್ರಜ್ಞೆ, ಪ್ರಕಾಶಕರು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2014
7. ಡಾ. ಈ.ಎಸ್. ಆಮೂರ, ಕನ್ನಡ ಕಥನ ಸಾಹಿತ್ಯ : ಕಾದಂಬರಿ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
8. ಕೀರ್ತನಾಥ ಕುರ್ತಕೋಟಿ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಂಗಾತಿ, ಪ್ರಕಾಶಕರು ಕುರ್ತಕೋಟಿ ಮೆಮೋರಿಯಲ್ ಟ್ರಸ್ಟ್, ಧಾರವಾಡ. 2009
9. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು – 2014
10. ಸಂ. ಡಾ! ಸಿ. ಆರ್. ಚಂದ್ರಶೇಖರ್, ಮುಂದಾಳುತನದ ಲಕ್ಷಣಗಳನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುವುದು ಹೇಗೆ?, ಪ್ರಕಾಶಕರು ನವಕರ್ನಾಟಕ ಪಬ್ಲಿಕೇಷನ್ಸ್ ಪ್ರೈವೇಟ್ ಲಿಮಿಟೆಡ್. 2010
11. ಆಧುನಿಕ ಕನ್ನಡ ಕಾವ್ಯ ಭಾಗ–2, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2004
12. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013.

B19BG4012	Language – II: Hindi	L	T	P	C

Duration:14 Wks		**2**	**1**	**0**	**3**

Prerequisites:

पूर्वापेक्षा:

- अध्येता को, हिन्दी खंड-काव्य का संक्षिप्त ज्ञान आवश्यक है |
- हिन्दी साहित्य के इतिहास का संक्षिप्त ज्ञान की आवश्यकता है |
- हिन्दी व्याकरण का अवबोधन आवश्यक है |
- सिनेमा रिव्यु की बुनियादी जानकारी आवश्यक है |

Pedagogy:

ICT and Digital support, Collaborative and Cooperative learning, Flipped Classroom

LTP: L:2 T:1 P:0

Course type:Theory
Contact Hours:39

Course Objectives:

पाठ्यक्रम उद्देश्य :

- संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
- साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना |
- छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
- अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

Course Outcomes:

अधिगम परिणाम :

अध्ययन की समाप्ति पर अध्येता –

- सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
- साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
- समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
- साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
B19BG4012	CO1	0	0	0	0	2	3	2	0	0	0
	CO2	0	0	0	0	2	2	3	0	0	0
	CO3	0	0	0	0	3	3	3	0	0	0
	CO4	0	0	0	0	3	2	3	0	0	0

Course Contents:

इकाई –1: खंड-काव्य – नहुष – मैथिलीशरण गुप्त

(10hrs)

कवि परिचय

काव्य परिचय

शची सर्ग

नहुष सर्ग

इकाई –2: खंड-काव्य – नहुष – मैथिलीशरण गुप्त (10hrs)

उर्वशी सर्ग

स्वर्गभोग सर्ग

इका ई –3: खंड-काव्य – नहुष – मैथिलीशरण गुप्त (10hrs)

सन्देश सर्ग

मंत्रणा सर्ग

पतन सर्ग

इका ई –4 (09hrs)

सिनिमा रिव्यू :

सूपर 30, मिशन मंगल, थप्पड़, आर्टिकल 15

सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

d) Suggested Text Books and References

Text book/s: पाठ्य पुस्तक:

1. खंड-काव्य – नहुष – मैथिलीशरण गुप्त

References: सन्दर्भ ग्रन्थ :

1. लेखक का सिनेमा - कुंवर नारायण
2. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
3. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
4. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
5. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
6. मीडिया विमर्श – रामशरण जोशी
7. सिनेमा-सिनेमा - दयानंद पाण्डेय

B19BG4013	Language-II: Additional English	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must possess fair knowledge of language, literature, culture and society.

Pedagogy:

Collaborative Method, Flipped Classroom, Blended Learning.

Course Objectives:

- To infer the myths from the contemporary perspective.
- To outline the idea of family represented in literature.
- To interpret horror and suspense as a genre of literature.
- To assess the impact of education in building a society.

Course Outcomes:

On completion of the course, learners will be able to:

- Examine the relevance of myths and mythology.
- Demonstrate family values and ethics essential to live in the society.
- Analyze horror and suspense as a significant genre of literature.
- Evaluate the applicability of academic contribution in building a society.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG4013	CO1	0	0	0	0	3	3	3	2	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	2	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Myths & Mythology **[9 hours]**

John W. May – Narcissus
W.B. Yeats – The Second Coming
Devdutt Pattanaik - Shikhandi and the Other Stories They Don't Tell you (Extracts)

Unit-II: Family & Relationships **[10 hours]**

Nissim Ezekiel – Night of the Scorpion
Langston Hughes – Mother to Son
Kate Chopin – The Story of an Hour
Henrik Ibsen – A Doll's House (Extract)

Unit-III: Horror & Suspense **[10 hours]**

Edgar Allan Poe – The Raven
Bram Stoker – A Dream of Red Hands
Satyajit Ray – Adventures of Feluda (Extract)

Unit-IV: Education **[10 hours]**

The Dalai Lama – The Paradox of Our Times
Kamala Wijeratne – To a Student
Sudha Murthy – In Sahyadri Hills, a Lesson in Humility
Frigyes Karinthy – Refund

Reference Books:

- Finneran, Richard J. *The Collected Works of W.B. Yeats*(Volume I: The Poems: Revised Second Edition). Simon & Schuster, 1996.
- Pattanaik, Devdutt. *Shikhandi: Ánd Other 'Queer' Tales They Don't Tell You*. Penguin Books, 2014.
- Ezekiel, Nissim. *Collected Poems* (With A New Introduction By John Thieme). OUP, 2005.
- Hughes, Langston. *The Collected Poems of Langston Hughes*. Vintage, 1995.
- Chopin, Kate. *The Awakening and Selected Stories of Kate Chopin*. Simon & Schuster, 2004.
- Ibsen, Henrik. *A Doll's House*. Maple Press, 2011.
- Poe, Edgar Allan. *The Complete Poetry of Edgar Allan Poe*. Penguin USA, 2008.
- Stoker, Bram. *Dracula*. Fingerprint Publishing, 2013.
- Ray, Satyajit. *The Complete Adventures of Feluda* (Vol. 2). Penguin Books Ltd., 2015.
- Lama, Dalai. *Freedom In Exile: The Autobiography of the Dalai Lama of Tibet*. Little, Brown Book Group, 1998.
- Murthy, Sudha. *Wise and Otherwise: A Salute to Life*. Penguin India, 2006.

B19BG4020	Communicative English-II	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

The student must possess functional knowledge of LSRW skills.

Pedagogy:

Direct method, ICT, Collaborative learning, Flipped Classroom.

Course Objectives:

- To infer the myths from the contemporary perspective.
- To outline the idea of family represented in literature.
- To interpret horror and suspense as a genre of literature.
- To assess the impact of education in building a society.

Course Outcomes:

On completion of the course, learners will be able to:

- Examine the relevance of myths and mythology.
- Demonstrate family values and ethics essential to live in the society.
- Analyze horror and suspense as a significant genre of literature.
- Evaluate the applicability of academic contribution in building a society.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
B19BG4020	CO1	0	0	0	0	3	3	3	3	0	0
	CO2	0	0	0	0	3	3	3	2	0	0
	CO3	0	0	0	0	3	3	3	2	0	0
	CO4	0	0	0	0	3	3	3	3	0	0

Course Contents:

Unit-I: Language Acquisition **[9 Hours]**
Remedial Grammar: Questions & Negatives; Questions Tags
Writing Skills: Email Writing
Activities: Group Discussions
Literature: Alphonse Daudet - The Last Lesson

Unit-II: Persuasive Skills **[10 Hours]**
Remedial Grammar: Past Simple & Past Perfect
Writing Skills: Report Writing
Activities: Book & Movie Reviews
Literature: Lord Alfred Tennyson – Ulysses

Unit-III: Cognitive Skills **[10 Hours]**
Remedial Grammar: Present & Past Passive; Conditionals
Writing Skills: Creative Writing
Activities: Role Plays
Literature: O. Henry – The Gift of the Magi

Unit-IV: Employability Skills **[10 Hours]**
Remedial Grammar: Reported Speech; Idioms
Writing Skills: Cover Letter & CV
Activities: Exchanging Information
Literature: Saki – The Open Window

Reference Books:

1. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Blackswan, 2013.
2. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford University Press, 2015.
3. Thorpe, Edgar and Showick Thorpe. *Objective English*. Pearson Education, 2013.
4. Dixson, Robert J. *Everyday Dialogues in English*. Prentice Hall India Pvt Ltd., 1988.
5. Turton, Nigel D. *ABC of Common Errors*. Mac Millan Publishers, 1995.
6. Samson, T. (ed.) *Innovate with English.* Cambridge University Press, 2010.
7. Kumar, E Suresh, J. Savitri and P Sreehari (ed). *Effective English*. Pearson Education, 2009.
8. Goodale, Malcolm. *Professional Presentation*. Cambridge University Press, 2013.

Course Code	Molecular Biology and Genetic Engineering	Course Type	L	T	P	C	CH
B19BG4030		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

- The student should have knowledge of biomolecules, cellular structures
- The student should have basic knowledge of biochemistry

Course Objectives:

1. The objective of this course is to have a firm foundation in the fundamentals of Molecular Biology mainly about genetic materials, central dogma, replication and gene expression study
2. To acquaint students with the complete information about the mechanism of protein synthesis, post translational activity and gene regulation.
3. To familiarize the students with the basic concepts and molecular tools in genetic engineering and recombinant DNA technology.
4. To appraise the students about the techniques and application of genetic engineering.

Course Outcome:

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

1. Understand the various types of genetic materials and its replication and post replication process in prokaryotes and eukaryotes
2. To explores the mechanisms associated with translations and various posttranslational activity and the regulation of gene in prokaryotes and eukaryotes
3. Describe the function of the most common enzymes, different types of cloning and transformation studies used in genetic engineering.
4. Explain about the concept of gene libraries and the principles of different nucleic acid sequencing methods, amplification, protein detection and analysis.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS03

B19BG4030	CO1	3	3	3	3	0	0	0	2	3	0	2	2	1
	CO2	3	2	3	3	0	0	0	3	3	0	2	2	1
	CO3	2	2	2	2	0	0	0	2	2	0	2	2	1
	CO4	3	3	3	3	0	0	0	3	3	0	2	3	3

Course Contents

UNIT-1 **12 hrs**

General outline of DNA and DNA replication: History and experiments to prove DNA and RNA of genetic material, Nucleosides & Nucleotides (introduction, structure & bonding), Watson and crick model of B-DNA, Types of DNA. DNA isolation and identification through electrophoresis technique. Concept of central dogma, Semi conservative nature of DNA, DNAreplication in Eukaryotes and Prokaryotes, DNA polymerase and other major enzymes involved in replication, rolling circle model of replication, Fidelity of replication.

UNIT-2 **12 hrs**

Transcription and Translation: Transcription in prokaryotes and eukaryotes. Post transcriptional modification and its significance: Capping, Polyadenylation, RNA splicing, Ribozymes, Alternative splicing and RNA editing. Genetic code and wobble hypothesis, tRNA and ribosome structure, Translation in prokaryotes and eukaryotes. Post translational modifications in detail, Overview of Gene regulation and concept in prokaryotes; Lactose and Tryptophan operons, Galactose operon in yeast.

UNIT-3 **12 Hrs**

Molecular Tools in Genetic Engineering

Scope of genetic engineering; Endo Nucleases and Exonucleases; Restriction Enzymes -Type I, Type II, Type III, Type IV; Invitro restriction digestion; Ligases- *E.coli* Ligase and T4 DNA Ligase.

Other DNA Modifying Enzymes- Terminal Transferase, Alkaline Phosphatases, Klenow Fragment. Introduction to cloning vectors - Prokaryotic & Eukaryotic; Plasmid Vectors (pBR, PUC); Phage Vectors (Bacteriophage lambda and Cosmid); Bacterial vectors (BACs); Yeast Vectors (YACs); Plant Vectors (Ti plasmid); Animal vectors (SV40, Retro virus).

UNIT-4 **12 Hrs**

Techniques in Genetic Engineering

Screening and selection of recombinants, Gene transformation (Physical & Chemical Transformation) plant transformation (*Agrobacterium).* Genomic library construction cDNA library construction (screening of gene libraries)

DNA sequencing (Dideoxy method, Maxam and Gilbert method, Polymerase Chain Reaction (PCR); Gel electrophoresis; AGE and PAGE; DNA hybridization (Southern blotting); Protein detection (Western blotting). Molecular Markers

Reference Books:

1. Cooper, G.M., Hausman, R.E. The Cell: A molecular approach. (2009) ASM Press and Sinauer Associates (Fifth Edition).
2. DeRobertis, E.D.P. Cell and Molecular Biology.(2008) Lippincott Williams and Williams (Sixth Edition).
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings.
4. Principles of Gene Manipulation and Genomics – 7th Edition – Sandy B. Primrose, Richard Twyman – Blackwell Publishing
5. Gene Cloning and DNA Analysis: An Introduction - 6th Edition - T. A. Brown - John Wiley & Sons
6. An Introduction to Genetic Engineering - 3rd Edition - Desmond S. T. Nicholl - Cambridge University Press.

Course Code	Evolutionary & Biometrical Genetics	Course Type	L	T	P	C	CH
B19BG4040		HC	2	1	0	3	4

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of theories of evolution.
2. Students should be aware Basic mathematical concepts.

Course Objectives:

1. To explain the concept of population genetics and its application in studying the evolution of the species.
2. To discuss the inheritance involving quantitative characters.
3. To study the basics of statistics and its applications.
4. To apply the knowledge of biometry in genetic variation.
5.

Course Outcomes:

Students will be able to:

1. Characterize the genetic variations observed in population.
2. Explore the mechanism of transposition.
3. Discuss the inheritance of quantitative characters.
4. Apply the knowledge of biometry in the phenotypic variation of traits.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3
B19BG4040	CO1	3	3	3		3	2	2			3	3	2	
	CO2	3	3	2							3	3	2	
	CO3	3	3	3		3	2				3	3	2	
	CO4	3	3	3	3	3	2				3	3	2	

Course Contents:

UNIT-I **12 hrs**

Darwinism, Neo Darwinism and Synthetic Theory.
Population genetics: Gene pool, Gene and genotype frequencies: Hardy-Weinberg principle, Evolutionary agents: Selection – differential selection, gametic selection, zygotic selection, fitness; Migration; Mutation and Random drift.
Speciation: Methods of speciation, - Isolating mechanisms-Pre-mating and Post mating. Evolution at molecular level: - Nucleotide sequence.
Transposable elements: Bacteria, Yeast, Maize and *Drosophila*, humans.

UNIT-II **12 hrs**

Quantitative Characters and Inheritance:
Quantitative Characters:-Types- Continuous, meristic and threshold characters with examples.
Quantitative inheritance:-Features of polygenic traits in relation to oligogenic traits. Inheritance of Kernel color in wheat and Skin colour in human.
Transgressive inheritance in Poultry.
Environmental effects - IQ in Humans
Significance of polygenic inheritance-Twin study

UNIT-III **12 hrs**

Elements of Biometry
Measures of Central Tendency - Mean, Median and Mode
Measures of Dispersion - Variance and Standard deviation
Test of Hypothesis - Student's 't' Test, Chi square Test.
Probability - Definition and rules.
Distribution - Normal, Binomial and Poisson.

UNIT-IV **12 hrs**

Biometrical Genetics:
An introduction to Correlation, Regression and ANOVA (Analysis of Variance)
Genetic analysis of quantitative trait: - Ear length in Corn
Variances in polygenic traits: - Phenotypic, genotypic, environmental, additive, dominance and Epistatic variance; Genotype and environmental interaction.
Heritability: - Broad sense and Narrow sense heritability, Quantitative trait loci (QTL). Problems related to Variance and Heritability.

Reference Books:

1. Evolution - Stickberger, M. W (1990) Jones and Bartlett, Boston.
2. Evolutionary Genetics by Maynard Smith J (1989), Oxford University press.
3. Genetics and Analysis of Quantitative traits by Lynch. M and B. Walsh (1997). Senauer Associates, Sunderland.
4. Introduction to Quantitative Genetics by Falconer, D (1995) 4th edition Longman, London.
5. Population Genetics and Quantitative Genetics by Mari selvi K. Kalyani Publications. 2008.

Course Code	Human Physiology	Course Type	L	T	P	C	CH
B19BG4050		HC	2	1	0	3	4

Prerequisites

Requires knowledge of pre-university, biology and its importance

Course Objective:

1. To understand the molecular mechanisms of early development
2. Define the molecular, cellular, and tissue-level organization of the central and peripheral nervous system
3. To understand about the gastrointestinal physiology, digestive gland, digestion, absorption and the muscular function
4. To know the male and female reproductive physiology and nerverous system

Course Outcomes:

After completing the course the student shall be able to:

1 .To understand the composition of the various body fluid compartments , cardiovascular system and associated disorders.
2 .Apply the knowledge of renal physiology and respiration on various disorders and detect the real symptoms for curing certain diseases.
3 .Develop surgical, medical and also interventional and non-interventional treatment plans for gastro intestinal and hepatic physiology.
4 .Understand the mechanisms involved in sexual differentiation and relate the properties of individual cells to their function in organized neural circuits and systems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG4050	CO1	3		3		2		2		2	1	1	2	
	CO2	2	2		1	1		3			3		2	2
	CO3	1		2	2		2	3		3	2	2	1	
	CO4	3	2		2	2		3	3		1	1	2	2

Course Contents:

UNIT -I **12 hrs**

The Body Fluid Compartments: Intracellular, extracellular and interstitial fluid. Plasma as an extracellular fluid; plasma composition; plasma proteins; Blood cellular components.

The Cardio Vascular System: Anatomy of heart; Physiology of the cardiac muscle; relationship between cardiac cycle, heart sound ventricular volumes and the ECG; Control of cardiac function and output; Control of blood flow to the tissues; Portal circulations. Arterial pressure and its regulation.Hypertension, Congestive heart disease, atherosclerosis and Myocardial infarction.

UNIT-II **12 hrs**

Renal Physiology: Anatomy of the kidney and the nephron; Regulation of renal blood flow; physiology of glomerular filtration; GFR; Tubular processing of the glomerular filtrate; Renal clearance; Assessment of kidney function. Glomerular nephritis, renal failure, definition and use of dialysis and diuretics.

Respiration: Organization of the pulmonary system; Mechanism of respiration; Principles of Gas exchange and transport; Regulation of respiration; pH; Acidosis and Alkalosis. Hypoxia, hypercapnea, pulmonary distress, emphesema.

UNIT-III **12 hrs**

Gastrointestinal and Hepatic Physiology: Secretion, regulation of secretion, composition and functions of saliva, gastric, pancreatic and intestinal juices and bile. Gastro-intestinal hormones. Digestion, absorption and transport of carbohydrates, proteins, lipids, nucleic acids, Anatomy of the hepatic lobule; blood flow into the liver. Metabolic importance of liver; Liver function tests. Jaundice and Liver cirrhosis. Musculoskeletal system: Bone structure and formation. Physiology of muscle contraction in striated and nonstriated muscle.

UNIT IV **12 hrs**

Reproductive Physiology: Development of female and male genital tracts; Spermatogenisis; capacitation of sperm; testis blood barrier; Physiology of female reproductive of placenta; the feto placental unit.

Neurophysiology: Organization of the central nervous system; cells of the nervous system and anatomy and physiology of Blood Brain Barrier. Introduction to neural networks: central, autonomic and peripheral; the sensory and motor tracts; mechanism and importance of myelination. Sensory perception of Pain, temperature, touch and vision; Physiology of reflex action; the motor cortex; corticospinal tracts.

Reference Books:

1) Human Physiology, Vol. I & II, - C. C. Chatterjee – Medical Allied Agency – Calcutta.
2) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
3) Textbook of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Textbook of medical physiology: A. C. Gyton, and J. E Hall .Saunders ElsevierPublications, A division of Reed Elsevier India Pvt .Ltd .New Delhi ISBN 81-8147-084-2.
6) Principles of anatomy and physiology: 13th edition, Gerard J Totora, Bryan Derrickson.

7) Widmaler, E.P, Raff.H, Strang,K.T. (2008) Vander's Human Physiology 11thedition, McGraw Hill International Publications.
8) Fox, S.I. (2002) Human Physiology 7th edition, McGraw Hill Publications.

Course Code	Soft Skill Training	Course Type	L	T	P	C	CH
B19BG4060		RULO	1	1	0	2	3

Note: The students will have to undergo Skill Development course being conducted by Training and Placement cell of the University.

Course Code	Molecular Biology & Genetic Engineering Lab	Course Type	L	T	P	C	CH
B19BG4070		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

The student should have knowledge of cell biology and basic biochemistry

Course Objectives:

1. To study the identification of nucleic acid and its amplification by PCR
2. To estimate genomic and plasmid DNA and RNA and to confirm by electrophoresis
3. To study the activity of bacterial transformation
4. Introduces students with the basic concepts in genetic engineering
5. Demonstrates different versatile tools and techniques employed in genetic engineering and recombinant DNA technology.

Course Outcomes:

After completion of the course the candidate should be able to:

1. Understand, and perform, the most important methods in molecular biology like DNA isolation, Protein estimation, Gel electrophoresis, PCR amplification
2. Understand the concept of bacterial transformation and its interpretation for confirmation using blue white colony.
3. Understand the concept of DNA digestion and ligation and analyze the result.
4. Prepare competent cells and transformation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS0 3
B19BG4070	CO1	4	4	4	4	4	0	0	4	4	0	2	3	3
	CO2	3	3	3	3	1	0	0	3	3	0	2	3	3

	CO3	3	3	3	3	3	0	0	3	3	0	2	3	3
	CO4	2	2	2	2	2	0	0	2	2	0	2	3	3

Course Contents:

1. Estimation of DNA by Diphenylamine (DPA) method
2. Isolation and purification of Genomic and Plasmid DNA from bacteria; confirmation by Agarose gel electrophoresis
3. Competent cell preparation, Bacterial Transformation and blue and white screening+
4. Electrophoresis of Proteins by SDS- PAGE
5. Restriction Digestion of DNA
6. Ligation of DNA
7. GFP Cloning
8. Amplification of DNA by PCR method

Reference Books:

1. J Sambrook & D. W. Russell (2001). Molecular cloning: a laboratory manual Vol 1, 2 & 3, CSHL Press.
2. Molecular Cell Biology, 3rd edn. (1995) W.H.H. Lodish, A. Berk, and C. A. Kaiser, Freeman & Co Ltd.
3. Sam brook al (2000) Molecular cleaning Volumes I, II, & III, Cold spring Harbor Laboratory Press, New York USA
4. Glick, B.R. and Pasternak J.J (196) Molecular biotechnology, Principles and application of recombinant DNA, American Society for Microbiology, Washington D.C.

Course Code	Evolutionary & Biometrical Genetics Lab	Course Type	L	T	P	C	CH
B19BG4080		**HC**	**0**	**0**	**2**	**2**	**3**

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of evolution.
2. Students should be aware of the asic mathematical concepts.

Course Objectives:

1. To study various inheritance involving quantitative traits.
2. To compute the statistical analysis for biological data.
3. To calculate the allelic and genotype frequencies with different inheritance data.

Course Outcomes:

1. Understand the pattern of quantitative inheritance.
2. Learn the statistical concepts used for data collection.
3. Analyze the data statistically.

4. To predict the allelic variations in the population.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG40 80	CO1	3	3		3	3	2	3		3	3	3	2	
	CO2	3	3	3	3		3	3	2	3	3	3	2	
	CO3	3	3	3	3		3	3		3	3	2		
	CO4	3	3	3		3	3	3		2	3	3	2	

Course Content:

1. Study of Quantitative inheritance in Kernel colour in Wheat/Skin colour in man .
2. Genetic problems on polygenic variance, Heritability and ANOVA
3. Biometrical Computation of:
   a. Mean, Median and Mode
   b. Variance, Standard Deviation
   c. Problems on: Student's 't' test and Chi square test
4. Biometrical problems (Minimum 3 problems in each topic)
5. Hardy Weinberg Genetic equilibrium: Study of gene & genotype frequencies. (PTC Tasters & nontasters)
6. Blood group typing using haemagglutination tests and calculation of allele frequencies.
7. To test for colour blindness using Ishihara charts and calculation of allele frequencies
8. Study of frequency of twins in the local population.

Reference Books:

1. Evolution - Stickberger, M. W (1990) Jones and Bartlett, Boston.
2. Evolutionary Genetics by Maynard Smith J (1989), Oxford University press.
3. Genetics and Analysis of Quantitative traits by Lynch. M and B. Walsh (1997). Senauer Associates, Sunderland.
4. Introduction to Quantitative Genetics by Falconer, D (1995) 4th edition Longman, London
5. Introduction to Quantitative Genetics by Falconer, D (1995) 4th edition Longman, London.
6. Population Genetics and Quantitative Genetics by Mari selvi K. Kalyani Publications. 2008.

Course Code	Laboratory course	Course Type	L	T	P	C	CH
B19BG4090	IV (Biochemistry)	HC	0	0	2	2	3

Prerequisites :

Requires skills in handling of biological sample for tests

Course Objective:

1. To gain knowledge of handling biological sample.
2. To understand the composition of biological sample.
3. To understand how to handle colorimetric instrument.

Course Outcomes:

After completing the course, the student shall be able to:

1. Analyze normal compositions present in the urine.
2. Evaluate abnormal constituents present in the urine.
3. Identify the different methods available to estimate different constituents present in the biological sample.

Course Contents:

1. Determination of titrable acidity of urine and Blood Clotting time.
2. Determination of A/G ratio in serum by biuret method.
3. Qualitative analysis of organic, inorganic&abnormal constituents of urine.
4. Colorimetric Estimation of bilirubin, Cholesterol, Creatinine, haemoglobin,Iron, Transferrin Binding Protein, Urea, Uric acid, Inorganic Phosphate.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG4090	CO1	1	1	1				1	1		2	1	1	
	CO2	2	2	1	2			1	1		3	2	1	
	CO3	2	2	2	3			2	2		3	2	1	
	CO4													

Reference Books:

1. Text book of Clinical Chemistry-Teitz
2. Clinical chemistry in Diagnosis and Treatment by P.D Mayne/ Arnold. NewDelhi
3. Medical Laboratory technology- Kanai L. Mukherjee, Tata Mc Graw Hill Publication and Co. Ltd; Vol I, II,III
4. Practical Clinical Biochemistry- Harold Varley CBS, 6th ed. NewDelhi 2002
5. Medical Laboratory Science, theory and practice. J. Ochei & A.Kolhakar, Tata Mc GrawHill.
6. Modern Experimental Biochemistry R.F.Boyer [Ed.] (1986) Addition Wesley.
7. Experimental Biochemistry: A Student Publisher**:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
8. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
9. Introductory practical Biochemistry , Sawhney, Randhir singh, 11th Edition (2015)

FIFTH SEMESTER

Course Code	Immunology	Course Type	L	T	P	C	CH
B19BG5010		HC	1	1	0	2	3

Prerequisites/Pre reading for the course:

- The student should have proper knowledge of cell biology and microbiology
- The student should have the basic knowledge of human physiology and anatomy

Course Objective:

1. To expose the students to the basics and advancement of immune response mechanism within the cell.
2. To explore various concepts of different cells and types of immune system with their detailed mechanism
3. To develop strong knowledge on techniques and its mechanisms.
4. To impart knowledge on recent advances in drugs, therapeutics and vaccines.

Course Outcome:

After the end of the Course students will be able to:

1. Demonstrate the basic knowledge of immunological processes at a cellular and molecular level.
2. Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and their co-relation
3. To identify the main mechanisms of different immune cells
4. To understand the principles governing vaccination, the mechanisms of protection against disease and basis of allergy and allergic diseases.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5010	CO1	1										1	1	1
	CO2	2	3									2	3	1
	CO3			2								2	3	1
	CO4			2	3		2					2	3	3

Course Contents:

UNIT-1 Basics of Immunology **12 Hrs**

Immune Response - an overview, components of mammalian immune system, organs of immune response, active and passive immunity, Humoral & Cellular immune responses, T-lymphocytes &

immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, B-lymphocyte differentiation , molecular structure of Immunoglobulins or Antibodies, Different types and functions of immunoglobulins.

UNIT-2: Regulation of Immune Cells **12 hrs**

Cytokines: structure and function, Interferons: structure, mechanism and functions, antibody diversity, T- cell and B- cell mechanisms, compliment pathway: alternate pathway and lecithin pathway, NK cells, Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing mechanisms, production of hybridomas and monoclonal antibodies.

UNIT-3: Immuno-Techniques **12 hrs**

Antigen-Antibody reactions: Agglutination and Precipitation reactions, Blood grouping, immuno-electrophoresis, ELISA, RIA, compliment fixation test, vaccines and vaccination- adjuvants, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines.

UNIT-4: Autoimmunity and Auto-immune diseases **12 hrs**

Autoimmunity & auto-immune diseases, factors contributing development of auto-immune diseases, mechanism of development, rejection of transplants, molecular mimicry, diagnosis & treatment of auto-immune diseases, 3D tissue engineering, Xenotransplantation, immune processes, nature of auto-antigens, immunodeficiency, AIDS, allergy and allergic disease.

Reference Books:

1. William, E. Paul, (1989) Fundamental immunology, 2nd Edition Raven Press, New York.
2. William, R. Clark (191) the Experimental Foundations of Modern Immunology (4th Edition) John Wiley, and Sons, New York.
3. Ivan, M. Roitt (194) Blackwell Scientific Publications, London.
4. Kubay, Kindt, Goldsby & Osborne (6th edition).
5. Delves, Martin, Burton and Roitt (11th edition). Essential Immunology.
6. Stites, Stobo, H. H. Fudenberg (5th edition). Basic and Clinical Immunology.
7. S. K. Gupta. Essentials of Immunology.

Course Code	Human Genetics	Course Type	L	T	P	C	CH
B19BG5020		HC	1	1	0	2	3

Prerequisites/Pre reading for the course:

1. Students should have basics of genetics knowledge.
2. They should have knowledge of morphology of chromosomes.

Course Objectives

The objective of this Course is:

1. To know the history of human genetics.
2. To employ the techniques such as karyotyping, FACS, genetic counselling.
3. To outline the inheritance pattern of genetic disorders.
4. To familiarize the diagnostic techniques used in medical and forensic fields.

Course Outcomes:

After completing the course, the student should be able to:

1. Outline the different patterns of inheritance of allosomes and autosomes.
2. Analyze the aberrations by karyotypes and Flow ctometry.
3. Interpret the inheritance by analysing pedigree tree.
4. Familiarize with the prenatal diagnosis, genetic counseling and dermatoglyphics.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG5020	CO1	3	3	3			3	3	3		3	3	2	3
	CO2	3	3	3	3		3	3	3		3	3	2	3
	CO3	3	3	3			2	2	2		3	3	2	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	2	3

Course Contents:

UNIT- I **12 Hrs.**

History of Human Genetics.

Paris Nomenclature, Flow karyotyping (Quantification of DNA of individual chromosomes) FACS-Fluorescence Activated Cell Sorter.

Human chromosomes and karyotyping: G-banding, nomenclature of banding

Nomenclature of aberrant karyotypes

Common syndromes due to numerical chromosome changes

Common syndromes due to structural alterations (translocations, duplications, deletions, microdeletion, fragile sites)

UNIT- II **12 Hrs.**

Genetic Diseases and Inheritance Pattern: Autosomal inheritance- Dominant (Ex. Adult polycystic kidney, Achondroplasia and Neurofibromatosis) Autosomal inheritance- Recessive (Ex. Albinism, Sickle cell anaemia, Phenylketonuria) X-linked – Recessive: (Ex. Duchenne muscular dystrophy-DMD) X-linked- Dominant : (Ex. Xg blood group) Y-linked inheritance : Holandric gene (Ex. Testes determining factor - TDF) Multifactorial inheritance :

(Ex.Congenital malformations: Cleft lip and palate, Rheumatoid arthritis and Diabetes) Mitochondrial diseases: (Ex. Leber's hereditary optic neuropathy)

UNIT-III **12 Hrs.**

Pedigree studies and Genetic Counselling: Symbols used in pedigree studies, Pedigree analysis and construction, Pedigree analysis for the inheritance pattern of genetic diseases,
Genetic Counselling.
Stage 1: History and pedigree construction
Stage 2: Examination
Stage 3: Diagnosis
Stage 4: Counselling
Stage 5: Follow up.
Problems and case studies.

UNIT-IV **12 Hrs.**

a.Dermatoglyphics: Introduction and Patterns. Dermatoglyphics in clinical disorders- Down's syndrome, Turner's syndrome, Klinefelter's syndrome and Cri du chat syndrome. Clinical applications, Advantages and Limitations.

b. Prenatal Diagnosis: Introduction and types Invasive Prenatal diagnosis - Amniocentesis, Chorionic villus sampling. Non – Invasive Prenatal diagnosis – Ultrasonography.

c. Genetics and Society: Eugenics: Positive and negative, Euthenics, Euphenics Human genome project – introduction and significance Gene therapy with reference to SCID Stem cells- Properties, types and sources. A brief account on Cord blood banking and Stem cell therapy.

Reference Books:

1. Basic Human Genetics by EJ. Manage and A.P. Manage (1997 India Reprint) a Rastogi Publications, Meerut.
2. Emery's Elements of Medical Genetics- Peter Turnpenny, SlanEllard 15th Edition. 2017.
3. Essentials of Human Genetics by S.M. Bhatnagaretal (1999) IV edition. Orient Longman.
4. Genetic basis of common diseases by R. A. King et al, Oxford University Press 2002.
5. Genetics in Medicine by M.W. Thompson et al, 5 Edition, W.B. Sounders Company, London 1996.
6. Human Cytogenetics. Denise Rooney Oxford University Press, 2001.
7. Human Genetics – Bruce.R.Korf. 2000
8. Human Genetics : Concepts and Applications by Lewis R (2001) McGrawHi; Boston.
9. Human Genetics by S.D. Gangane (2nd edition-Reprint 2001), B.L Churchill Livingstone Pvt. Ltd., New Delhi.
10. Medical Genetics. Lynn Jorde John CareyMichael Bamshad. 2015.
11. Mendelian inheritance in Man by-Mc. Kusick V.A, (1998), 12 Edition, John Hopsins University Press.
12. Molecular Basis of Inherited Diseases, (6th Edition-1989) by Scriver, C.R. A.L. Beudit, W.S. Sty abnd D. Valle (EdsOMcGrawHill, New York.

Course Code	Metabolism – I	Course Type	L	T	P	C	CH
B19BG5030		HC	1	1	0	2	3

Prerequisites

Requires knowledge of pre-university, Chemistry of Biomolecules and its degradation

Course Obiective:

1. To understand the enzymes, their properties, activities and kinetics
2. To gain knowledge about carbohydrate, and its clinical importance
3. To understand lipid metabolic pathways and its importance
4. To Understand about biological oxidation and its variations

Course Outcomes:

1. Know about the basic principle of enzyme activity and their role in metabolism
2. Find out the various intermediate pathways and basic energy generation of synthesis and degradation of carbohydrates
3. Find out lipids degradation with clinical aspects
4. Know about the reactions involved correlation with biological oxidation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG5030	CO1	3		2		2		3		3		2		1
	CO2	2		2		2	3		1		1		2	
	CO3	2	3			3	3			2	2		2	
	CO4	3	2		2	2		1	1	1	2	1	2	

Course Contents:

UNIT-I **12 hrs**

Enzymes: Definition, General characteristics, Co-factors – coenzymes and metal ions. Nomenclature and classification of enzymes based on IUB with examples. Enzyme specificity.

Concept of active site. Factors affecting rate of enzyme catalyzed reaction. Effect of substrate, enzyme, product concentration, pH, temperature.

Michaelis–Menten equation. Lineweaver-Burk plot. Determination of Vmax and Km from L-B plot and itssignificance.

EnzymeInhibition: Competitive, noncompetitive and uncompetitive inhibition. Graphical representation of enzyme inhibition by L-B plot. Application of competitive inhibitors in chemotherapy.

UNIT of enzyme activity – definition of IU, enzyme turn over number and nature of non-enzymatic and enzymatic catalysis. Specific activity.

Theories of Enzyme catalysis: Lock and key model, Koshland's induced fit theory. Types of enzyme catalysis- Acid-base, covalent, substrate strain.

Regulation ofenzymes: Allosteric enzyme – Definition, Sigmoidal curve, positive and negative modulators, with AT Case, phosphofructokinase as an example.

Isoenzymes- LDH, Multienzyme complex- pyruvate dehydrogenase complex. Ribozyme. Clinical and Biotechnological application of enzymes.

UNIT-II **12 hrs**

Metabolism of Carbohydrates:
Definition, phases of metabolism, Anabolism and Catabolism- definition, schematic representation of metabolism.
Glycolysis;definition, individual reactions with energetic. Irreversible reactions/ATP dependent reactions. Entry of lactose, sucrose and glycogen into glycolysis. Fate of pyruvate- formation of Acetyl-CoA, Ethanol and Lactate. Regulation of Glycolysis and Inhibitors.
Pyruvate dehydrogenase enzyme. TCA cycle- Individual reactions. Net reaction of TCA cycle. Number of ATP molecules production. Functions of TCA cycle- Amphibolic roles (Anapleorosis). Regulation of TCA cycle, Energetics of TCA cycle.
Gluconeogenesis- Definition and significance, flow chart of gluconeogenesis. CORI cycle-explanation, diagram, purpose.
Glycogen metabolism- Glycogenolysis- definition, reactions. Glycogenesis- definition, reaction, Cori-diseases. Glycogen synthetase and phosphorylase and their regulation, Glycogen Storagediseases.
Pentose phosphate pathways (PPP/ HMP) -Significance, reactions. Synthesis of starch, cellulose andpeptidoglycan.
Substrate level phosphorylation in carbohydrate metabolism. Stoichiometry and energetics of all pathways.
Regulation of blood glucose level; role of Insulin and Glucagon.

UNIT-III **12 hrs**

Lipid metabolism: β-oxidation of saturated fatty acids; individual reactions, enzymes, coenzymes. Energetics of β- oxidation of palmitic acid and stearic acid role of carnitine, Oxidation of fatty acids-with odd number of carbon atoms, fate of propionylcoA, oxidation of unsaturated fatty acids.

Fatty acid synthetases; structure and functions. Biosynthesis of fatty acids-general flow chart, fatty acid oxidation v/s fatty acid synthesis.

Cholesterol-structure and functions. Cholesterol biosynthesis and regulation. Atherosclerosis-causes, blood cholesterol levels. Ketone bodies- Synthesis and degradation. Abnormalities of Ketone bodies.

UNIT-IV **12 hrs**

Bioenergetics and Biological Oxidation:
Laws of thermodynamics. Definition of bioenergetics, stages of energy transformation-photosynthesis, respiration and utilization of energy.
Free energy concepts: free energy change, exergonic and endergonic reactions, meaning of ΔG,ΔG°,ΔG°'; Biochemical standard state and ΔG°',ΔG and Keq (relationship).

High energy compounds:Definition and examples; energy coupling.
Biological oxidation: Calculation of thermodynamic efficiency of biological oxidation for a mole of glucose; Redox potential of some biologically important half reactions. Calculation of energy yields from biological Redox reaction; Electron transport chain: components sequence-ubiquinone, coenzyme Q,NAD, FMN and FAD, cytochromes and Iron sulphur proteinsand their arrangement of 4 complexes and their functions. Sites of energy conservation; Oxidative phosphorylation -definition, salient features of chemiosmotic theory, P:Oratio.

Reference Books:

1. Biochemistry; Voet, D. and Voet, J.G. [Eds.] 5 Ed. Jhon Wiley and sons.
2. Principles of Biochemistry; Lehninger et al., [Eds.] 7th Edn. Worth Publishers.
3. Principles of Biochemistry; Smith et al., [Ed.] 19thEdnMcGarw Hill.

4. Text Book of Biochemistry with Clinical correlations; Thomas Devlin [7th Ed.], Wiley-Liss.
5. P.K. Stump, Outlines Of Biochemistry, 5th edn. , Wiley Eastern, New Delhi,
6. L. Stryer Biochemistry 8th Ed. W.H. Reeman Co., San Francisco, US

Course Code	Bioethics & IPR	Course Type	L	T	P	C	CH
B19BG5041		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

- The student should have basic knowledge of biology
- The student should have knowledge of fundamental rights and duties

Course Objectives:

1. To introduce basic concepts of ethics for various branches of science involving technical procedures and protection of intellectual property and related rights.
2. To understand balanced integration of scientific and social knowledge in sustainable development.

Course Outcomes:

After completing the course, the student should be able to:

1. Define bioethics and describe various biosafety guidelines
2. Ascess the impact of ethical values in conserving environment and human values
3. Recognize the importance of protection of new knowledge and innovations
4. Explain the various processes in patenting of biotechnology products and processes

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5041	CO1	2	3	3	1	2	2	2	3	2	2	2	2	2
	CO2	2	3	3	1	2	2	3	4	2	2	2	2	2
	CO3	2	3	3	2	2	2	2	4	3	2	2	2	1
	CO4	2	3	3	2	2	2	2	4	3	2	2	3	3

Course Contents:

UNIT-I **12 hrs**

Introduction to Bioethics

Need Of Bioethics, Need of bioethics, Bioethics and its relation with other branches, Applications. Biosafety, Biosafety guideline in India. Regulations specific to Biotechnology Companies and Research Institutions. Biosafety protocol.

UNIT-II **13 hrs**

Bioethics in Biotechnology

Ethical, Legal & Social impacts of Biotechnology. National & International issues on Genetic modification & recombinant DNA technologies, Release of GMO's in environment, Human embryonic cloning & stem cell research, transgenic plants and animals.

UNIT-III **11 hrs**

Introduction to IPR

Concept of Intellectual Property, Types of Intellectual Property, Patents, Process of patenting, Copyrights, Designs, Trademarks, Geographical Indication, Trade Secrets. Agreements and Organisations; GATT, TRIPS, WIPO.

UNIT-IV **12 Hrs**

Concept of traditional knowledge, Biopiracy and Bioprospecting, Protection of plant varieties-Farmers Rights and Plant breeders rights, Patentingbiotechnological inventions, Microorganisms as Biotechnological Inventions. Moral issues in patenting Biotechnological inventions.

Reference Books:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S.Chand.
2. Text Book of Microbiology - R.Ananthanaryan and CKJ Pannikar (2005)
3. CBSPublishers.
4. Immunology: Introductory text book- Nandini Shetty(2008).New Age Publications
5. M.Pelczar, E.C.S.ChanandM.R.Krieg,Microbiology, McGrawHillInc., Singapore(1997).
6. Powar, Daginawala – Himalaya Publishing House. General Microbiology, Vol.I & II.
7. Stanier, Adelberg, Ingraham – The Macmillan Press – London.General Microbiology.
8. Nandini Shetty. Introduction toImmunology.
9. J. Kuby “Immunology” 3rd edn., Mosby Year Book Co.,England

Course Code	Industrial Biotechnology	Course Type	L	T	P	C	CH
B19BG5042		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

- The student should have proper knowledge of microbiology and biochemistry
- The student should have basic knowledge of analytical instrumentation.

Course Objectives:

1.To learn about the culturing and isolation of biologically important microbial strains
2. To learn and execute the skills required for culturing in bioreactors
3. Acquire the skills employed in upstream and downstream processes in fermentation technology.
4. Optimize the fermentation techniques and formulate the downstream desired products for maximum productivity.

Course Outcomes:

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

1. Students will be acquantained with identification and isolation of biologcialy important strains
2. Comprehend the role of industrial biotechnology in improving microbial cells as factories.
3. Apply the knowledge of microorganisms in the industrial production of primary and secondary metabolites.
4. Optimise a suitable scheme of bio-product separations based upon the molecular characteristics of the product and other process criteria.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5042	CO1	2										2	3	1
	CO2		3	3	3	2						2	3	2
	CO3		3	3	3	2						2	3	2
	CO4			3	3	2		2			3	2	3	3

Course Contents:

UNIT-1: 12 Hrs

Introduction to Industrial Biotechnology, basis principles of fermentation technology, screening and Isolation of microorganisms, maintenance of strains improvement (Mutant selection, Recombinant DNA methods). Fermentation media Natural and Synthetic Media. Sterilization techniques – Heat, Radiation and Filtration method.

UNIT-2: 12 Hrs

Fermenter, structure of fermenter, Process of Aeration, Agitation, Temperature regulation and Filtration method. Types of Fermentation, solid state, submerged fermentation and continuous fermentation Immobilized enzyme and cell bioreactors. Process Development – Shake flask fermentation, Downstream processing (DSP), Disintegration of cells, Separation, Extraction, Concentration and purification of products.

UNIT-3: **12 Hrs**

Production of Microbial products, Brief account products obtained by industrial microbiological fermentation, Alcohol and Alcoholic Beverage – Beer Organic acid – Citric acid Antibiotic – Penicillin, Amino acids – Glutamic acid, Vitamin – B12, brief account of Steroid biotransformation. Microbial polysaccharides and polyesters; production of xanthan gum and polyhydroxyalkonoides, production of food addictives – Safforn and Capasicin using plant suspension culture

UNIT-4: **12 Hrs**

Enzyme Biotechnogy Characteristics of enzymes – amylases. Industrial uses of enzymes – Detergents, Leather, Beverage, food and Pharmaceutical Bioreactors for enzyme production – Stirred tank, membrane reactors and continuous flow reactors. Fermented Foods Fermented Foods – Yoghurt, Cheese, Tempeh. Microbial Foods – Single cell proteins (SCP), single cell oils (SCO).

Reference Books:

1. Sullia S. B& Shantharam S: (1998) General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd.
2. Bisen P.S (1994) Frontiers in Microbial Technology, 1 st Edition, CBS Publishers.
3. Glaser A.N & Nilaido.H (1995) Microbial Biotechnology,W.H Freeman & Co.
4. Prescott & Dunn (1987) Industrial Microbiology 4 th Edition, CBS Publishers &Distributors.
5. Prescott & Dunn (2002) Industrial Microbiology, Agrobios (India) Publishers.
6. Crueger W. & Crueger A. (2000) A text of Industrial Microbiology, 2 nd Edition, Panima Publishing Corp.
7. Stanbury P.F, Ehitaker H, Hall S.J (1997) PriciplesofFermentation Technology, Aditya Books (P) Ltd.

Course Code	Medical Genetics	Course Type	L	T	P	C	CH
B19BG5051		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

1. Students should have basics of genetics knowledge about pathology.
2. They should have knowledge of cancer biology.

Course Objectives:

The Objective of this Course is:

1. To teach the basics of medical genetics and learn the patterns of heredity
2. To categorize the genetic disorders.
3. To explore the molecular therapeutics for disease management
4. To understand the mechanism of carcinogenesis.

Course Outcomes:

After completing the course, the student should be able to:

1. Predict the patterns of heredity.
2. Analyze the molecular reason of genetic disorders and therapeutic methods.
3. Illustrate the process involved in recombinant protein production.
4. Understand the characteristics and categories of cancer

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG5051	CO1	3	3	3			3		3		3	3	2	
	CO2	3	3	3			3		3		3	3	3	2
	CO3	3	3	3	3		2				3	3	3	3
	CO4	3	3	3	3		3		3		3	3	3	

Course Contents:

UNIT-I **12 Hrs**

Genetics in medical Practice:
Genetic Principles and their application in medical practice, Case studies (Interacting with patients, learning family history and drawing pedigree chart), Syndromes and disorders: Definition and their genetic basis.

UNIT-II **12 Hrs**

Human Genetic Disorders of Nervous system and Eye : Neurogenetic disorders - Charcot-Marie tooth syndrome, Spino-muscular atrophy, Alzheimer's disease & Syndromes due to triplet repeat expansion, Parkinson's disease, Prion diseases, Colour Blindness, Retinitis pigmentosa, Glaucoma & Cataracts.

UNIT-III **12 Hrs**

Patterns of Single Gene Inheritance: Haematopoietic systems-Sickle cell Anemia, Thalassemias and Haemophilias, Muscle genetic Disorders-Duchenne Muscular Dystrophy, Becker Muscular Dystrophy, Cystic Fibrosis, Tay Sach's Syndrome & Marfan Syndrome;
Genetics of diseases due to Inborn errors of metabolism: Phenylketonuria, galactosemia.

UNIT-IV **12 Hrs**

Gene therapy, molecular therapeutics, pharmacogenetics, Production of recombinant insulin, interferon and human growth hormone (HGH) Vaccines: Hepatitis B vaccine Preparation of molecular probes, Monoclonal antibodies and diagnostic kits, Microarray

Oncogenetics: A brief account of cancer-definition, types-Benign and Malignant; Sarcoma, Carcinoma, Lymphoma and Leukaemia Properties of malignant cells.

Types of genes - Proto oncogenes, Oncogenes, Difference between V- and C oncogenes, Tumor Suppressor genes-p53, pRb.

Chromosomal abnormalities associated with the specific malignancies- Acute Promyelocytic Leukaemia(APL),Chronic Myeloid Leukaemia(CML) and Acute lymphoblastic leukaemia *(*ALL)

Reference Books:

1. Human Genetics by S.D. Gangane (2nd edition-Reprint 2001), B.L Churchill Livingstone Pvt. Ltd., New Delhi.
2. Medical Genetics. Lynn Jorde John CareyMichael Bamshad. 2015.
3. Mendelian inheritance in Man by-Mc. Kusick V.A, (1998), 12 Edition, John Hopsins University Press.
4. Molecular Basis of Inherited Diseases, (6th Edition-1989) by Scriver, C.R. A.L. Beudit, W.S. Sty abnd D. Valle (EdsOMcGrawHill, New York.

Course Code	Forensic Biology	Course Type	L	T	P	C	CH
B19BG5052		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

1. Students should have Critical thinking capacity.
2. They should have knowledge of crime scene.

Course Objectives:

The Objectives of this course is:

1. To teach the methodology involved in forensic investigation**.**
2. To understand and utilize the facilities available at forensic laboratories.
3. To document and analyze the crime scene.
4. To analyze the biological andentomological evidences for interpretation.

Course Outcomes:

By the end of the Course students will be able to:

1. Outline the protocol of forensic science investigation.
2. Involve in forensic investigation.
3. Categorize the evidences and analyze them.
4. Explore the significance of different biological evidences and their significance in interpretation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS0 1	PS0 2	PS03
B19BG5052	CO1	3	3	3			3				3	3	3	3
	CO2	3	3	3	3		3	3			3	3	3	3
	CO3	3	3	3	3		3				3	3	2	
	CO4	3	3	3	3		3	3	3		3	3	3	3

Course Contents:

UNIT-1 Crime scene Management and evidences **12 Hrs**

Forensic science Laboratories – CFSL & SFSL
Types of crime scenes – indoor and outdoor. Securing and isolating the crime scene. Crime scene search methods. Safety measures at crime scenes. Legal considerations at crime scenes.
Documentation of crime scenes – photography, videography, sketching and recording notes.
Duties of first responders at crime scenes. Coordination between police personnel and forensic scientists at crime scenes.
Crime Scene Evidence - Classification of crime scene evidence, physical and trace evidence. Locard principle. Collection, labeling, sealing of evidence. Hazardous evidence. Preservation of evidence. Chain of custody. Reconstruction of crime scene.

UNIT-II

Biological Evidence **12 Hrs**

Nature and importance of biological evidence. Types and identification of microbial organisms of forensic significance. Identification of wood, leaves, pollens and juices as botanical evidence. Diatomsand their forensic significance. Dermatoglyphics. Wildlife Forensics - Fundamentals of wildlife forensic. Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, flowers and plants. Identification of physical evidence pertaining to wildlife forensics. Forensic entomology - Insects of forensic importance. Collection of entomological evidence during death investigations.

UNIT-III

Forensic Serology **12 Hrs**

Forensic characterization of bloodstains. Typing of dried stains. Blood enzymes and proteins.
Composition, functions and forensic significance of saliva, sweat, semen, milk and urine. Tests for their identifications.
Bloodstain Pattern Analysis

Bloodstain characteristics. Impact bloodstain patterns. Cast off bloodstain patterns. Projected bloodstain patterns. Contact bloodstain patterns. Blood trails. Bloodstain drying times.
Documentation of bloodstain pattern evidence. Crime scene reconstruction with the aid of bloodstain pattern analysis.

UNIT IV Genetic Marker Analysis **12 Hrs**

Cellular antigens. ABO blood groups. Extracellular proteins and intracellular enzymes. Significance of genetic marker typing data. Sexual assault investigations. Principles of heredity. Genetics of paternity. DNA markers in forensics. DNA testing in disputed paternity. Missing body cases. Reference populations and databases.

Reference Books:

1. Richard Saferstein, 2001, Criminalistic: An Introduction to Forensic Science. 7th edition Prentice-Hall, New Jersey.
2. Evidence in Civil and Criminal cases, IV edition, Foundation Press, Westbury, New York.
3. James, S.H. and Nordby J.J. Forensic Science: An introduction to Scientific and investigative techniques, CRC Press, USA, 2003.
4. Chowdhri, S., Forensic Biology B.P.R. &D, Govt. ofIndia.
5. Najjar and NacWillim, 1978. Forensic Authropology.
6. Byrd, J.H. and Cartner, J.L., 2001. Forensic Entomology, CRC Press, LIC.
7. Robertson, J., 1999. Forensic Examination of Hair. Taylor & Forensic.
8. Cammins, H. and Middle C., 1961. Fingerprints Palms and Soles. Dover Publications.

Course Code	Nutritional Biochemistry	Course Type	L	T	P	C	CH
B19BG5061		SC	2	0	0	2	2

Prerequisites:

Requires knowledge of pre-university, Chemistry of nutrional compounds and its importance.

Course Objective:

1. To understand the balanced diet, energy content of food.
2. To know about essential macronutrient and micronutrient rolesin human physiology.
3. To get aware about anti nutrient factor and component influence on metabolism.
4. To know the nutrition requirement of men and women for their normal growth.

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the requirement of balanced diet, energy content of food.
2. Receive knowledge about the different types of macronutrient and micronutrient required for normal physiological functions.
3. Understand the different types of anti-nutrient compound and crop to hamper normal metabolism.
4. Understand requirement of nutrition during normal and pregnancy conditions

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5061	CO1	3	-	3	-	3	-	2	-	1	1	2	1	-
	CO2	1		2	2	-	3	3	-	2	2	2	-	1
	CO3	2	2	-	1	1	-	2	2	-	1	1	2	-
	CO4	3	-	2	2	-	-	1	1	-	1	2	2	-

Course Content:

UNIT-I **12 hrs**

Nutrition: Understanding relationship between food, nutrition and health, Principles of Meal Planning, Energy content of foods, Balanced diet- Definition, characteristic feature of balanced diet, proximate analysis of foods for carbohydrate, proteins, fats, fiber material and water content. Bomb calorimeter- diagram and description, Determination of calorific value of foods (Carbohydrate, fat and protein); respiratory quotient of food stuffs and significance of RQ.

BMR determination by direct and indirect method; BOD; SDA- definition; SDA for carbohydrate, fat and mixed diet and its significance. RDA for different physical activities pregnant women, lactating woman, infants and children.

Meth**ods of Cooking:** Dry, moist, frying and microwave cooking. Advantages, disadvantages and the effect of various methods of cooking on foods. Nutrient losses in cooking and enhancing the nutritional quality of foods.

UNIT-II **12 hrs**

Macronutrients Carbohydrate, proteins, lipid and fiber; Essential amino acids, semi essential and non-essential amino acids ; complete and incomplete proteins, protein efficiency ratio; Nitrogen balance Positive and negative nitrogen balance.; Fortification - Definition and Biomedical importance; Protein Energy malnutrition: Kwashiorkar & Marasmus - causative factors , treatment and prevention.

Micronutrients: Nutritional importance of vitamin, classification, source, daily requirements and functions; Deficiency symptoms- hyper vitaminosis of fat soluble vitamins. Nutritional importance of Minerals- Definition, classification, source, daily requirement and deficiency symptoms.

UNIT-III **12 hrs**

Anti nutritional factors: Sources and harmful effects of anti-vitamins (avidin, dicoumarol), Natural toxicants (Lathyrus sativa) and adultrants (butter yellow, lead chromate, malachite green)

Acid base balance disorders:Acidosis and Alkalosis. Functions of water, Distribution of total body water, Regulation of water balance, disorders of water metabolism. Distribution of fluids in the body, ECF, ICF. Interaction between immunity, nutrition and infection. Impact of malnutrition on immunity and occurrence of infections. Effect of Infection on nutritional status

UNIT-IV **12 hrs**

Adults – Nutrition for adult man and woman, nutritional concerns, diet and lifestyle related diseases and their prevention

Pregnancy – Physiological changes in pregnancy, nutritional needs, effect of nutritional status on pregnancy outcome, optimal weight gain and its components, nutrition related problems in pregnancy and ways to control them.

Lactation – Physiology of lactation, nutritional needs of a nursing mother, feeding the baby

Elderly – Life expectancy, physiological changes in elderly, nutritional and health concerns in old age and their management, factors contributing to longevity

Reference Books:

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009).
2. Textbook of Human Nutrition, 3rd edition. Oxford and IBH Publishing Co. Pvt. Ltd.
3. Srilakshmi (2010). Food Science, 5th Edition. New Age International Ltd.
4. Wardlaw MG, Insel PM (2004). Perspectives in Nutrition, Sixth Edition, Mosby
5. Principles of Nutrition by M.S Swaminathan
6. Principles of Nutrition by Dr.C. Gopalan.
7. Human Nutrition and Dietetics by Davidson and Passmore; 8th edition (1986)
8. Modern Nutrition and Health disease by M.E. Skillis and V.R. Young

Course Code	Hormonal Biochemistry	Course Type	L	T	P	C	CH
B19BG5062		SC	2	0	0	2	2

Prerequisites

Requires knowledge of pre-university, Chemistry of Hormones and its importance.

Course Objective:

1. To understand about types of endocrine gland, hormone and signaling pathways
2. To know about hormones and their receptors, toxic compounds effect on signalling pathways.
3. To understand role of hormone in various disorders
4. To know the importance of hormones and its imbalance.

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the classification and their functions concerned with metabolism.
2. Gain knowledge about signaling molecule, pathways and how toxic compound hamper normal pathways
3. Know the types of disease related with endocrine disorder.
4. Understand about the sex hormone for male and female development and physiology

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5062	CO1	3	-	2	-	2	-	1	-	-	-	2	2	1
	CO2	1	-	-	3	-	2	-	3	--	3	2	3	-
	CO3	3	-	3	-	-	-	-	3	-	3	2	-	2
	CO4	2	3	-	3	-	2	-	3	2	2	-	1	

Course Content:

UNIT-I **12 Hrs**

Introduction - History, endocrine glands, and hormones as chemical messengers, stimulus for hormone release: change in homeostasis, sensory stimulus and others.

Cell signaling & Mechanism of Hormone action: Receptor study, Binding affinity, specificity, Scatchard plot and purification. G protein linked receptor family; Signal transduction pathways involving G- proteins .Phosphoprotein phosphatases&Phosphodiesterases. Receptor tyrosine kinase family- EGF receptor family, Insulin receptor family, & Cytokine/erythropoietin receptor family associated with non-receptor Tyrosine kinase (Signal transduction pathways involving: SH2 proteins, ras, IRS-1,Raf, MEK, MAP kinase, JAK-STAT pathway).

UNIT-II **12 hrs**

Intra-cellular Receptors - Steroid hormone receptors, Thyroid hormone receptors.Sensitisation& Desensitization of receptors; Short term regulation & Long term regulation. Drugs and Toxins affecting cell signaling: Cholera toxin, pertussis toxin, anthrax toxin, Bubonic Plague virulence, Forskolin, theophyllin, Phorbol esters, Seldenafil (Viagra).

Hypothalmic Hormones: CRH, TRH, GnRH, PRL/PRIH, GHRH/GHRIH.

Pituitary Hormones - Anterior Pituitary hormones- Growth hormone, Prolactin, POMC peptide family, LH, FSH, TSH; Posterior Pituitary: Vasopressin, Oxytocin.

UNIT-III **12 hrs**

Endocrine disorders: Gigantism, Acromegaly, dwarfs, pigmies

Pathophysiology: Diabetes insipidus. Thyroid Hormone (include biosynthesis) Goiter, Graves disease, Cretinism, Myxedema, Hashimoto's disease.

Hormones regulating Ca2+ Homeostasis: PTH, Vit D, Calcitonin. Pathophysiology: Rickets, Osteomalacia, Osteoporosis.

Pancreatic Hormones: Insulin, Glucagon, Diabetes type I &II. GI tract Hormones:Gastrin, Secretin, CCK, GIP, Ghrelin

UNIT-IV **12 hrs**

Hormones of Adrenal Cortex: Aldosterone (renin angiotensin system) & cortisol. Pathophysiology: Addisons disease, Conn's syndrome, Cushings syndrome. Hormones of Adrenal Medulla, Epinephrine & norepinephrine.

Reproductive Hormones: Male & female Sex hormones.

Other organs with endocrine function: Heart (ANP), Kidney (erythropoietin), Liver (Angiotensinogen, IGF-1), Adipose tissue (Leptin, adiponectin).

Pathophysiology: Obesity. Growth factors: PDGF, EGF, IGF-I, II,& NGF.

Reference Books:

1. Nelson, D.L. and Cox, M.M. (2005). Lehninger Principles of Biochemistry, W.H. Freeman & Com
2.Widmaier, E.P.,Raff, H. and Strang, K.T.(2008).Vander,Sherman,Luciano's Human Physiology, McGraw- Hill Higher Education.
3. Darnell, J.,Lodish, H. and Baltimore, D.(2008). Molecular Cell Biology, Scientific American Books.
4. Human Physiology by CC. Chatterjee, 11th edition (1985)
5. Essentials of Medical physiology by K Sambulingam, 3rd edition, 2005
6. Principles of Biochemistry; Smith et al., [Ed.] (1986) McGarw Hill.

7. Text Book of Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley-Liss.

Course Code	Soft Skill Training	Course Type	L	T	P	C	CH
B19BG5070		RULO	1	1	0	2	3

Note: The students will have to undergo Skill Development course being conducted by Training and Placement cell of the University.

Course Code	Immunology Lab	Course Type	L	T	P	C	CH
B19BG5090		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

- The student should have knowledge of cell biology and microbiology.
- The student should have the knowledge of basic human physiology and anatomy.

Course Objectives:

1. To understand the basic concepts of immune system
2. To famarilize the students in the immunotechnology
3. To explore various aspects of immunology in the other field
4. To exploit the immunological methods for commercial needs

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the importance and scope of immunology
2. Handle immunological techniques for mankind
3. Explore various methods and new techniques in immunology
4. Take small research project in the field of immunology

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG5090	CO1	2	3	3					2		3	2	1	1
	CO2	2	3	3	3				2		3	2	3	2
	CO3	2	3	3		2			2		3	2	3	2
	CO4	2	3	3					2		3	2	3	3

Course Contents:

1. Blood Typing
2. Separation of Blood and Serum
3. VDRL
4. WIDAL
5. Oucterlony Double Diffusion
6. Counting of RBCs
7. Dot ELISA
8. Rocket Electrophoresis

Reference Books:

1. Keith Wilson and John Walker, Practical Biochemistry- 5th edition, Cambridge University Press, UK 2000
2. Bertram G. Katzung, Basic and Clinical Pharmacology, 9th Edition, Mc Graw Hill Publications 2004
3. Devlin TM, Text book of biochemistry with Clinical Correlations 5th edition 2002
4. Warren Levinson, Ernest Jawetz, Medical Microbiology and Immunology: Examination and Board Review 7th edn. McGraw Hill Publications 2003
5. Jawetz, Melnuk and Adelgerg, Medical Microbiology, Appleton and Lange

Course Code	Human Genetics Lab	Course Type	L	T	P	C	CH
B19BG5X10		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

1. Students should have basics of genetics knowledge.
2. They should have knowledge of morphology of chromosomes.

Course Objectives:

1. To study different banding techniques and karyotypes
2. To understand the concept of dosage compensation in different cells.
3. To analyse the count of blood cells
4. To construct the pedigree and record the fingerprints.

Course Outcomes:

After completing the course, the student should be able to:

1. Analyse the karyotypes and interpret the disorder.
2. Visualize Barr body in epithelial cells and drumsticks in neutrophils.
3. Diagnose genetic diseases.
4. Compare the fingerprints in forensic investigation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3
B19BG5X 10	CO1	3	3	3			3				3	3	3	3
	CO2	3	3	3	3		3	3			3	3	3	
	CO3	3	3	3	3		3				3	3	2	3
	CO4	3	3	3	3		3	3	3		3	3	3	3

Course Contents:

1. Study of Karyotypes I: Normal Karyotyping in Human 1Prc. Male (46,XY) Female (46, XX).
2. Study of Karyotypes II: Abnormal Karyotypes 1 Prc. Down's syndrome (autosomal). Turner's syndrome (sex chromosomal), Klinefelter's syndrome (sex chromosomal)
3. Study of banding techniques (G-banding technique).
4. Sex chromatin: Study of Barr body in the Buccal epithelial cells.
5. Study of drum sticks in Neutrophils of Blood smear.
6. Blood Cell counting using Haemocytometer (RBC and WBC).
7. Pedigree analysis and construction: Symbols used and problems associated with autosomal recessive disorder, autosomal dominant disorder, Sex linked inheritance (X and Y)

8. Dermatoglyphics: Recording of print of fingertips and palm. Classifying ridges on the Finger tips: arch, loop, and whorl.Palm print - area demark as hypothenar, thenar and inter - digital areas, Recording presence or absence of Simian crease. Ridge Counting and angle calculation.

Reference Books:

1. Basic Human Genetics by EJ. Manage and A.P. Manage (1997 India Reprint) a Rastogi Publications, Meerut.
2. Emery's Elements of Medical Genetics- Peter Turnpenny, SlanEllard 15th Edition. 2017.
3. Essentials of Human Genetics by S.M. Bhatnagaretal (1999) IV edition. Orient Longman.
4. Genetic basis of common diseases by R. A. King et al, Oxford University Press 2002.
5. Genetics in Medicine by M.W. Thompson et al, 5 Edition, W.B. Sounders Company, London 1996.
6. Human Cytogenetics. Denise Rooney Oxford University Press, 2001.
7. Human Genetics – Bruce.R.Korf. 2000
8. Human Genetics : Concepts and Applications by Lewis R (2001) McGrawHi; Boston.
9. Human Genetics by S.D. Gangane (2nd edition-Reprint 2001), B.L Churchill Livingstone Pvt. Ltd., New Delhi.
10. Medical Genetics. Lynn Jorde John CareyMichael Bamshad. 2015.
11. Mendelian inheritance in Man by-Mc. Kusick V.A, (1998), 12 Edition, John Hopsins University Press.
12. Molecular Basis of Inherited Diseases, (6th Edition-1989) by Scriver, C.R. A.L. Beudit, W.S. Sty abnd D. Valle (EdsOMcGrawHill, New York.

Course Code	Laboratory Course –V	Course Type	L	T	P	C	CH
B19BG5X20	(Biochemistry)	HC	0	0	2	2	3

Prerequisites

Requires knowledge of enzymology.

Course Objectives:

1. To gain thorough practical knowledge on enzyme kinetics
2. To determine biochemical metabolites by colorimetric method.
3. To acquire the method of analysis of biochemical constituents in urine.

Course Outcomes:

After completing the course, the student shall be able to:

1. Understand the assay of enzyme activity using their respective standards.
2. Avail the practical knowledge of factors influencing enzyme activity.
3. Interpret the biochemical metabolites SGOT and SGPT by quantitative determination.
4. Understand the Creatine kinase by quantitatively

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3
B19BG5X 20	CO1	1		1				1	1		2	1	1	
	CO2	2	1	1	2			1	1		1	1	1	
	CO3	2	1	2	1			1	1		2	1	1	
	CO4	1	1	1					1		2	1	1	

Course Contents

1. Determination of total activity through preparation of standard curves, optimum temperature and pH of the following enzymes
   a. α amylase (using Standard curve of maltose)
   b. Acid phosphatase (using Standard curve of p-nitro phenol)
   c. Urease (using Standard curve of ammonium sulfate)
2. Determination of activity of SGOT ,SGPT&Creatine kinase

Reference Books:

1. An Introduction to practical Biochemistry—PlummerD.T, Tata Mc GrawHill
2. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry: Trevor Palmer, Horwood, (2001).
3. Methods in Enzymology; Colowick, S.P. et al., [Eds.] (1987) Vol. 152, Academic Press.
4. Methods of Enzymatic Analysis; Berg Meyer (1974) Vol. 1-X,
5. Experimental Biochemistry: A Student Publisher**:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
6. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
7. Introductory practical Biochemistry, Sawhney, Randhir singh, 11th Edition (2015)

SIXTH SEMESTER

Course Code	Plant Biotechnology	Course Type	L	T	P	C	CH
B19BG6010		HC	1	1	0	2	3

Prerequisites/Pre reading for the course:

- The student should be familiar with the basic concepts in botany and plant physiology
- The student should know basics in molecular biology and genetic engineering

Course Objectives:

To enable the students

1. To introduce the underlying principles involved in plant tissue culture.
2. To familiarize the students with the concepts and techniques in plant genetic engineering.
3. To understand the significance of transgenic plants in molecular farming.

Course Outcomes:

By the end of the course, the students will be able to

1. Describe the various plant tissue culture techniques with the associated advantages and disadvantages.
2. Explain the significance of somatic hybridization in creating new varieties through tissue culture.
3. Choose alternative plant biotechnology tools in place of genetic modification by engineering.
4. Comprehend the process of production of commercially important compounds through molecular farming.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3
B19BG6010	CO1	2	3	2	1	2	2	2	3	1	3	2	3	3
	CO2	2	3	2	1	2	1	2	1	1	3	2	2	3
	CO3	2	3	2	2	1	1	2	1	1	3	2	2	2
	CO4	2	3	2	2	1	1	2	1	1	3	2	3	3

Course Contents:

UNIT 1

Introduction to Plant tissue culture 13 hrs

Laboratory organization, Aseptic techniques, plant tissue culture media and growth regulators.Concept of totipotency.Micropropagation: Shoot tip and Axillary bud proliferation,

Organogenesis and Somatic embryogenesis.Organ culture: Anther, embryo and endosperm culture.Ovary and ovule culture. Secondary metabolite production through cell culture and hairy root culture.

UNIT II

Somaclonal Variation and Somatic Hybridisation 13 hrs

Concept and Screening of somaclonal variants. Applications of variants. Protoplast culture - isolation of protoplast- mechanical and enzymatic methods, viability of protoplast, protoplast fusion- PEG mediated and electrofusion, selection, culture of protoplasts, regeneration, screening and applications.Cybridisation and its applications.

UNIT III

Production of transgenic plants 11 hrs

Methods of plant transformation: *Agrobacterium* mediated gene transfer. Selectable and reporter genes. rDNA approaches for introducing herbicide tolerance, pest resistance-*Bt* cottonproduction, plant disease resistance-bacterial and viral resistance. Ethical issues associated with genetically modified plants.

UNIT IV

Molecular Farming 11 hrs

Edible vaccines from plants-water melon and banana as the host plant, Plantibodies- Various approaches, Production of PHB-targeted and non-targeted approach, Therapeutic protein production: production systems and strategies- Hirudinproduction , Industrial enzymes-Amylase, cellulase, phytases.

References

1. Adrian Slater, Nigel W. Scott, Mark R. Fowler. (2008).Plant Biotechnology: An Introduction to Genetic Engineering by Oxford University Press.
2. Adams, Food Microbiology Bhojwani. S.S and Razdan by M.K (2004). Plant tissue culture, Oxford and IBH Publishing Co, New Delhi.
3. Gamborg O.L. and Philips G.C. (1998) Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. New Delhi.
4. Razdan. M.K. (2003). An introduction to Plant Tissue Culture. Oxford and IBH Publishing Co, New Delhi.
5. Singh B D (2006). Plant Biotechnology. Kalyani Publishers.
6. Chawla H S (2000). Introduction to Plant Biotechnology. Science Publishers.

Course Code	Developmental Genetics	Course Type	L	T	P	C	CH
B19BG6020		HC	1	1	0	2	3

Prerequisites/Pre reading for the course:

1. Students should have the knowledge of developmental process.
2. Students should be familiar with gene expression.

Course Objectives:

The objective of this Course is to

1. To learn the essentials of developmental biology.
2. To get familiarized with the embryonic development.
3. To distinguish the organogenesis and metamorphosis.
4. To study the developmental disorders.

Course Outcomes:

After the end of the Course students will be able to:

1. Differentiate the developmental stages.
2. Compare the developmental milestones of different organisms.

3. Illustrate the phenomenon of organogenesis and metamorphosis.
4. Outline the characteristics of developmental disorders.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG6020	CO1	3	3	3		3	2	2			3	3	2	
	CO2	3	3				2				3	3		
	CO3	3	3	3	3	3	2				3	3	2	
	CO4	3	3	3			3	3	2		3	3	2	

Course Contents:

UNIT-I **12 hrs**

ESSENTIAL CONCEPTS IN DEVELOPMENTAL BIOLOGY

Early embryonic development in Frog, Gametogenesis , fertilization, cleavage, blastula and gastrula. Nuclear transplantation experiments in Amphibians and *Acetabularia* . Epigenesis and preformation - Generating new cells and organs — Cell-cell communication in development – Fate Maps .

UNIT-II **12 hrs**

EMBRYONIC DEVELOPMENT AND GERM LAYERSPECIFICATION

Genetics of development in plants – *Arabidopsis*: Flower development (Floral morphogenesis and Homeotic gene expression). Genetics of development in Animals - *Drosophila*: Early development; Origin of anterior-posterior and dorso-ventral polarity: Role of Maternal genes, Zygotic genes- Segmentation genes (gap, pair rule and segment polarity genes) and Homeotic selector genes. d. Switching genes on and off during development- Ex. Differential expression of haemoglobin *C. elegans* – Early development in Vertebrates – Early mammalian development – Origin and emergence of Ectodermal, Mesodermal and Endodermal cell layers

UNIT-III **10 hrs**

ORGANOGENESIS AND SEX DETERMINATION

CNS and epidermis –Neural crest cells – The Somites and their derivatives – Development of tetrapod limb –Development of gonads-– Sex determination .

.

UNIT-IV **14 hrs**

METAMORPHOSIS, REGENERATION AND AGEING

Insect and amphibian metamorphosis – Stem Cell mediated regeneration –Regeneration in planaria and zebrafish – Biology of senescence – Role ofmTOR pathway and telomeres in ageing (gerontology).

DEVELOPMENTAL DISORDERS

Embryonic origins of adult disease - Genetic errors of human development – Teratogenesis – Transgenerational inheritance of developmental disorders –Cancer as a disease of development – Disease models and mechanisms.

Reference Books:

1. Balansky, Text book of embryology.
2. Principles of Development by Lewis Wolpert et al. 5th Edition. oxford University press 2015.
3. Winter,P.C., Hickey,G.I. and Fletcher, H.L.(2002)Genetics, 4th edition,Viva Books
4. Lewin, Benjamin; Krebs, Jocelyn E.; Goldstein, Elliott S.; Kilpatrick, Stephen T. (2014),
5. Genes XI, Jones and Bartlett Learning.
6. Brown, T.A., Chapman and Hall (2011) Genetics a Molecular Approach, 2nd edition, Garland science.
7. Gilbert. (2013) Developmental biology. 10th edition.

Course Code	Metabolism - II	Course Type	L	T	P	C	CH
B19BG6030		HC	1	1	0	2	3

Prerequisites

Requires knowledge of pre-university, Chemistry of Biomolecules and its degradation.

Course Objectives:

1. Understand about the metabolism of amino acids.
2. Understand the metabolism of purine and pyrimidine nucleotides.
3. To know about the biochemical constituents related with diagnosis of diseases.
4. Understand the microbial pathogenicity and immune response.

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the general and various synthesis, degradation and diseases of animo acids.
2. Know biochemical constituent related with kidney, liver and other organ function tests.
3. Learn about different components required for the microbial growth. Also about the pathogenic virus and bacterial life cycle.
4. Know about the Cellular, humoral immunity, organ and different type of immune responsive cells

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG6030	CO1	2			2			2		3		2	1	
	CO2	3		2		3		3		2	3		2	2
	CO3	2		3		3		3	2		3	2		
	CO4	3		3		3		1		3	2	2	1	2

Course Contents

UNIT-I **12 hrs**

Amino acid metabolism: General reactions- transamination- definition, reactions catalyzed by SGOT and SGPT, importance of transamination; Deamination - definition, oxidative and non-oxidative, examples for oxidative deamination- L-glutamate and non-oxidative- serine, aspartic acid and glutamine. Decarboxylation - definition, decaboxylation of glutamic acid, Histidine. Urea cycle- individual reactions, importance of urea cycle, hyperammonemia, regulation of urea cycle. Interrelationship between urea cycle and TCA cycle. Biosynthesis of glycine from serine and choline. Biosynthesis of alanine from transamination reaction. Biosynthesis of cysteine from L-serine. Epinephrine and Nor-epinephrine- importance and biosynthesis from tyrosine. Histamine; biological importance and synthesis.Glucogenic and ketogenic amino acids.
Biosynthesis of non-essential amino acids; biosynthesis of Essential amino acids (Only overview-in plants) andtheir regulation.

Disorders of amino acid metabolism: Phenylketonuria, Alkaptonuria, Maple syrup urine disease, Methylmalonicaciduria, Parkinson's disease, Homocystinuria, and Hartnup'sdisease. Porphyrin biosynthesis and disorders of porphyrinmetabolism.

UNIT-II **12 hrs**

Nucleic acid metabolism: Biosynthesis of purine and pyrimidine nucleotides- sources of nitrogen and carbon atoms of purine and pyrimidine ring. Precursors of purineand pyrimidine biosynthesis. Reactions involved in the biosynthesis. Conversion of nucleotides to deoxynucleotides. Orotic acid uria- general features. Gout;generalfeatures. Biosynthesis of IMP; pathways from IMP to AMP and GMP; conversion to triphosphates; regulation of purine nucleotide biosynthesis, salvage pathways; synthesis of coenzymes (NAD^+, FMN, FAD, CoASH) Biosynthesis of UMP, conversion of triphosphates andregulation. Biosynthesisofpyrimidinenucleotidesynthesis; Deoxyribonucleotides and synthesis of dTTP- inhibitors of nucleotide metabolism and their use as anti-bacterial / anticancerdrugs Degradation of purine and pyrimidinenucleotides. Disorders of nucleotide metabolism: LeschNyhan syndrome, Gout, SCID, Adenosine deaminasedeficiency.

UNIT-III **12 hrs**

Urine:

Normal composition of urine- volume, specific gravity. Constituents- urea, uric, acid, creatinine, pigments and their clinical significance in brief. Kidney disorder.**Blood:** Normal constituents of blood. Urea, Uric acid, Creatinine, Glucose, Bilirubin, Total protein, Albumin/ globulin ratio-Variation in pathological conditions. Lipid Profile- Cholesterol, Triglycerides, lipoproteins, HDL and LDL. **Diognosticenzymes:**SGOT, SGPT, Alkaline Phosphatase. Cardiac injury profile- CPK and LDH.**Inborn errorsofmetabolism:** Sickle cell anaemia, Gylcogen storage disease, Neimann-pick disease, LeschNyhan syndrome**.**

UNIT-IV **12 hrs**

Study of Micro-organisms:

Staining micro-organisms – principle and procedure of gram stain and acid fast stain.**Microbial nutrition:** Growth of micro-organisms, measurement of growth, factors influencing growth – Nutrition,carbon source, Nitrogen source, Temperature, pH and oxygen. Batch and Continuous culture. Growth curve, phases of growth curve. Concept of synchronousCultures.

Antibiotics: Definition, Mechanism of action of penicillin streptomycin, and chloramphenicol, Antibiotic resistance in brief.**Viruses:** Classification based on genetic material with examples.Plant viruses – TMV, morphology, general characteristics and its replication. **Bacteriophages:** Morphology, general characteristics, life cycle (lysogeny and lytic cycle) of T-even Bacteriophage. Definition of Haptenes, Epitopes, General features. Antigenicity. Primary lymphoid organs. Immunoglobulin: Definition, types and structure. Antigen-antibody reaction invitro:Formation of antigen-antibody complex. Precipitation reactions- Immunodiffusion- single, double diffusion, immunoelectophoresis. ELISA, RIA.

Immunity: Cellular and humoral immunity. Role of immunologically important organs and cells-bone marrow, thymus, spleen and lymphocytes. Formation and functions of T and B lymphocytes and macrophages. Helper T-cells and Killer T-cells. Allergy- definition, types. AIDS.

Reference Books:

1. Fundamentals of Biochemistry-JL Jain, S. Jain and N.Jain (2000), S.Chand.
2. Text Book of Microbiology - R.Ananthanaryan and CKJ Pannikar (2005) CBS Publishers.
3.Immunology: Introductory text book- NandiniShetty(2008) .New AgePublications
4. M. Pelczar, E.C.S. Chan and M.R. Krieg, MICROBIOLOGY, McGraw Hill Inc., Singapore (1997).
5. Powar, Daginawala – Himalaya Publishing House. General Microbiology, Vol. I& II.
6. Stanier, Adelberg, Ingraham – The Macmillan Press – London. General Microbiology.
7. NandiniShetty. Introduction to Immunology.
8. J. Kuby "Immunology" 3rd edn., Mosby Year Book Co., England

Course Code	Animal Biotechnology	Course Type	L	T	P	C	CH
B19BG6041		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

- The student should be familiar with knowledge of zoology
- The student should have the basic knowledge of molecular biology and genetic engineering

Course Objectives:

1. To Identification and characterization of animal breeds.
2. To develop DNA - based diagnostics and genetically engineered vaccines for animals.
3. To study animal genomics and its varied applications.
4. To develop embryo - transfer technology, cloning, transgenic animals.

Course Outcomes:

By the end of the course the students will be able to:

1. Implment tissue culture techniques in th lab .
2. Know the technology for the production of transgenic animals.
3. Implement the transgenic technology for the production of Vaccines and biotehrapeutics.
4. Understand the ethical isuuess and policies regard to transgenic technology.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3
B19BG604 1	CO1	2	3	3	2	2	2	2	1	2	3	2	3	2
	CO2	2	3	3	2	2	1	2	1	2	3	2	3	2
	CO3	2	3	3	2	2	1	2	1	2	3	2	3	2
	CO4	2	3	3	2	2	1	2	1	2	3	2	2	2

Course Contents

UNIT-I:Animal tissue culture and cell lines **12 Hrs**

Cell culture technique: cell culture media, sterilization techniques, Types of Animal cell culture; Organ culture; Primary cellcultures; Secondary cultures, Cell lines: characteristic feature of cell lines and maintenance,Established cell lines; commonly used cell lines, Methods of separation of various cell types (physical and enzymatic methods), Commercial applications of cell culture: Cell based manufacturing (vaccines),

UNIT-II:SpecializedCell CultureTechniques **12 Hrs**

Transfection in animal cells, Production of special secondary metabolites/ products (insulin, growth hormone, interferon, t – plasminogen activator, factor VIII etc), processing of chosen protein; Growth of cells in suspension and bioreactors for large scale culture of cells, various downstream processes

UNIT-III:Transgenic animals, Vaccines and Tissue Engineering **12 Hrs**

Transgenic animals: Mice, Sheep, Fish; use and applications. Production and applications of monoclonal antibodies; Production of vaccines using animal cell culture: Polyclonal, monoclonal antibodies and humanized vaccines, recombinant vaccines, DNA vaccines. Tissue engineering: Elementary idea of tissue engineering, Xenotransplantation.

UNIT-IV: Applications of Animal Biotechnology **12 Hrs**

Stem cell culture, Embryonic and adult stem cell culture and its applications, Somatic gene therapy, Application of transgenic animals as models of human diseases. Embryo transfer technologies in cattle and its application, Ethical issues in relation to animal biotechnology.

Reference Books:

1. Text book of Animal Biotechnology by B.Singh, S.K.Gupta and S.K Gautam Teri publishers
2. Culture of Animal cells by R.Ian Freshney seventh edition Wiley publishere

3. Animal Biotechnology and Ethics | Alan J. Holland | Springer
4. Animal Biotechnology: Models in Discovery and Translation, Second Edition, Anchal Singh, Ashish Verma.
5. Animals as Biotechnology: Ethics, Sustainability and Critical Animal Studies Book by Richard Twine
6. Transgenic Animal Technology: A Laboratory Handbook Book by Carl A. Pinkert
7. Transgenic Insects: Techniques and Applications,by Mark Q. Benedict 2014.
8. The Role of Biotechnology in Improvement of Livestock: Animal Health and Biotechnology by Muhammad Abubakar, Ali Saeed, Oguz Kul

Course Code	Bioinformatics & Biostatistics	Course Type	L	T	P	C	CH
B19BG6042		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

- The student should have knowledge of molecular biology and biochemistry
- The student should have basic knowledge of computers and mathematics

Course Objectives:

1. To acquire various principles of biostatistics.
2. To understand the importance of statistics in biological sciences.
3. To understand the importance of computer science in biological sciences.
4. To understand the tools, databases and softwares used in biological data understanding and interpretation.

Course Outcomes:

By the end of the course the students will be able to:

1. Analyse the different statistical measures required for studying the biological events.
2. Understanding the concepts of statistics which can be implemented in research purposes.
3. Explain the basic principles and concepts of biology, computer science and Mathematics.
4. Apply existing software effectively to extract information from large databases and to use this information in computer modeling.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS /COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03
B19BG6042	CO	2	3	3	3	1	2		3		3	2	3	3
	CO	2	3	3	3	1	2		3		3	2	2	3
	CO	2	3	3	3	1	2		3		3	2	2	2
	CO	2	3	3	3	2	2		4		3	2	3	3

Course Contents:

UNIT-I **10 hrs**

Introduction to Biostatistics: Population and sample, Types of Variables, Variables in biology; Collection of data: Classification of Data, Primary and Secondary Data, Diagrams and Graphs; Frequency Distribution: Relative and Percentage Relative Frequency, Discrete and continuous frequency, Frequency Graphs

UNIT-II **14 hrs**

Descriptive Statistics: Measures of Central Tendency: Mean, Median and Mode, Measures of Dispersion-Variance andStandard deviation, Test of Hypothesis -Students Test, Chi square Test, Probability- Definition and rules Distribution - Normal, Binomial and Poisson.

UNIT-III **12 hrs**

Fundamentals of Bioinformatics: Introduction to Bioinformatics, Goal, Scope, Applications, Limitations; Biological Databases: Types of Databases, Biological databases; Literature databases; Genome browsers; Sequence Analysis: Basic concepts of sequence similarity, identity and homology; Scoring matrices: basic concept of a scoring matrix PAM, BLOSUM series; Sequence alignment: Basic concepts of sequence alignment, Needleman and Wunsch, Smith and Waterman algorithms for pairwise alignments, gap penalties, use of pairwise alignments for analysis of Nucleic acid and protein sequences and interpretation of results.

UNIT-IV **12 hrs**

Multiple sequence alignments (MSA): The need for MSA, basic concepts of various approaches for MSA; Phylogenetic Analysis: Definition and description of phylogenetic trees and various types of trees; Structure Predictions: Gene structure prediction, protein structure prediction; **Drug design:** Drug discovery process. Target identification and validation, lead optimization and validation. Methods and Tools in Computer-aided molecular Design.

Reference Books:

1. Edwards David, Stajich Jason, Hansen David, Bioinformatics: Tools and Applications, Springer-Verlag New York. 2009.
2. Jin Xiong, Essential Bioinformatics, Cambridge University Press, 2006.
3. T.R. Sharma, Genome Analysis and Bioinformatics: A Practical Approach, 1st Edition, IK International publishing house Pvt. Ltd. 2009.
4. Cynthia Gibas, Per Jambeck, Developing Bioinformatics Computer Skills, O'Reilly & Associates, 2001.
5. An Introduction to Biostatistics: N Gurumani, MJP Publishers, Chennai. ISBN 81-8094-006-3 (pbk)
6. Text Book of Biostatistics I: A.K Sharma, Discovery Publishing House, 2005 - Biometry - 480 pages

Course Code	Genotoxicity	Course Type	L	T	P	C	CH
B19BG6051		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

1. Students should know the concept of mutagenicity.
2. They should be aware of the chemical nature of compounds.

Course Objective

1. Facilitate the understanding of general principles of toxicology, cellular mechanism against drug targets and regulatory protein functions.
2. Impart knowledge of mutagenesis and chemical carcinogenicity
3. Enable students to know the principles of absorption, distribution, metabolism, excretion and toxicity of the drug administration.

Course Outcomes:

After completing the course, the student should be able to:

1. Design and assess exposed chemicals based on cytotoxicity studies.
2. Analyze and interpret exposure measurement applying different modelling tools for toxicity study.
3. Evaluate and measure the degree of toxicity.
4. Adapt and develop oral and written skills to effectively communicate and analyze toxicology related knowledge in scientific literatures

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG6051	CO1	3	3	3	3	2	3	3	2		3	3	3	3
	CO2	3	3	3	3	3	3	2	2		3	3	3	3
	CO3	3	3	3		2	2				3	3	2	3
	CO4	3					3	3	3		3	3		

Course Contents:

UNIT-1 **12 Hrs**

General Principles and terminology, Types of toxicity, Factors affecting toxicity,

Acute, subacute and chronic toxicity, Classification of toxicants, Estimation of toxicity; LD50; LC50, LT50. Teratogens, Food additives and contaminations; Air, water and soil pollutants .Genotoxicity .

UNIT-II **12 Hrs**

Categories of mutations; Mechanisms of spontaneous and induced mutations; gene mutations, recombination and transposable elements in genetic variation.

Numerical aberrations – aneuploidy and polyploidy; Structural aberrations – deletion, duplication, inversion, translocation. Role of numerical and structural changes of chromosomes, Mechanisms of DNA damage repair: Proof reading activity of DNA polymerases, Direct reversal of damaged DNA, Post replication repair, Error prone repair, Repair of double strand breaks.

UNIT-III **12 hrs**

Toxicity studies-Acute, sub-acute and chronic studies: Protocols, objectives, methods of execution and regulatory requirement. Reproductive toxicology assessment: Male reproductive toxicity, spermatogenesis, risk assessment in male reproductive toxicity, female reproductive toxicology, oocyte toxicity, alterations in reproductive endocrinology, relationship between maternal and developmental toxicity.

UNIT-IV **12 hrs**

Mutagenicity: In vitro tests for gene mutations in bacteria, chromosome damage, gene mutations in vivo (micronucleus tests and metaphase analysis) in rodents. Carcinogenicity studies: In vivo and In vitro studies e. Toxicological requirements for biological and bio-tech products: Safety analysis, concept of safety Pharmacology, antibodies, transmission of viral infections, residual DNA.

Reference Books:

1. Goodman and Gilman's The Pharmacological Basis of Therapeutics. (International Edition) McGraw Hill, New York (2001), 10th edition.
2. Pharmacology by Rang HP, Dale MM and Ritter JM. Churchill Livingstone, London, 6th 3. Edition, 1999.
3. Basic and Clinical Pharmacology by Bertram G Katzung (International Edition) Lange Medical Book/McGraw-Hill, U.S.A. (2001) 8th Edition.
4. Clinical Pharmacy by D.R. Laurence, P.N. Bennett & Mi. Brown, 8th Edition Churchill Livingstone 1997.
5. Clinical pharmacy and therapeutics –Eric T,Herfindal, Wil liamsand Wilkins Publication

Course Code	Applicative Genetics	Course Type	L	T	P	C	CH
B19BG6052		SC	2	0	0	2	2

Prerequisites/Pre reading for the course:

1. Students should have basics of Recombinat DNA technology.
2. They should have knowledge about sequencing.

Course Objectives:

The Objectives of this course is to:

1. To understand the process of recombinant DNA technology and its applications.
2. To learn the methodology of DNA fingerprinting and its applications.
3. To explore the world of genomics and proteomics.\
4. To study the basics of bioinformatics.

Course Outcomes:

After completing the course, the student should be able to:

1. Outline the process involved in the production of molecular therapeutics.
2. Design the sequencing process and analyse the data.
3. Align the sequences and interpret them in constructing phylogeny.
4. Apply the knowledge of genetics in pharmacogenomics and transgenic technology.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02
B19BG6052	CO1	3		3					3		3	3	3
	CO2	3	3	3	3	2	2				3	3	3
	CO3	3	3	3	3	3	3		3		3	3	3
	CO4	3	3	3	3	3	3				3	3	3

Course Contents:

UNIT-I **12 Hrs**

Cryogenetics: Stem cell bank, cell bank, gene bank, cDNA library, embryo bank , sperm bank, pollen bank,

Cryopreservation: DNA Fingerprinting

Methodology of DNA fingerprinting

Molecular markers –RAPD, RFLP, Microsatellite, SNPs, STR

Applications in Forensic science, Medicolegal aspects.

UNIT-II Genomics and Proteomics **12 Hrs**

Genomics:

Structural and functional genomics. Whole genome sequencing – Maxam-Gilbert sequencing, Sanger sequencing, Pyrosequencing, Next generation sequencing.

Protein engineering and proteome analysis:

Insertional and deletion mutagenesis, Site directed mutagenesis, Proteome analysis, Protein arrays and their applications.

UNIT-III Bioinformatics **12 Hrs.**

Biological databases: Overview, modes of database search, mode of data storage (Flat file format, db0tables), flat0file formats of GenBank, EMBL, DDBJ, PDB.

Sequence alignment:

Concept of local and global sequence alignment, Pairwise sequence alignment, scoring an alignment, substitutional matrices, multiple sequence alignment.

Phylogenetic analysis:

Basic concept of phylogenetic analysis, rooted/unrooted trees, approaches for phylogenetic tree construction (UPGMA, Neighbor joining, Maximum parsimony, Maximum likelihood).

UNIT-IV Applicative Genetics **12 Hrs.**

Transgenics and animal cloning: Creating transgenic animals and plants. Animal cloning. Restriction and regulation for the release of GMOs into environment. Ethical, legal, social and environmental Issues related to rDNA Technology. Biosafety and Bioethics.

Pharmacogenetics: History, Early evidence; Clinical determinants; Molecular insights (genes involved in pharmacokinetics and pharmacodynamics of drugs); Applications in pre-prescription testing. Pharmacogenomics, Clinical trials.

Reference Books:

1. Gene cloning and DNA analysis, T.A.Brown (2010) 6th edition, Wiley-Blackwell publication
2. Human Molecular Genetics, Peter Sudbery (2002) 2nd Edition, Prentice Hall
3. Human Molecular Genetics, Tom Strachen and Andrew P. Read (1999) 2nd edition, John Wile and sons.
4. Molecular Biotechnology, Principles and application of recombinant DNA Glick and Pasternak. 2010.
5. Introduction to bioinformatics Arthur M Lesk

Course Code	Biochemistry of Plant Sciences	Course Type	L	T	P	C	CH
B19BG6061		SC	2	0	0	2	2

Prerequisites:

Requires knowledge of pre-university, the basic concept of plants and its Biological importance.

Course Objectives:

1. To understand basic plant cell development, structure, function and plant physiology.
2. To know plant hormones and secondary metabolites.
3. To understand the biological nitrogen fixation by microorganisms and photosynthesis in plant.
4. To understand recombinant technology for transgenic plant development

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the plant cell and physiology.
2. Learn about the plant hormones and secondary metabolites
3. Gain an understanding on about the biological nitrogen and photosynthesis in plant.
4. Understand the concepts in vector, gene cloning, biofertilizers and pesticide management

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS0 2

B19BG6061	CO1	3		3		2	2		3		3	1	
	CO2	2		2	3		2		2		2		2
	CO3	1	3		2		3	2		2	3	3	
	CO4	3		3		3		2		3	3	2	2

Course Contents

UNIT-I **12 hrs**

Plant Structure and development: Structure and biochemical aspects of specialised plant cell organelles - cell plate, primary and secondary cell walls, plsmodesmata, importance of vacuoles, characteristics of meristematic cells. Cell division - Mitosis, Meiosis, extension, differentiation and their controls.

Plant Physiology: General features of Photosynthesis, Respiration and photorespiration, Nitrogen metabolism, Plant hormones, Sensory photobiology, Stress physiology. Solute transport - role of water, absorption, adsorption, conduction and transpiration, guttation water balance and stress. Photo assimilate translocation. Defence system in plants. Mineral metabolism - role of different minerals absorption and translocation of inorganic and organic substances.

UNIT-II **12 hrs**

Secondary Metabolites: Classification, isolation, characterization, Biosynthetic pathway of secondary metabolites, tracer techniques.Special features of secondary plant metabolism formation and functions of phenolic acids, tannins lignins, flavonoid pigments, surface waxes, cutin and suberin - the plant protective wats, terpenes.

Plant Hormones - Growth regulating substances and their mode of action. Role of auxins, gibberllic acid, abscisic acid and cytokinins in the regulatory cell extension, germination, embryogenetics growth and development.

UNIT-III **12 hrs**

Biological Nitrogen Fixation:

Nitrogen cycle, components of nitrogenase complex, stoichiometry of nitrogen fixation, nifgenes.

Photosynthesis: Photosynthetic pigments and Photosynthetic unit. Light reactions – photosystem- I and II and their interactions. Synthesis of NADPH, photolysis of water, synthesis of ATP in cyclic and non-cyclic photophosphorylation. Dark reactions - chemical reactions upto the synthesis of fructose-6-phosphate. Trans- ketolation and aldolation reactions (shall be given in the form of flow chart). Interdependence of light and dark reactions. C_3 and C_4 plants- definition and C_4 pathway (HSK pathway).Bacterialphotosynthesis.

UNIT IV **12 hrs**

Agricultural Biotechnology: Biopesticides, integrated pest control, sericulture, biofertilizers, Bio-

communication, bioremediation, bio-catalysis, phytomedicine.Tissue culture Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer. Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane etc.

Reference Books:

1. Plant Biology. Allison Smith et al. Garland Science, 2010.
2. Organic Chemistry- Finar Natural Product Chemistry at a Glance by S P Stanforth.
4. Plant Biochemistry -Hans-Walter Heldt in cooperation with Fiona Heldt
5. Plant Physiology - TaizZeiger
6. Biochemistry & Molecular Biology of Plants. Bob Buchanan, Wilhelm Gruissem, Russell Jones. John Wiley & Sons, 2002.
7. Phytochemical Methods A Guide to Modern Techniques of Plant Analysis by JB Harborne. Springer, 1998**.**
8. Plant Biochemistry by P. M. Dey and J. B. Harborne, Harcourt Aria PTE Ltd. Singapore.
9. Plant Physiology by Salinbury.
10. Plant Physiology by Davin.
11. Plant Physiology by Srivastava.

Course Code	Biochemistry of Animal Sciences	Course Type	L	T	P	C	CH
B19BG6062		SC	2	0	0	2	2

Prerequisites:

Requires knowledge of pre-university, Need the basic concept of Microbiology, and Immunotechniqoes.

Course Objective:

- Understand the scope of biochemistry and molecular biology in animal sciences.
- Learn about the maintenance of cell culture, growthkinetics and type of media.
- To know about biochemical constituents in various tissues and their related disorders.
- To gain knowledge in clinical biochemistry

Course Outcomes:

After completing the course the student shall be able to:

1. Understand the scope of biochemistry and molecular biology in animal sciences
2. Learn about the cell culture, growth of cell culture and different types of media.
3. Know various metabolic disorders concerned with deficiency and excess of biochemical constituents
4. Acquire practical skills in clinical diagnostics of various diseases.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS0 2
B19BG6062	CO1	3		3		3		2		2	3	1	2
	CO2	2		2		2			3			1	
	CO3	3	2	2	2	3	3	2		2	3		1
	CO4	2		3		3		2		2	3	1	2

Course Contents

UNIT-I **12 hrs**

Scope of Biochemistry and molecular biology in animal sciences. Structural and functional organization of prokaryotic and eukaryotic cells, viruses and bacteriophages. Compartmentalization of metabolic processes within the cell and fractionation of subcellular components. Structure and functions of biomembranes with special reference to active transport
of ions and metabolites. Extra and intracellular communication. General description of cell culture, hybridoma and animal cloning techniques.

UNIT-II **12 hrs**

Culture techniques of cells- Disaggregation of cells, cell viability and preparation of substrate. Primary cell culture, Sub culture and cell lines- Characteristics of cell line and their maintenance, kinetics of cell growth and applications of cell line. Culture media – Type of media (Serum, Serum free and chemically defined media). Tissue and Organ culture – Different methods of tissue and organ culture. Embryo – culture and transfer in farm animals.

UNIT-III **12 hrs**

Blood composition and their biochemical constituents of erythrocytes, leucocytes and platelets. Important plasma proteins and their functions. Haemoglobin in oxygen and carbon dioxide transport. Composition and metabolism of muscle, connective, tissue, cartilage, bone, nervous, tissue, adipose tissue and mammary tissue.

Clinical significance of iron, iodine calcium and phosphorus metabolism in domestic animals and human metabolic functions, Deficiencies and nutritional significance of water soluble , lipid soluble vitamins B and Trace elements in animals, human, neutraceuticels & probiotics.

Metabolic function of different hormones and associated disorders.

UNIT-IV **12 hrs**

Approaches to clinical biochemistry : Concepts of accuracy, precision, sensitivity and reproducibility; Quality control, fixation of normal range. Collection and processing of blood and urine samples, Anticoagulants, Preservative for blood and urine, Transport of biological samples Disorders of carbohydrate, protein,lipid and nucleic acid metabolism.

Clinical significance of non-protein nitrogenous compounds.Liver,Kidney and Gastric function tests.

Reference Books:

1. Modern Biotechnology Primrose, S.B. Blackwell Scientific Pub..,London, England

2. Genetic Engineering SandhyaMitra Macmillan India Ltd. Principles and Practice

3. Elements of Biotechnology Gupta, P.K. Rastogi& Company Meerut

4. Animal Cell Culture Fresheny, R. I.

5. Practical Biochemistry Wilson, Kand walker, J

6. Instrumental methods of Analysis Willard

7. Practical Clinical Biochemistry-Harold Varley, Fifth edition,CBS Publication and Distributors, New Delhi.

8. Medical BiochemistryDr.M.N.Chatterjee III Edition,1998JAYPEE BROTHERS, Medica Publishers (p) LTD, NewDelhi.

9.Essentials of Medical Physiology 7th Edition 2016 by KSembulingam Prema Sembulingam.

10. Textbook of Biochemistry for Medical Students by VasudevanDM

Course Code	Skill Development Courses	Course Type	L	T	P	C	CH
B19BG6070		RULO	1	1	0	2	3

Note: The students will have to undergo Skill Development course being conducted by Training and Placement cell of the University.

Course Code	Plant Biotechnology Lab	Course Type	L	T	P	C	CH
B19BG6080		HC	0	0	2	2	3

Prerequisites/Pre reading for the course:

The student should have basic knowledge of botany, plant anatomy and histology

Course Objectives:

1. Introduce the basic techniques in plant tissue culture.
2. Familiarize the students with the techniques in plant regeneration.
3. Understand the significance of artificial seed production for propagation.

Course Outcomes:

After completing the course the student shall be able to:

1. Acquire the knowledge about the techniques of Plant Tissue Culture, Lab, organization & measures adopted for aseptic manipulation and nutritional requirements of cultured tissues.
2. Explain the techniques of culturing tissues protoplasts & anther culture.
3. Apply the large scale clonal propagation of plants through various micropropagation techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS0 3

B19BG6080	CO1	2	3	3	2	2	2	2	1	1	3	2	3	3
	CO2	2	3	3	2	2	1	2	1	1	3	2	3	3
	CO3	2	3	3	2	1	1	2	1	1	3	2	3	3
	CO4	2	3	3	2	1	1	2	1	1	3	2	3	3

Course Contents:

1. Organisation of Tissue culture lab
2. Preparation of Murashige and Skoog's Medium
3. Single node culture
4. Shoot tip culture
5. Callus cultureand initiation of suspension culture
6. Anther culture for haploid plant production
7. Isolation of Protoplast from various sources
8. Preparation of synthetic seeds

Reference Books:

1. Christou P and Klee H. (2004). Handbook of Plant Biotechnology. John Wiley and Sons.
2. Dixon RA. (2003). Plant Cell Culture. IRL Press.
3. George EF, Hall MA and De Klerk GJ. (2008). Plant Propagation by Tissue Culture. Agritech Publ.
4. Gamborg O.L. and Philips G.C. (1998) Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. New Delhi.
5. Hammond J, P McGravey and Yusibov.V (2000). Plant Biotechnology, Springer verlag.
6. Kirakosyan A and Kaufman P.B. (2009) Recent Advances in Plant Biotechnology
7. Razdan. M.K. (2003). An introduction to Plant Tissue Culture. Oxford and IBH Publishing Co, New Delhi.

Course Code	Developmental Genetics Lab	Course Type	L	T	P	C	CH
B19BG6090		**HC**	**0**	**0**	**2**	**2**	**3**

Prerequisites/Pre reading for the course:

1. Students should know the developmental process.
2. They should be capable of Logical thinking.

Course Objectives:

1. To study the developmental pattern of different stages.
2. To understand the involvement of genes in development.
3. To study the potentiality of organ formation.

Course Outcomes:

After the course, student will be able to

1. Outline the patterns of the development.
2. Co-relate the gene expression and development.
3. Analyse the development of organs from pre-determined mass of cells.

4. Involve in project-based learning.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG60 90	CO1	3	3			3	2				3	3	2	
	CO2	3	3			3					3	2	2	
	CO3	3	3			3					3	3		
	CO4	3	3	3	3	3	3	3	3	3	3	3	3	3

Course Contents

1. Early embryonic development in Frog- Egg, cleavage, blastula and gastrula.
2. Genetics of development in Arabidopsis – ABC model Homeotic gene expression (Slide/Chart)
3. Genetics of development in Drosophila - Anterior-posterior/dorso-ventral polarity (Slide/Chart)
4. Study of imaginal discs in *Drosophila*
5. Project work

Reference Books:

1. Balansky, Text book of embryology.
2. Developmental biology by Scott.F.Gilbert. Sinauer Associates, Sunderland. 2000.
3. Principles of Development by Lewis Wolpert et al. 5th Edition. oxford University press 2015.
4. Winter,P.C., Hickey,G.I. and Fletcher, H.L.(2002)Genetics, 4th edition,Viva Books
5. Lewin, Benjamin; Krebs, Jocelyn E.; Goldstein, Elliott S.; Kilpatrick, Stephen T. (2014),
6. Genes XI, Jones and Bartlett Learning.
7. Brown, T.A., Chapman and Hall (2011) Genetics a Molecular Approach, 2nd edition, Garland science.
8. Gilbert. (2013) Developmental biology. 10th edition.

Course Code	**Laboratory Course (Biochemistry- VI)**	**Course Type**	**L**	**T**	**P**	**C**	**CH**
B19BG6X10		**HC**	**0**	**0**	**2**	**2**	**3**

Prerequisites:

Requires knowledge of pre-university, Need the basic concept of Microbiology, and Immunotechniqoes.

Course Objective:

To learn microbiology, molecular and immunological experiments.

Course outcomes:

After completing the course the student shall be able to:

1. Prepare the microbial culture.
2. Isolate and characterize microbes.
3. Identify antigens by immunological methods.
4. Separate and quantify DNA from different sources.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS COS	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PS01	PS0 2	PS03
B19BG6X 10	CO1	2		3		2		3		2	2	2	2	
	CO2	2		2	3				2			2		1
	CO3	3	2			2	2	3	3		3	2	2	
	CO4	3		2	3			2	2	3		2	2	1

Course Contents

1. Preparation of microbial culture media. Sterilization and staining methods (Gram and endospore staining)
2. Isolation and characterization ofmicroorganisms from soil, sewage water and fermented foods.
3. Alcoholic and Sugar fermentation in Microorganisms
4. Identification of antigen by OuchterlonyImmuno diffusion technique.
5. Immunoelectrophoresis of serum &Complement fixation test.
6. Isolation, digestion (restriction enzymes), separation (by agar-gel-electrophoresis) & quantification of DNA (by DPA method).
7. Separation of isoenzymes of LDH by electrophoresis.

Reference Books:

1. Text book of Clinical Chemistry-Teitz
2. Practical Clinical Biochemistry- Harold Varley CBS, 6th ed. NewDelhi 2002
3. An Introduction to practical Biochemistry—PlummerD.T, Tata Mc GrawHill
4. Lab manual of Biochemistry, Immunology and BioTechnology, Artinigam and Archana Ayyagiri -- Tata Mc GrawHill.
5. Principles and techniques of Biochemistry and Molecular Biology; Keith Wilson and John Walker; 6th Edn. (2005) Cambridge University Press.
6. Experimental Biochemistry: A Student Publisher**:** I.K. International Publishing House Pvt. Ltd.(Deshpande)
7. Biochemical methods S.Sadasivam A Manickam, New Age International Pvt Ltd Publishers; Third edition
8. Introductory practical Biochemistry , Sawhney, Randhir singh, 11th Edition (2015)

Course Code	Project	Course Type	L	T	P	C	CH
B19BG6X20		**HC**	**0**	**0**	**4**	**4**	**6**

Objective:

To carry out the research under the guidance of supervisor and in the process learn the techniques of research.

Outcomes:

On successful completion of the project, the student shall be able to:

1. Familiarize with literature search
2. Conduct the survey related to research
3. Interpret the research data.
4. Write report and defend the research findings

Each student will choose the topic of research preferably from any area of soft cores studied and work under the guidance of allocated faculty member. The project shall be as far as possible application oriented or societal need based that could be useful to the society. It shall also be related to Bioinformatics related industry, in which case the student may opt co-supervisor from the concerned industry. The student will have to make a preliminary experiment in broad area of his/her area of interest and decide on the topic in consultation with his/her supervisor(s). The project work floated should be completed within 16 weeks and project report has to be submitted within the stipulated date by the University/ within 18 weeks whichever is earlier. The student has to meet the concerned supervisor(s) frequently to seek guidance and also to produce the progress of the work being carried out. The student should also submit progress report during 5th week and 10th week of the beginning of the semester and final draft report with findings by 15th week. After the completion of the project the student shall submit project report in the form of dissertation on a specified date by the School.

CAREER OPPORTUNITIES

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their

employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Biotechnology, Biochemistry, Genetics isnot only the knowledge in the subject, but also the skill to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality

development, career building, English proficiency, reasoning, puzzles, and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his / her interest and march forward to make better career. The School of Applied sciences also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU's with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.