REVA UNIVERSITY
Bengaluru, India

# SCHOOL OF APPLIED SCIENCES

## B.Sc. – BIOINFORMATICS, MATHEMATICS, COMPUTER SCIENCE

HANDBOOK: 2018-19

Rukmini Educational Charitable Trust

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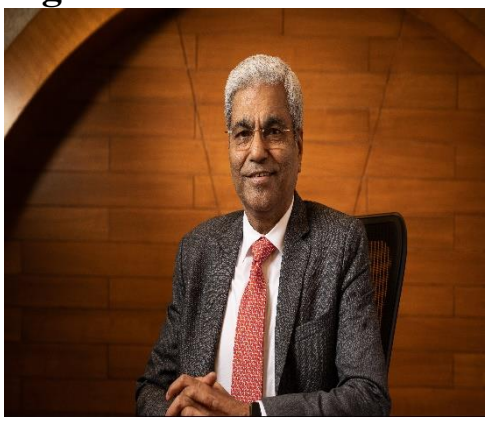
# Chancellor's Message



*"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-cantered 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 teamwork 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 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 - many 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 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 Centres" 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 endeavour 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 graduates in a big way. 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.

The B.Sc. (BMCs) degree program of REVA University is designed to prepare biotechnologist, biochemists, genetics, scientists, teachers, professionals & administrators who are motivated, enthuastics & creative thinkers to meet the challenges of growing economy as well as to fulfil 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. 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.

This handy document containing brief information about B.Sc. (BMCs) program, scheme of instruction and detailed course content will serve as a guiding path to you to move forward in a right direction.

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

**Dr. Beena G**

Director, School of Applied Sciences

# 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 fulfil 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 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and connective 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 No. 80 dated 7th February 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 center, 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.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines. The curriculum of each Programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

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 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 MOUs with many industries, business

firms and other institutions seeking their help in imparting quality education through practice, internship and 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 topmost 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 Genetics, Molecular Biology, Biotechnology, Biochemistry, Chemical Sciences, Synthetic chemistry, Nano chemistry, Nanotechnology, bioinformatics, Plant and Agricultural Research, 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, Nana 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, Counsellors 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, Oklahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC2, VMware, SAP, Apollo etc., to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitate 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 IISc., 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 awards instituted by REVA University is **'Lifetime 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 Lifetime 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 at 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 won

medals 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 class is every day 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 honoured 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.

## Mission

- 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 M.Sc. degree programs in Biochemistry, Biotechnology, Bioinformatics, Microbial Technology, Genetics, Chemistry, Physics, Mathematics and B. Sc with various combinations viz, Physics Chemistry and Mathematics (PCM), Physics, Mathematics, and Statistics (PMSt), Mathematics, Statistics and Computer Science (MStCs), and Biology (Bioinformatics), Mathematics & Computer Science (BMCs) and Post Graduate Diploma in Clinical Research Management. 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 is socially relevant and transforms them to become global citizens.

### Mission

- To achieve excellence in studies and research through pedagogy and support interface between industry and academia.
- To create intellectual curiosity, academic excellence, and integrity through multidimensional exposure
- To establish state of the art laboratories to support research and innovation and promote mastery of science.
- To inculcate an ethical attitude and make students competitive to serve the society and nation.

# BOS MEMBERS

| Sl.No. | Name of the Member | Designation |
|---|---|---|
| **1** | **Prof. Shilpa B R**<br>Professor, Department of Bio Technology, REVA University, shilpa.br@reva.edu.in; 9900602752 | **Chairman** |
| **2** | **Dr. Prashantha C.N**<br>Assistant Professor<br>Department of Bio Technology, REVA University, prashantha.cn@reva.edu.in; 9844158444 | **Biology –** Internal Member |
| **3** | **Mr. Vivek Chandra Mohan**<br>Assistant Prof, Department of Biotechnology<br>Siddaganga Institute of Technology, Tumakur | **Biology –** External Member |
| **4** | **Dr. Harish Babu G A**<br>Professor and coordinator, Department of Mathematics, REVA University, harishbabuga@reva.edu.in; 9845549977 | **Mathematics –** Internal Member |
| **5** | **Dr. Uday Kumar K. N**<br>Associate Professor, Department of Mathematics, REVA University, udaykumarkn@reva.edu.in; 9980923283 | **Mathematics –** Internal Member |
| **6** | **Dr. Latha Devi P**<br>Assistant Professor, Department of Mathematics, GFGC Yelahanka, lathadevipuli@gmail.com; 9448259415 | **Mathematics –** External Member |
| **7** | **Prof. Prasanna Kumar R B**<br>Assistant Professor, School of Computer Science and Applications, REVA University, prasannakumarrb@reva.edu.in; 9342203018 | **Computer Science –** Internal Member |
| **8** | **Mr. Kiran Kumar A N**<br>Senior Member Technical Staff, Oracle India Pvt Ltd, Thavarekere, Bangalore. kiran.f.kumar@oracle.com; 9945508652 | **Computer Science –** External Member |

# B.Sc. - BMCs

# Bioinformatics: (Biology, Mathematics & Computer Science)

**Programme Overview**

Bioinformatics is an interdisciplinary field that develops methods and software tools for understanding biological data. As an interdisciplinary field of science, bioinformatics combines biology, computer science, mathematics and statistics to analyse and interpret biological data. The primary goal of bioinformatics is to increase the understanding of biological processes. What sets it apart from other approaches, however, is its focus on developing and applying computationally intensive techniques to achieve this goal. Examples include: pattern recognition, data mining, machine learning algorithms, and visualization. Major research efforts in the field include sequence alignment, gene finding, genome assembly, drug design, drug discovery, protein structure alignment, protein structure prediction, prediction of gene expression and protein–protein interactions, genome-wide association studies, the modelling of evolution and cell division/mitosis.

Bioinformatics now entails the creation and advancement of databases, algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data. Over the past few decades, rapid developments in genomic and other molecular research technologies and developments in information technologies have combined to produce a tremendous amount of information related to molecular biology. Bioinformatics is the name given to these mathematical and computing approaches used to glean understanding of biological processes.

Common activities in bioinformatics include mapping and analysing DNA and protein sequences, aligning DNA and protein sequences to compare them, and creating and viewing 3-D models of protein structures.
The School of Applied Sciences at REVA UNIVERSITY has designed to offer B.Sc. Bioinformatics as an undergraduate degree programme to create motivated, enthusiastic, creative and thinking graduates to fill the roles bioinformatics professionals.

Indian economy is experiencing an upward growth right from the beginning of 21st century except for a short stint during the mid of present decade necessitating well qualified science graduates to work as teachers, professors, scientists, 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 thus there will be too many youths with varied educational aspirations. The B.Sc. –Bioinformatics programme designed will act as a foundation and first degree to prepare bioinformatics analysts who could assist biotech industries in gene finding, genome assembly, drug design, drug discovery, protein structure alignment, protein structure prediction, prediction of gene expression and protein–protein interactions, genome-wide association studies, the modelling of evolution and cell division/mitosis.

The B.Sc. Bioinformatics programme at the School of Applied Sciences, has been developed by the members of the faculty based on interactions with various universities, research establishments and industries in India and abroad. The curriculum is outcome based and it comprises required theoretical concepts and practical

skills in the domain. By undergoing this programme, students develop critical, analytical thinking and problem solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in communication skills and interdisciplinary topics to enhance their scope. The above mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with industry and research organizations makes this programme unique.

# Program Educational Objectives (PEOs)

After 3 years of graduation, the graduate will:

| | |
|---|---|
| **PEO -1** | Develop conceptual as well as applied knowledge and skills in the field of bioinformatics and data science for sustainable approach in order to solve scientific problems. |
| **PEO - 2** | Express oral and Written skills to understand, learn and advance their careers through entrepreneurial orientation, research and higher education. |
| **PEO – 3** | Understand the professional, ethical and social responsibilities through lifelong learning skills. |

# Program Outcomes (POs)

**PO1. Science knowledge:** Apply the knowledge of bioinformatics for the solution of complex biological problems to understand the molecular functions of organism.

**PO2. Problem analysis:** Bioinformatics can solve some of the biological problems based on the gene identification, protein identification and structure prediction. Drug discovery to predict the exact drug to the disease targets and also to produce some solutions on statistical interpretations.

**PO3. Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO4. Modern tool usage:** Bioinformatics always uses advanced tools, software's or algorithms and also to create advanced algorithms for product/process development which in turn benefit the society and lifelong learning.

**PO5. Environment and sustainability:** Understand and implement environmental friendly approaches in Biopharmaceutical industries to support sustainable development.

**PO6. Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and norms in Life Sciences.

**PO7. Individual and team work:** Function effectively as an individual or team work to demonstrate and understand biological problems and manage projects in multidisciplinary and interdisciplinary research.

**PO8. Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

# Program Specific Outcomes (PSO)

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

**PSO-1:** Acquire a strong conceptual foundation in the area of bioinformatics, compute science and mathematics using latest tools and software's, algorithms and programming languages along with analytical and managerial skills to arrive at cost effective and optimum solutions.

**PSO-2:** Demonstrate domain expertise for the use of databases and software packages for analysis and interpretation of biological data as required by researchers in the area of Biotechnology and Life Science.

# REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Bachelor Degree programs- 2018-19 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 Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Under Graduate Degree Programs- 2018".

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 2018-19:

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 in Physics, Chemistry, Maths

BSc in Maths, Statistics, Comp Sci.

BSc in Bioinformatics: Biology, Maths, Computer Science

BSc in Physics, Maths, Computer Science

**3. Duration and Medium of Instructions:**

**3.1. Duration:** The bachelor's 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's degree, including blank semesters, if any. Whenever a candidate opts for blank semester, s/he must 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: "Cell Biology" in B.Sc. (BMCs) program is an example of course to be studied under respective program.

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

| | |
|---|---|
| **L** | **Lecture** |
| **T** | **Tutorial** |
| **P** | **Practical** |

**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, SEC, Project work/Dissertation

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

**4.2.2. Core Course (CC):** 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 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's degree Programs (6 Semesters) is given below:

| S. No | 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 (Honors) | | 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 (Honors) | 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<br>a) Journalism, English & Psychology (JEP)<br>b) Political Science, Economics, Journalism<br>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 | 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. |
| 10 | B Sc in<br>a) Physics, Chemistry and Mathematics (PCM)<br>b) Mathematics, Statistics and Computer Science (MStCs)<br>c) Physics, Mathematics and Computer Science | 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. |
| 11 | B.Sc. in Bioinformatics<br>a). Biology, Mathematics & 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 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.

| **Credit Pattern** | | | | | |
|---|---|---|---|---|---|
| **Lectures (L)** | **Tutorials (T)** | **Practice (P)** | **Credits (L: T: P)** | **Total Credits** | **Total contact 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 Courses of Study:**

Different **Courses of Study** are labelled 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 equivalent to a credit. School can classify a 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 carry double the number of credits of a minor project.

These are defined under Section 4 of these regulations.

**8. Credits and Credit Distribution**

8.1. Registered candidates are required to earn the credits stated in the scheme:

| 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, B.Sc. in Maths, Statistics, Comp Sci., BSc in Bioinformatics: Biology, Maths, Computer Science, 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 distribution pattern given above 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, 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 based on the eligibility criteria and 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 undergraduate degree 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:

| **Component** | **Description** | **Conduction** | **Weight Percentage** |
|---|---|---|---|
| C1 | Test-1: IA1 | 8th Week from the starting date of semester | 15 |
| | Test-2: IA2 | 16th Week from the starting date of semester | 15 |
| C2 | 1 Assignment | 7th Week | 10 |
| | 2 Assignment | 14th Week | 10 |
| C3 | SEE including practical | Between 17th week-20th week | 50 |
| **Results to be announced** | | **By the end of 21st week** | |

**9.4.** There shall be three internal tests conducted as per the schedule given below. The students have to attend all the three tests compulsorily.

- 1st test for 15 marks at the end of 5th week of the beginning of the Semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the Semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the Semester

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

- For the 1st test syllabus shall be 1st unit and 1st half of Second Unit of the Course;
- For the 2nd test it shall be 2nd half of Second Unit and Third Unit of the Course;
- For the 3rd test the syllabus will be 4th Unit of the Course.

**9.6.** Out of 3 tests, the highest marks scored in two tests are automatically considered while assessing the performance of the students.

**9.7.** The assessment and evaluation procedure for integrated course with theory 3 credits and practical 1.5 credits that has been designed.

Theory: L: T: P: C - 3-0-0 (Total Contact Hours 4hrs)

Practical's: L: T: P: C - 0-0-1.5 (Total Contact Hours 3hrs)

Total semester end theory examination and practical examination marks will be scaled down to 50 The marks distribution is - IA1 +IA2 + SEE (Theory and practical) = 25+25+50=100.

**9.8.** 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.

**9.9.** The coverage of syllabus for the said tests shall be as under:

**i.** Question paper of the **1st test should be based on first 50% of the total syllabus.**

ii. Question paper of the **2nd test should be based on second 50% of the total syllabus.**

**9.10.** 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.

**9.11.** 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 student's outcomes described in the course document.

**9.12.** 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.

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

**9.14.** 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 plagiarize the answer from web or any other resources. An IA1 and IA2 assignment / Quiz can be set each for a maximum of 5 marks, totals to 10 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 self-study.

**9.15.** Internal assessment marks must be decided well before the commencement of Semester End examinations.

**9.16.** Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 19th and 20th week of the semester and the entire course syllabus must be covered while setting the question paper.

**9.17.** Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Question paper must be prepared as per the respective School set format.

**9.18.** Each question is set using Bloom's verbs. The questions must be set to assess the student's outcomes described in the course document. (Please note question papers must be set to test the course outcomes)

**9.19.** 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 enough external examiners are not available to serve as moderator's internal senior faculty member shall be appointed as moderators.

**9.20.** 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.

**9.21.** There shall also be a **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 as Semester End Examinations and submit to the Director of the respective School about the scope of curriculum covered and quality of the questions.

**9.22.** 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.

**9.23.** During unforeseen situation, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC.

**9.24.** University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper.

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

**9.26.** Online courses may be offered as per UGC 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.

**9.27.** 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.

**9.28.** 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

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

Summary of Internal Assessment and Evaluation Schedule

| **Type of Assessment** | **Period** | **Syllabus** | **Marks** | **Activity** |
|---|---|---|---|---|
| Allocation of Topics for assignment/ Seminars/ Model Making | Beginning of 5th Week | Unit-I & Unit-II | | Instructional process and continuous assessment |
| First Internal test | Second Part of 6th Week | Unit-I & First half of Unit-II | 15 | Consolidation of First Unit and 1st half of Second Unit |
| Submission of Assignments | 8th week | Unit-I & Unit-II | 5 | Instructional process and continuous assessment |
| Seminars | 9th Week | Unit-I & Unit-II | 5 | Instructional process and continuous assessment |
| Second Internal test | 2nd Part of 13th Week | 2nd half of Unit-II & Unit-III | 15 | Consolidation of Second half Unit and Third Unit |

| | | | | |
|---|---|---|---|---|
| Allocation of Topics for assignment/ Seminars/ Model Making | 11th week | Unit-III & Unit-IV | | Instructional process and continuous assessment |
| Submission of Assignments | 13th week | Unit-III & Unit-IV | 5 | Instructional process and continuous assessment |
| Seminars | 14th week | Unit-III & Unit-IV | 5 | Instructional process and continuous assessment |
| Third Internal test | 2nd Part of 16th week | Unit-IV | 15 | Consolidation of entire Unit-IV |
| Semester end practical examination | 17th & 18th week | Entire Syllabus | 50 | Conduct of semester end practical exams |
| Preparation for semester end exam | 17th & 18th Week | Entire syllabus | | Revision and preparation for semester end examination |
| Semester end theory examination | 19th and 20th week | Entire syllabus | 50 | Evaluation and Tabulation |
| | End of 21st week | | | Notification of final grade |

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

2. Practical examination wherever applicable shall be conducted after 2nd test and before 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 second test for theory courses); the performance assessments of the mid-term test include performance in the conduction of experiment 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**.**

**10.3.** For MOOC and other 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 must submit the progress reports periodically and 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 for final evaluation. The components of evaluation are as follows:

| | |
|---|---|
| Component – I | Progress Report 1 (25%) |
| Component – II | Progress Report 2 (25%) |
| Component – III | Evaluation of Report and final viva voce (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 all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50). A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful.

**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 to compute the 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 |
| | **20** | | | **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 |
| Cour se 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 considering 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** | | **930.54** |

**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 two-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 test 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 40% (20 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 each 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 four 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 photocopy 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 applying 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** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|
| **PEO1** | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PEO2** | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PEO3** | √ | √ | √ | √ | √ | √ | √ | √ | √ |

**Attainment of CO (Course Outcome)**

| **CO Attainment** | **Value** |
|---|---|
| 0.4 – 0.60 | 1 |
| 0.61 – 0.75 | 2 |
| >0.75 | 3 |

**Mapping of Course Outcomes with programme Outcomes**

| **Course Code** | **POS/ COs** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1012 | 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 | PS01 | PS02 |
| B18MC1013 | 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 | PS01 | PS02 |
| B18MC1020 | CO1 | | | | | 3 | 3 | 3 | 1 | | |
| | CO2 | | | | | 3 | 3 | 3 | 2 | | |
| | CO3 | | | | | 3 | 3 | 3 | 2 | | |
| | CO4 | | | | | 3 | 3 | 3 | 1 | | |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1030 | CO1 | 1 | 2 | 1 | | 1 | 1 | 2 | 1 | 1 | |
| | CO2 | 1 | 2 | 1 | 1 | | 1 | 2 | 1 | 2 | 1 |
| | CO3 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| | CO4 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1040 | CO1 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| | CO3 | 3 | 2 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1050 | CO1 | 3 | 3 | 3 | 3 | 2 | | 1 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | 2 | | 3 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 2 | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | 2 | | | | 2 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1070 | CO1 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| | CO2 | 2 | 2 | 5 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO3 | 2 | 3 | 4 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1080 | CO1 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| | CO3 | 3 | 2 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |
| **Course Code** | **POS/COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC1090 | CO1 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 2 |
| | CO2 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | | | | 1 | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2012 | 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 | PS01 | PS02 |
| B18MC2013 | 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 | PS01 | PS02 |
| B18MC2020 | 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 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2030 | CO1 | 1 | 1 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 |
| | CO2 | 1 | 2 | 2 | | 1 | | 2 | 2 | 1 | 2 |
| | CO3 | 1 | 2 | 2 | 1 | | 1 | 2 | 2 | 2 | 1 |
| | CO4 | 1 | 2 | 2 | 2 | 2 | | 2 | 1 | 2 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2040 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2050 | CO1 | 3 | 3 | 3 | 3 | 2 | | 2 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | | | | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | 2 | | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 2 | | | 2 | 2 | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2060 | 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 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2080 | CO1 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO3 | 2 | 1 | 4 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 2 | 1 | 5 | 2 | 2 | 1 | 1 | 2 | 3 | 3 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2090 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC2X10 | CO1 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | | | | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | | | | | 3 | 2 |
| **Course Code** | **POS / COS** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3012 | 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 | PS01 | PS02 |
| B18MC3013 | 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 | PS01 | PS02 |
| B18MC3020 | 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 | PS01 | PS02 |
| B18MC3030 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO3 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3040 | CO1 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 |
| | CO2 | 3 | 1 | 1 | 2 | | | | 1 | 2 | 1 |
| | CO3 | 3 | 1 | 1 | 1 | | | | 1 | 1 | 1 |
| | CO4 | 3 | 2 | | 1 | | | | 1 | | |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3050 | CO1 | 3 | 3 | 3 | 2 | | | | 3 | 2 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | | | 2 | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | | | 2 | | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | | | 2 | 3 | 3 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3060 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3070 | CO1 | 3 | 2 | 2 | 2 | | | | | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | | | | 3 | 2 |
| | CO3 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | | | 2 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3080 | CO1 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | 2 | | 3 | 2 | 2 |
| | CO3 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | 3 | 2 | 3 | 2 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3090 | CO1 | 3 | 3 | 3 | 2 | 1 | | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO3 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3X10 | CO1 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 |
| | CO2 | 3 | 1 | 1 | 2 | | | | 1 | 2 | 1 |
| | CO3 | 3 | 1 | 1 | 1 | | | | 1 | 1 | 1 |
| | CO4 | 3 | 2 | | 1 | | | | 1 | | |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC3X20 | CO1 | 3 | 3 | 3 | 3 | | | | 3 | 3 | 1 |
| | CO2 | 3 | 3 | 2 | 1 | | | | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | | | 1 | 3 | 2 | 1 |
| | CO4 | 3 | 3 | 3 | 1 | | | | 3 | 3 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4011 | CO1 | | | | | 2 | 3 | | | | |
| | CO2 | | | | | 2 | 3 | | | | |
| | CO3 | | | | | | 3 | | | | |
| | CO4 | | | | | | | 3 | 2 | | |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4012 | 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 | PS01 | PS02 |
| B18MC4013 | 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 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4020 | 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 | PS01 | PS02 |
| B18BG4030 | CO1 | 3 | 3 | 3 | 2 | 1 | | 2 | 1 | 2 | 1 |
| | CO2 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 2 | 1 |
| | CO3 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4040 | CO1 | 2 | 1 | 2 | 3 | | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 2 | 1 | 2 | | | 1 | 3 | 1 | 3 |
| | CO3 | 2 | 1 | 1 | 1 | | | 2 | 1 | 1 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 1 | 3 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4011 | CO1 | 3 | 3 | 3 | | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | | | | 2 | 3 | 1 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B180MC4070 | CO1 | 2 | 3 | 3 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 |
| | CO3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4080 | CO1 | 2 | 1 | 2 | 3 | | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 2 | 1 | 2 | | | 1 | 3 | 1 | 3 |
| | CO3 | 2 | 1 | 1 | 1 | | | 2 | 1 | 1 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 1 | 3 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC4090 | CO1 | 3 | 2 | 1 | 1 | | | 1 | 3 | 3 | 2 |
| | CO2 | 3 | 2 | 3 | 2 | | | | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 3 | 3 | | | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5010 | CO1 | 3 | 3 | 3 | 2 | 2 | | 3 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5020 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5030 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5041 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5042 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5051 | CO1 | 3 | 2 | 1 | 2 | | | 1 | 2 | 3 | 2 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | | 1 | 2 | 1 | 1 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 2 | 2 | 1 | 2 | | 1 | | 3 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5052 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5053 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5061 | CO1 | 1 | | | 3 | 31 | 2 | 2 | 2 | 1 | 3 |
| | CO2 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 |
| | CO3 | 3 | 1 | 2 | 2 | 3 | | 1 | 2 | 2 | 3 |
| | CO4 | 2 | 2 | 2 | 2 | 1 | | 3 | 1 | 2 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5062 | CO1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 1 | 3 | 3 |
| | CO2 | 1 | 3 | 3 | 3 | 3 | | 3 | | 3 | 3 |
| | CO3 | 3 | 3 | 3 | | 3 | | 3 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 1 | 3 | 3 | | | 3 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5063 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5080 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5090 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5X10 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5X20 | CO1 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 2 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 1 | 3 | 2 | | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | 3 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC5X30 | CO1 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO2 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 2 | 2 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO4 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6010 | CO1 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 |
| | CO3 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6020 | CO1 | 3 | | | 1 | | | 1 | | 3 | |
| | CO2 | 2 | 3 | | | | | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | | 2 | | | | 3 | | |
| | CO4 | 1 | 1 | | 2 | | | | | 2 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6030 | CO1 | 3 | 2 | 3 | 1 | | | | | 3 | 2 |
| | CO2 | 2 | 2 | 3 | 1 | | | 3 | 2 | 2 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| | CO4 | 2 | 2 | 3 | 3 | | | 3 | | 3 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6041 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6042 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | 2 | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6051 | CO1 | 2 | 1 | | 2 | | | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 1 | | 3 | 1 | | | 2 | 1 | 1 |
| | CO3 | 2 | 1 | | 2 | 2 | | 1 | 1 | 2 | 1 |
| | CO4 | 2 | 2 | | 1 | 2 | | 1 | 3 | 1 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6052 | CO1 | 3 | 3 | 2 | | | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 3 | 1 | 1 | 1 | | 3 | 3 | 3 | 2 |
| | CO3 | 3 | 3 | 1 | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6053 | CO1 | 3 | 2 | | 2 | | | 2 | 2 | 2 | 1 |
| | CO2 | 2 | 1 | | 2 | | | 1 | 1 | 1 | 2 |
| | CO3 | 3 | 2 | 1 | 3 | | 2 | 2 | | 2 | 3 |
| | CO4 | 1 | 2 | 2 | 2 | | 1 | 2 | 1 | 1 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6061 | CO1 | 3 | 2 | | | | 1 | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| | CO3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 |
| | CO4 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6062 | CO1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6063 | CO1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | 2 | | | 2 | 2 | 2 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6090 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |
| Course code | PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
| B18MC6X10 | CO1 | 2 | 3 | | 3 | | | | | 3 | 2 |
| | CO2 | 2 | 2 | 3 | 3 | 3 | 3 | | | 2 | 3 |
| | CO3 | 2 | 2 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
| B18MC6X20 | CO1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 3 |
| | CO3 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| | CO4 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 3 |

# B.Sc. – B M Cs
# Bioinformatics: (Biology, Mathematics, Computer Science)

**Scheme of Instruction and Detailed Syllabus**

**(Effective from the Academic Year 2018-19)**

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

| Sl.No | Course Code | Title of the Course | HC/SC/CC | Credit Pattern | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | Hours |
| **FIRST SEMESTER** | | | | | | | | |
| 1 | B18MC1011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B18MC1012 | Language – II: Hindi | CC | 2 | 1 | 0 | 3 | 4 |
| 3 | B18MC1013 | Language – II: Additional English | CC | 2 | 1 | 0 | 3 | 4 |
| 4 | B18MC1020 | Functional English – I | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B18MC1030 | Molecular Biology and Genetics | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B18MC1040 | Fundamental of Mathematics - I | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B18MC1050 | Problem Solving Techniques using C | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B18MC1060 | Constitution of India | FC | 2 | 0 | 0 | 2 | 2 |
| **Practical's** | | | | | | | | |
| 9 | B18MC1070 | Molecular Biology and Genetics Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B18MC1080 | Mathematics Practical-I | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B18MC1090 | C Programming Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **12** | **5** | **6** | **23** | **31** |
| **SECOND SEMESTER** | | | | | | | | |
| 1 | B18MC2011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B18MC2012 | Language – II: Hindi | CC | 2 | 1 | 0 | 3 | 4 |
| 3 | B18MC2013 | Language – II: Additional English | CC | 2 | 1 | 0 | 3 | 4 |
| 4 | B18MC2020 | Functional English – II | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B18MC2030 | Biochemistry & Microbiology | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B18MC2040 | Fundamental of Mathematics - II | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B18MC2050 | Data Structures Using C | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B18MC2060 | Environmental Science | FC | 2 | 0 | 0 | 2 | 2 |
| 9 | B18MC2070 | Sports/Yoga/music/dance/theatre | RULO | 2 | 0 | 0 | 2 | 2 |
| **Practical's** | | | | | | | | |
| 10 | B18MC2080 | Biochemistry & Microbiology Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B18MC2090 | Mathematics Practical -II | HC | 0 | 0 | 2 | 2 | 3 |
| 12 | B18MC2X10 | Data Structures Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **14** | **5** | **6** | **25** | **33** |
| **THIRD SEMESTER** | | | | | | | | |
| 1 | B18MC3011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B18MC3012 | Language – II: Hindi | CC | 2 | 1 | 0 | 3 | 4 |
| 3 | B18MC3013 | Language – II: Additional English | CC | 2 | 1 | 0 | 3 | 4 |
| 4 | B18MC3020 | Communicative English - I | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B18MC3030 | Bioinformatics & Biostatistics | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B18MC3040 | Biostatistics - I | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B18MC3050 | RDBMS | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B18MC3060 | Physics of Clouds | OE | 4 | 0 | 0 | 4 | 4 |
| 9 | B18MC3070 | Classical Optimization | OE | | | | | |
| 10 | B18MC3080 | Chemistry for Life | OE | | | | | |
| **Practical's** | | | | | | | | |
| 11 | B18MC3090 | Bioinformatics & Biostatistics Lab | HC | 0 | 0 | 2 | 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 12 | B18MC3X10 | Mathematics Practical -III | HC | 0 | 0 | 2 | 2 | 3 |
| 13 | B18MC3X20 | RDBMS Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **14** | **5** | **6** | **25** | **33** |
| **FOURTH SEMESTER** | | | | | | | | |
| 1 | B18MC4011 | Language – II: Kannada | CC | 2 | 1 | 0 | 3 | 4 |
| 2 | B18MC4012 | Language – II: Hindi | CC | 2 | 1 | 0 | 3 | 4 |
| 3 | B18MC4013 | Language – II: Additional English | CC | 2 | 1 | 0 | 3 | 4 |
| 4 | B18MC4020 | Communicative English - II | CC | 2 | 1 | 0 | 3 | 4 |
| 5 | B18MC4030 | Bioperl & Biopython | HC | 2 | 1 | 0 | 3 | 4 |
| 6 | B18MC4040 | Biostatistics - II | HC | 2 | 1 | 0 | 3 | 4 |
| 7 | B18MC4050 | Operating System & Shell Program Using LINUX | HC | 2 | 1 | 0 | 3 | 4 |
| 8 | B18MC4060 | Soft Skill Training | RULO | 1 | 1 | 0 | 2 | 3 |
| **Practical's** | | | | | | | | |
| 9 | B18MC4070 | Bioperl & Biopython Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B18MC4080 | Mathematics Practical -IV | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B18MC4090 | LINUX Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **11** | **6** | **6** | **23** | **32** |
| **FIFTH SEMESTER** | | | | | | | | |
| 1 | B18MC5010 | Biology –V (Genomics & Proteomics) | HC | 1 | 1 | 0 | 2 | 3 |
| 2 | B18MC5020 | Discrete Mathematical Structural | HC | 1 | 1 | 0 | 2 | 3 |
| 3 | B18MC5030 | JAVA Programming | HC | 1 | 1 | 0 | 2 | 3 |
| 4 | B18MC5041 | Data mining & Artificial Intelligence | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC5042 | Data mining & warehousing | | | | | | |
| 5 | B18MC5051 | Biostatistics - III | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC5052 | Numerical Methods - I | | | | | | |
| | B18MC5053 | Graph Theory | | | | | | |
| 6 | B18MC5061 | Web Programming | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC5062 | Visual Programming | | | | | | |
| | B18MC5063 | Computer Graphics | | | | | | |
| 7 | B18MC5070 | Soft Skill Training | RULO | 1 | 1 | 0 | 2 | 3 |
| **Practical's** | | | | | | | | |
| 8 | B18MC5080 | Genomics and Proteomics Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 9 | B18MC5090 | Programming using R | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B18MC5X10 | Mathematics Practical–V | HC | 0 | 0 | 2 | 2 | 3 |
| 11 | B18MC5X20 | JAVA Programming Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 12 | B18MC5X30 | Web Programming Lab / Visual Programming Lab / Computer Graphics Lab | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **10** | **04** | **10** | **24** | **33** |
| **SIXTH SEMESTER** | | | | | | | | |
| 1 | B18MC6010 | Chemo informatics & Drug designing | HC | 1 | 1 | 0 | 2 | 3 |
| 2 | B18MC6020 | Operations Research - I | HC | 1 | 1 | 0 | 2 | 3 |
| 3 | B18MC6030 | Software Engineering | HC | 1 | 1 | 0 | 2 | 3 |
| 4 | B18MC6041 | Medical Informatics | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC6042 | Structural Chemistry | | | | | | |
| 5 | B18MC6051 | Biostatistics - IV | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC6052 | Numerical Methods - II | | | | | | |
| | B18MC6053 | Operations Research - II | | | | | | |
| 6 | B18MC6061 | Computer Networks | SC | 2 | 0 | 0 | 2 | 2 |
| | B18MC6062 | Design and Analysis of Algorithms | | | | | | |
| | B18MC6063 | Computer Architecture | | | | | | |
| 7 | B18MC6070 | MOOC/SWAYAM/Internship | RULO | 0 | 0 | 2 | 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8 | B18MC6080 | Skill Development Courses | RULO | 1 | 1 | 0 | 2 | 3 |
| **Practical's** | | | | | | | | |
| 9 | B18MC6090 | Chemo informatics & Drug designing Lab | HC | 0 | 0 | 2 | 2 | 3 |
| 10 | B18MC6X10 | Project Work | HC | 0 | 0 | 4 | 4 | 6 |
| 11 | B18MC6X20 | Computer Science Project | HC | 0 | 0 | 2 | 2 | 3 |
| **Total Credits** | | | | **10** | **4** | **10** | **24** | **33** |
| **Total Credits of all Semesters** | | | | | | | **144** | **195** |

**Semester-wise Summary of Credit Distribution**

| Semester | L | T | P | Total | Total Hours |
|---|---|---|---|---|---|
| I | 12 | 05 | 06 | 23 | 31 |
| II | 14 | 05 | 06 | 25 | 33 |
| III | 14 | 05 | 06 | 25 | 33 |
| IV | 11 | 06 | 06 | 23 | 32 |
| V | 10 | 04 | 10 | 24 | 33 |
| VI | 10 | 04 | 10 | 24 | 33 |
| **Total Credits** | **71** | **29** | **44** | **144** | **195** |

# B.Sc. in Bioinformatics: Biology, Mathematics, Computer Science (BMCs)

## Detailed Syllabus
## (effective from Academic Year-2018-19)
## FIRST SEMESTER

| Course code | | L | T | P | C |
|---|---|---|---|---|---|
| **B18MC1011** | **Language-II: Kannada** | **2** | **1** | **0** | **3** |

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

**Course objectives:**
1. 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.
2. ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
3. ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
4. ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
5. ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

Course outcomes
1. ಜನಪದ, ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.
2. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
3. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
4. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1011 | 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 content:

**Unit I: ಜನಪದ ಮತ್ತು ಪ್ರಾಚೀನ ಕಾವ್ಯ** **10 hours**

| | |
|---|---|
| ಸತ್ಯವಂತೆ ಹಡೆದವ್ವ | ಜನಪದ ಗೀತೆ |
| ನೆಲಸುಗೆ ನಿನ್ನ ವಕ್ಷದೊಳೆ | ಪಂಪ |
| ನೆಲಕಿರಿವೆನೆಂದು ಬಗೆವಿರೆ ಛಲಕಿರಿವೆಂ | ರನ್ನ |
| ಚಿತ್ರಮಪಾತ್ರೆ ರಮತೆ ನಾರಿ | ಜನ್ನ |

**Unit II: ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ** **10 hours**

| | |
|---|---|
| ಅಬ್ಬಿಯುಮೊರ್ಮೆ ಕಾಲವಶದಿಂ ಮರ್ಯಾದೆಯಂ ದಾಂಟದೇ.... | ನಾಗಚಂದ್ರ |
| ವಚನಗಳು | ಅಕ್ಕಮಹಾದೇವಿ |
| ವಚನಗಳು | ಬಸವಣ್ಣ |
| ತಿರುನೀಲಕಂಠರ ರಗಳೆ | ಹರಿಹರ |

**Unit III: ಸಣ್ಣ ಕಥೆಗಳು** **10 hours**

| | |
|---|---|
| ಮೊಲಂ ಸಿಂಹಮಂ ಕೊಂದ ಕಥೆ | ದುರ್ಗಸಿಂಹ |
| ಕಲ್ಲಾಡಿಯ ಕೋಣ | ಮಾಸ್ತಿ |
| ಯಾರೂ ಅರಿಯದ ವೀರ | ಕುವೆಂಪು |
| ಸಮಸ್ಯೆಯ ಮಗು | ತ್ರಿವೇಣಿ |

**Unit IV: ನಾಟಕ** **9 hours**

| | |
|---|---|
| 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
13. ನರಸಿಂಹಾಚಾರ್. ಡಿ.ಎಲ್., ಪಂಪ ಭಾರತ ದೀಪಿಕೆ, ಪ್ರಕಾಶಕರು ಡಿ.ವಿ.ಕೆ ಮೂರ್ತಿ ಪ್ರಕಾಶನ, ಮೈಸೂರು. 2012
14. ರಂಜಾನ್ ದರ್ಗಾ, ಶರಣರ ಸಮಗ್ರ ಕ್ರಾಂತಿ, ಪ್ರಕಾಶಕರು. ಲೋಹಿಯಾ ಪ್ರಕಾಶನ, ಬಳ್ಳಾರಿ. 2015
15. ದೇಶಪಾಂಡೆ ಎಸ್.ಎಲ್. ಬೇಂದ್ರೆ ಶರೀಫರ ಕಾವ್ಯಾಯಾನ, ಪ್ರಕಾಶಕರು ದೇಸಿ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು. 2013
16. ಸಂ. ಬಿ.ಎಸ್. ಕೇಶವರಾವ್. ಕೈಲಾಸಂ ಕನ್ನಡ ನಾಟಕಗಳು, ಪ್ರಕಾಶಕರು ಅಂಕಿತ ಪುಸ್ತಕ, ಬೆಂಗಳೂರು. 2005
17. ಶಾಮರಾಯ ತ.ಸು., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ತಳುಕಿನ ವೆಂಕಣ್ಣಯ್ಯ ಸ್ಮಾರಕ ಗ್ರಂಥಮಾಲೆ, ಮೈಸೂರು –2014
18. ಶಿವರುದ್ರಪ್ಪ ಜಿ.ಎಸ್. ಕನ್ನಡ ಸಾಹಿತ್ಯ ಸಮೀಕ್ಷೆ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013


| Course code | Language-II: Hindi | L | T | P | C |
|---|---|---|---|---|---|
| B18MC1012 | | 2 | 1 | 0 | 3 |

**Prerequisites:**

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:**

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

**Course outcomes:**
अध्ययन की समाप्ति पर अध्येता –
1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
3. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है |

Mapping of Course Outcomes with programme Outcomes

| Course Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 | PO1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1012 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 3 | 2 | 3 | 0 | 0 | 0 | 0 |

## Course content:
अध्ययन विषय सूची / पाठ्यक्रम

इकाई –**1** :कहानी , संस्मरण **10 hours**

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 hours**

4.कहानी – मरने से पहले – भीष्म साहनी
5.कहानी – लाल हवेली – शिवानी
6.. रेखाचित्र – घीसा – महादेवी वर्मा

इकाई –**3** :एकांकी, व्यंग्य रचना **10 hours**

7. एकांकी – आवाज का नीलाम – धर्मवीर भारती
8.व्यंग्य रचना – भेड़े और भेडियें – हरिशंकर परसाई

इकाई –**4** :अनुवाद, संक्षेपण **09 hours**

अनुवाद : अंग्रेज़ी – हिन्दी (शब्द एवं अनुच्छेद )
संक्षेपण : परिच्छेद का एक तिहाई भाग में |
सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

| **Course code** | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B18MC1013** | | **2** | **1** | **0** | **3** |

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

**Course objectives:**
1. To develop linguistic prowess of the students.
2. To appraise different genres of literature.
3. To illustrate the fundamentals of creative language.
4. To enhance consistent reading habits.

**Course outcomes**
1. On completion of the course, learners will be able to:
2. Demonstrate a thorough understanding of sensitive and critical social issues.
3. Develop reading skills and a wide range of vocabulary.
4. Critically analyze a piece of prose or poetry.
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1013 | 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 content:**

**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:**


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

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

| Course code | Functional English-I | L | T | P | C |
|---|---|---|---|---|---|
| B18MC1020 | | 2 | 1 | 0 | 3 |

**Prerequisites:**
The student must have knowledge of intermediate English Grammar and LSRW skills.

**Course objectives:**

1. To develop basic communication skills in English for the learners of Bachelor of Science.
2. To prioritize listening and reading skills among the learners.
3. To simplify writing skills needed for academic as well as workplace context.
4. To examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

**Course outcomes:**

1. On completion of the course, learners will be able to:
2. Interpret audio files and comprehend different spoken discourses/ excerpts in different accents.
3. Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies.
4. Make use of reading different genres of texts adopting various reading strategies.
5. Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1020 | 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 content**

**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:**


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** | **Molecular Biology and Genetics** | **Course type** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|
| **B18MC1030** | | **HC** | **2** | **1** | **0** | **3** |

**Prerequisites:**

Basic knowledge of Biological Science

**Course objectives**

The objectives of this course are to:

1. Have a firm foundation in the fundamentals of the cell Molecular Biology.
2. Know the complex organization of the genetic material of prokaryotes and eukaryotes and gene expression studies.
3. Have basic knowledge of transmission genetics, hereditary mechanism and mutations.

**Course outcomes**

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

1. Understand and describe the basic Principles of Cells, Cell organelles and its various cellular mechanisms.
2. Analyse the various mechanisms associated with Genome structure, Gene Expression at the level of Transcription and Translation.
3. Understand the genome of Mitochondria Chloroplast and variations associated with the nuclear DNA.
4. Analyse the genotypic and phenotypic relationship of normal genotype and mutant types.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1030 | CO1 | 1 | 2 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 |
| | CO2 | 1 | 2 | 1 | 1 | 0 | 1 | 2 | 1 | 2 | 1 |
| | CO3 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| | CO4 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |

## Course content

**UNIT-I** **12 hours**

Basics of Cell Biology (structure & function) – Discovery of cell and Cell Theory; Comparison between prokaryotes and eukaryotes; Cell wall, Plasma membrane, Cell organelles structure and function: Mitochondria, Chloroplast, ER, Golgi complex, Lysosome, Ribosome and Nucleus, DNA as genetic material: Cell Cycles, Central dogma theory, Griffith's and Avery's transformation experiments, Hershey Chase bacteriophage experiment, Watson and Crick model of DNA structure, types of DNA. DNA replication (Prokaryotes and eukaryotes): Semi–conservative model of replication, Enzymes and molecular mechanism involved in prokaryotic and eukaryotic replication.

**UNIT-II** **12 hours**

Transcription and Translation (Prokaryotes and Eukaryote) Transcription: Structures and Function of different types of RNA (mRNA, tRNA, rRNA), SiRNA, miRNA, RNAi; Enzymes and Molecular mechanism involved in Prokaryotic and Eukaryotic transcription. Translation: Features of genetic code and deciphering, universality of genetic code and exceptions in some systems. Charging of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides, post transcriptional and post translational modifications.

**UNIT-III** **12 hours**

Gene – Structure and Transmission Microscopy – basics of microscopy; bright field, dark field, fluorescence and imaging. Biography of Mendel and Mendelism, transmission genetics. Allelic Variation & Gene function –Multiple allele, Genetic interaction, Epistatic interactions, Non-Epistatic inter-allelic genetic interactions, Atavism/Reversion, Penetrance (complete & Incomplete), Expressivity, Pleiotropism, Modifier/Modifying genes. Organization of DNA – nucleosome model, solenoid, scaffold, super coiling. Fine structure of the gene – structural genes, operon, compound genes, split genes, overlapping genes, ORFs.

**UNIT-IV** **12 hours**

Genome Organization and Gene Mutation Genome organization – Prokaryotic and eukaryotic genome. Mitochondrial DNA, chloroplast DNA, unique DNA, repetitive DNA, transposable elements in prokaryotes and eukaryotes. Mutation – Occurrence, Types of muations (CNVs, SNPs, InDel), kinds of Mutation, spontaneous & induced Mutation, Mutagens – Physical and chemical, detection of Mutation. Human genome project.

**Reference Books:**


1. Cooper GM, Hausman RE. The Cell: A molecular approach. ASM Press & Sinauer A 5th Edn 2009. 2. De Robertis, E.D.P. Cell and Molecular Biology. Lippincott Williams and Williams 6th Edition 2008. 3. Klug WS, Cummings MR, Spencer CA, Benjamin Cummings, Concepts of Genetics, 11th Edn 2009. 4. Russell, P. J. iGenetics- A Molecular Approach. Benjamin Cummings, 3rd Edition, 2009
2. Simmons, Principles of genetics, John Wiley & Sons (Asia) Pte Ltd. New Jersey, 4th Edition, 2006. 6. Brown T. A, Genomes 3. Garland Science Publishing, New York, 2007.
3. Griffiths AJF, Wessler SR, Lewontin RC, Gelbart WM and JH Miller, Introduction to genetic analysis, W.H. Freeman and Company, New York. 2005.


| Course Code | Fundamental of Mathematics - I | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC1040 | | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisite:**

Fundamental knowledge on the Concepts of High School Mathematics

**Course objectives**

The objective of this Course is to:

1. Studythe Basic Mathematical Concepts in Bio Informatics
2. Study the Elementary Differentiation and Integration
3. Study the rate of change using Differentiation
4. Study ofBiological samples using Mathematical Modeling

**Course outcomes**

1. Understand the Mathematical Conceptsin sets and probability.
2. Understand Differentiation and Integration
3. Solve the concepts of rate of change and surface Areas
4. Convention of Mathematical Model of Biological Samples

**Mapping of Course Outcomes with programme Outcomes**

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1040 | CO1 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| | CO3 | 3 | 2 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |

**Course content**

**UNIT-I** **12 hours**

Sets, Types of Sets, Subsets, Complement of Sets, union and Intersection of Sets, Difference of Sets, DE Morgan's Law, Cartesian product of Sets. Basics of Probability, Permutation and Combination.

**Unit-II** **12 hours**

Basics of Functions and Limits, Elementary Differentiation and Integration Differentiability of functions, Chain rule, Derivatives of Functions in Parametric Forms.

**Unit-III** **12 hours**

Simple application of Derivatives: Rate of Change of Quantities, Increasing and Decreasing Functions

**Unit-IV** **12 hours**

Differential Calculus Successive Differentiation, Leibnitz theorem (statement without proof) and simple problems

**Reference Books:**

1. Mathematics for Biosciences by Arya J.C and Lardner R.W (1990) PHI, New Delhi.
2. Textbook of NCERT (For class XI & XII), 2006.

| **Course Code** | **Problem Solving Techniques using C** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC1050** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

Formulate simple algorithms for arithmetic and logical problems, Test and execute the programs and correct syntax and logical errors, Implement conditional branching, iteration and recursion, apply programming to solve simple numerical method problems.

**Course objectives:**

The objectives of this course are to:

1. To gain experience about structured programming
2. To familiarize students to use C language
3. To understand various features in C language
4. Create the solutions for various Real World Problems

**Course outcomes:**

On successful completion of this course; the student shall be able to:

1. To write algorithms and to draw flowcharts for solving problems.
2. To convert the algorithms/flowcharts to C programs
3. To code and test a given logic in C programming language
4. To decompose a problem into functions and to develop modular Reusable code

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1050 | CO1 | 3 | 3 | 3 | 3 | 2 | 0 | 1 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | 2 | 0 | 3 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 2 | 0 | 2 | 3 | 3 | 3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO4 | 3 | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 2 | 2 |

**Course content**

**UNIT-I** **12 hours**

Introduction to Programming Concepts: Software, Classification of Software, Modular Programming, Structured Programming, Algorithms and Flowcharts with examples. Overview of C Language: History of C, Character set, C tokens, Identifiers, Keywords, Data types, Variables, Constants, Symbolic Constants, Operators in C, Hierarchy of Operators, Expressions, Type Conversions and Library Functions.

**UNIT-II** **12 hours**

Managing Input and Output Operation: Formatted and Unformatted I/O Functions Decision making, branching and looping: Decision Making Statements - if Statement, if–else statement, nesting of if-else statements, else–if ladder, switch statement, operator, Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements. Functions: Function Definition, prototyping, types of functions, passing arguments to functions, Nested Functions, Recursive functions.

**UNIT-III** **12 hours**

Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi-Dimensional Arrays - Passing arrays to functions. Strings: Declaring and Initializing strings, Operations on strings, Arrays of strings, passing strings to functions. Storage Classes - Automatic, External, Static and Register Variables. C Pre-processor directives, Macros – Definition, types of Macros, Creating and implementing user defined header files.

**UNIT-IV** **12 hours**

Structures - Declaring and Initializing, Nested structure, Array of Structure, passing structures to functions, Unions, typedef, enum, Bit fields. Pointers – Declarations, Pointer arithmetic, Pointers and functions, call by value, Call by reference, Pointers and Arrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamic memory allocation, Memory allocation functions.

**Text Books & Reference Books:**

1. Let us C - Y.Kanetkar, BPB Publications
2. Programming in ANSI C - Balaguruswami, TMH
3. C The Complete Reference - H.Sohildt, TMH
4. The ‘C’ programming language - B.W.Kernighan, D.M.Ritchie, PHI
5. Programming in C - Gottfried B.S., TMH
6. A Structured Programming Approach using C – BA Forouzan & RF Gillberg, Thomson Indian Edn.

| Course Code | Indian Constitution & Professional Ethics | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC1060 | | FC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Basic knowledge on biology and social science.

**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.

**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 of it.

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 a unconstitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.

**Course content**

**Unit -I: 6 hours**

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 hours**

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 hours**

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 hours**

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 Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence.

**Reference 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 & Molecular Biology Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC1070 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

Student should be familiar with the concepts of Prokaryotic and Eukaryotic genomes.

**Course objectives:**

The objectives of this course are to:

1. Explore the fascinating field of cell biology, molecular biology and genetics
2. Provide deeper insight into the mechanism of inheritance at chromosomal and molecular level
3. Understand the structure, organization and function of the genome.

**Course outcomes:**

By the end of the course, the students will be able to….

1. Handle the light microscope techniques.
2. Explore about the bio-molecules like nucleic acids and proteins and to develop the skills regarding estimation of biomolecules.
3. Access the cellular organization and genetic makeup of various organism.
4. Understand the basics of cytogenetics.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1070 | CO1 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| | CO2 | 2 | 2 | 5 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO3 | 2 | 3 | 4 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |

**Course content**

1. Estimation of DNA by Diphenylamine (DPA) method
2. Isolation and purification of Genomic DNA from bacteria
3. Isolation and purification of plant genomic DNA from bacteria
4. Agarose gel electrophoresis of DNA
5. Electrophoresis of Proteins by SDS- PAGE
6. Basics and handling of microscopes
7. Measurements of cells and chromosomes using Micrometry
8. Sex chromatin - Barr body analysis/blood smear analysis
9. Study of Karyotype and image analysis NCBI database Mapviewer.
10. Dissection of salivary gland of Drosophila and preparation of polytene chromosomes

**Reference Book**

1. J Sambrook & DW Russell (2001). Molecular cloning: a laboratory manual Vol 1, 2 & 3, CSHL Press.

| **Course Code** | **Mathematics Practical – I** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC1080** | | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisite:**

Fundamental knowledge on the concepts of High School Mathematics

**Course objectives:**

The objective of this Course is to

1. Introduce basic Mathematics to the students
2. Demonstrate the Mathematical Models in Bio Informatics

**Course outcomes:**

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

1. Formulate problems in the language of sets and perform set operations.
2. Apply the Fundamental Principle of Counting, Multiplication Principle.
3. Apply basic concepts of probability.
4. Develop the ability to explain mathematical results in language understandable by biologists.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1080 | CO1 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | 1 | 3 | 3 | 2 | 3 |
| | CO3 | 3 | 2 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |

## Course content

**PART – A:**

1. Sets -Venn-Diagram, Union, Intersection, Difference of sets, Symmetric Difference of sets, Complement of sets. -Using Maxima
2. Laws on sets – commutative, Associative, Identity, Inverse-Using Maxima
3. Laws on Sets-Distributive, Demorgan's Laws-using Maxima
4. Differential Calculus – Finding nth Derivatives-Using Maxima
5. Using Leibnitz's Theorem, find the nth Derivative-Using Maxima
6. Without Using Leibnitz Theorem, find the nth Derivative-Using Maxima

**PART – B**

1. During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

**References Books**

| Course Code | C Programming Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC1090 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

The students must have basic knowledge of mathematical and algorithmic logics, to understand major control structures such as branching, loops and expressions, to be able to use functions and to create arrays of elementary objects in their simple C programs. The course teaching language is English, so students have to have communication, reading and apprehension skills of English

**Course objectives:**

1. The objectives of this course are to:
2. To make the student learn a programming language.
3. To learn problem solving techniques.
4. To teach the student to write programs in C and to solve the problems.

**Course outcomes:**

On successful completion of this course; the student shall be able to:

1. Read, understand and trace the execution of programs written in C language.
2. Write the C code for a given algorithm.
3. Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
4. Write programs that perform operations using derived data types.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC1090 | CO1 | 3 | 3 | 3 | 3 | 0 | 0 | 2 | 3 | 3 | 2 |
| | CO2 | 3 | 3 | 3 | 3 | 0 | 0 | 2 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 0 | 0 | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 1 | 3 | 2 |

**PART – A**

1. Write a Program to find the roots of the given quadratic equation.
2. Write a C Program to generate and print first N Fibonacci numbers.
3. Write a Program to find the GCD and LCM of two integer numbers
4. Write a C Program that reverse a given integer number and check whether the number is palindrome or not.
5. Write a Program to find whether a given number is prime number or not
6. Write a C program to arrange the given set of numbers in ascending and descending order.
7. Write a C Program to read two matrices and perform addition and subtractions of two matrices.
8. Write a C Program to read a string and check whether it is palindrome or not.
9. Write a Program to find the factorial of a number using function
10. Write a C program to demonstrate the user defined header file.

**PART – B**

1. During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

**Reference Books:**

1. Problem Solving and Program Design in C, 4th edition, by jeri R. Hanly and Elli B.Koffman.

2. P.V.P. Siddhartha Institute of Technology (Autonomous), I B.Tech. Syllabus under PVP14 regulations
3. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press.
4. E. Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill
5. Weightage Distribution for Assessment

## SECOND SEMESTER

| Course code | Language-II: Kannada | L | T | P | C |
|---|---|---|---|---|---|
| B18MC2011 | | 2 | 1 | 0 | 3 |

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

**Course objectives:**
1. 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.
2. ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
3. ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
4. ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
5. ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

**Course outcomes:**
1. ಪ್ರಾಚೀನ, ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯಗಳು, ಹೊಸಗನ್ನಡದ ಲೇಖನಗಳು ಹಾಗು ಪ್ರವಾಸ ಕಥನ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.
2. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
3. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
4. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2011 | 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 content:**

**Unit-I: ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ** **10 hours**

| | |
|---|---|
| ಚಂದ್ರಮತಿ ವಿಲಾಪ | ರಾಘವಾಂಕ |
| ಹಗೆಗಳನು ಹಿಂಡಿದನು ಮನದೊಳಗೆ | ಕುಮಾರವ್ಯಾಸ |
| ಬಿರುಗಾಳಿ ಪೊಡೆಯಲೆ | ಲಕ್ಷ್ಮೀಶ |
| ಗೋರಕ್ಷ ಪ್ರಸಂಗ | ಚಾಮರಸ |

**Unit II: ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ** **10 hours**

| | |
|---|---|
| ತ್ರಿಪದಿಗಳು | ಸರ್ವಜ್ಞ |
| ಮುಂದಕ್ಕೆ ಲೇಸುಂಟು ನಮಗೆ | ಹೆಳವನ ಕಟ್ಟೆ ಗಿರಿಯಮ್ಮ |
| ಗಿಳಿಯು ಪಂಜರದೊಳಿಲ್ಲ | ಪುರಂದರ ದಾಸರು |
| ಕರೆದು ಕೊಟ್ಟನು ಶಾಪವನು | ಕನಕದಾಸರು |

**Unit III: ಲೇಖನಗಳು** **10 hours**

| | |
|---|---|
| ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ | ಪಿ. ಲಂಕೇಶ |
| ನಿರಂಕುಶಮತಿಯಿಂದ ಆತ್ಮಶ್ರೀ | ಕುವೆಂಪು |
| ಮಾನವೀಯತೆ ಅಂತಾರಲ್ಲಾ | ದೇವನೂರು ಮಹಾದೇವ |
| ಭೂತಾಯಿ ಮುನಿದಾಳು | ಮುರಾರಿ ಬಲ್ಲಾಳ |

**Unit IV: ಪ್ರವಾಸ ಕಥನ** **10 hours**

| | |
|---|---|
| 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.


| Course code | Language-II: Hindi | L | T | P | C |
|---|---|---|---|---|---|
| B18MC2012 | | 2 | 1 | 0 | 2 |

**Prerequisites:**

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 |

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS/COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B18MC2012** | 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 content

अध्ययन विषय सूची / पाठ्यक्रम

इकाई – 1 कविता: प्राचीन एवं आधुनिक **10 hours**
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 hours**
4.तुलसीदस के पद
5.कविता – पाषाणी – नागार्जुन
6.कविता – चलना हमारा काम है- शिवमंगल सिंह सुमन

इकाई – 3 कविता: प्राचीन एवं आधुनिक **10 hours**
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 hours**
अनुवाद : शब्द एवं अनुच्छेद (हिन्दी से अंग्रेज़ी)
मीडिया लेखन
सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

**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

| **Course content** | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B18MC2013** | | **2** | **1** | **0** | **3** |

**Prerequisites:**
The student must possess fair knowledge of language and literature.

**Course objectives:**

1. To assess ecological and environmental concerns through literature.
2. To identify the in equal structures of power in society.
3. To compare the position of men and women in society.
4. To interpret the representation of society in popular culture.

**Course outcomes:**

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

1. Demonstrate a thorough understanding of sensitive and critical ecological and environmental issues.
2. Analyze the rigid structure of center and margin in our society.
3. To criticize the subordinate position of women in society.
4. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2013 | 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 content**

**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:**


1. Agrawal, K.A. Toru Dutt the Pioneer Spirit of Indian English Poetry - A Critical Study. Atlantic Publications, 2009.
2. Latham, Edward Connery (ed). The Poetry of Robert Frost. Holt Paperbacks, 2002.
3. Gale, Cengage Learning. A Study Guide for Tomas Rivera's The Harvest. Gale, Study Guides, 2017.
4. Basu, Tejan Kumar. The Life and Times of C.V. Raman. PrabhatPrakashan, 2016.
5. Rozewicz, Tadeusz. New Poems. Archipelago, 2007.

6. Manohar, Murli. Critical Essays on Dalit Literature. Atlantic Publishers, 2013.
7. Hansda, SowvendraShekhar. The Adivasi Will Not Dance: Stories. Speaking Tiger Publishing Private Limited, 2017.
8. Jacobs, Harriet. Incidents in the Life of a Slave Girl. Createspace Independent Publication, 2014.
9. Das, Kamala. Selected Poems. Penguin Books India, 2014.
10. Tagore, Rabindranath. Selected Short Stories of Rabindranath Tagore. Maple Press, 2012.
11. Gale, Cengage Learning.A Study Guide for Jamaica Kincaid's Girl. Gale, Study Guides, 2017.
12. Kipling, Rudyard. The Absent-Minded Beggar. Hardpress Publishing, 2013.
13. Doyle, Arthur Conan. The Hound of the Baskervilles. General Press, 2017.
14. Dixson, Robert J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd., 1988.
15. Turton, Nigel D. ABC of Common Errors. Mac Millan Publishers, 1995.
16. Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.
17. Kumar, E Suresh, J. Savitri and P Sreehari (ed). Effective English. Pearson Education, 2009.

| Course code | Functional English-II | L | T | P | C |
|---|---|---|---|---|---|
| B18MC2020 | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2020 | 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 content:**

**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** | **Biochemistry and Microbiology** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|
| **B18MC2030** | | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

Students need to have basic knowledge about microorganisms and cellular organelles.

**Course objectives:**

The objectives of this course are to:
1. Understand the basic concepts of biochemistry and microbiology.
2. Familiarize the carbohydrates, lipids, amino acids and proteins.
3. Familiarize the students in culturing of microorganism.
4. Identify and characterize biochemical using various techniques.
5. Understand and exploit the microorganism for beneficial purpose.

**Course outcomes**

On successful completion of this course, the student will be able to:
1. Understand and handle the biochemical techniques to the industry standards.
2. Analyse and interpret various biochemical pathways.
3. Explores the techniques to analyse carbohydrate, lipids and proteins.
4. Learn various methodology and techniques used in Microbiology research.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2030 | CO1 | 1 | 1 | 3 | 1 | 2 | 1 | 2 | 3 | 1 | 2 |
| | CO2 | 1 | 2 | 2 | 0 | 1 | 0 | 2 | 2 | 1 | 2 |
| | CO3 | 1 | 2 | 2 | 1 | 0 | 1 | 2 | 2 | 2 | 1 |
| | CO4 | 1 | 2 | 2 | 2 | 2 | 0 | 2 | 1 | 2 | 2 |

**Course content**

**UNIT I** **12 hours**

Introduction to carbohydrates: Scope of Biochemistry, Biomolecules, characteristics, classification of carbohydrates; Monosaccharaides: structure of aldoses and ketoses, Linear and ring forms (Haworth formula) for monosaccharaides for glucose and fructose, structure of biologically important sugar derivatives, oxidation of sugars; Disaccharides -sucrose and lactose -occurrence, structure; Physical and chemical properties, Hydrolysis of sucrose; Polysaccharides- Homopolysaccharides (storage) - starch, glycogen, cellulose, chitin-occurrence, structure, physical and chemical properties, Heteropolysaccharides (structural) – peptidoglycan, hyaluronic acid, Anomers, Epimers, Enantiomers, Optical isomers, Stereoisomers, Structure and role of proteoglycans, Functions of carbohydrates,

**UNIT-II** **12 hours**

Proteins: Introduction to amino acids, structure and properties of amino acids, classification of amino acids, Protein classification, peptides, protein functions; Glycoproteins, globular proteins, membrane proteins. Introduction to lipids: Classification, types of lipids and functions, oils and fats, saturated and unsaturated lipids, glycerol, triglycerides, glycolipids, phospholipids, steroids; Introduction to Vitamins and minerals: Structure, classification and functions of fat soluble and water soluble vitamins, Micro and Macro minerals and its absorption.

**UNIT-III** **12 hours**

Introduction to Microbiology: Origin, Historical Development and Scope of Microbiology. Prokaryotic (bacteria) and Eukaryotic microorganisms (fungi, algae) -general characteristics, classification and importance. Virology- General Characteristics, classification and importance. Brief introduction, characteristics, classification and importance to Mycoplasma, Prions and Viroids.

**UNIT-IV** **12 hours**

Concepts in Microbiology: Different methods of Sterilization and disinfection with examples. Microbial medium, Isolation and enumeration techniques used in Microbiology. Stains and Staining techniques used in microbiology. Microbial taxonomy-methods and its importance. Microbial diversity and its importance Metabolism-bacterial photosynthesis, aerobic and anaerobic respiration.

**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,


| Course Code | | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC2040 | Fundamentals of Mathematics-II | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisites:**

Fundamental knowledge on the formulae in Differentiation

**Course objectives:**

The objective of this Course is to

1. Explain Integration to the students
2. Find the solutions of different problems using Integration
3. Select the suitable method for solving differential equations
4. Construct a matrix to model a problem in Biology.

**Course outcomes**

After the end of the Course students will be able to

1. Solve problems by using Integration
2. Find the Areas of the surfaces using integration

3. Apply the concepts of Differential Equations
4. Relate the Biological Problems in the form of Matrices

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2040 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |

**Course contents:**

**Unit-I: 12 hours**

Primitive, different methods of integration – integration by substitution and integration by parts, definite integrals and its properties, double integrals (simple cases only).

**Unit-2: Integration 12 hours**

Integration (Definite and indefinite): Methods of Integration, Fundamental theorem of Calculus, Area under simple curves

Unit-3 : Differential Equations **12 hours**

Solution of Differential Equations by Variable separable, linear, Bernoullis and exact differential equations

**Unit- 4 – Linear Algebra 12 hours**

Definition of a matrix, adjoint and inverse of a square matrix, orthogonal matrix, rank of a matrix, elementary transformation of a matrix – reduction of a matrix to normal and echelon forms. Determinant of square matrix of order n, its properties, multiplication of determinants.

**Reference Books:**

1. Text Book of Calculus by Manicavavhagom Pillai
2. Differential Equations by George F Simmons
3. Integration by Manicavavhagom Pillai
4. Linear Algebra – Schaum Series
5. Matrices - Schaum Series
6. Matrix Theory by D Raghava Rao
7. Introduction to Vector Analysis by Harry F Davis

| **Course Code** | **Data Structures using C** | **Course type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC2050** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

The basic data structures like Arrays, Linked Lists, some of the basic algorithms like Sorting, Searching and mathematics knowledge.

**Course objectives:**

The objectives of this course are to:

1. Assess how the choice of data structures and algorithm design methods.
2. Choose the appropriate data structure and algorithm design method for a specified application.
3. Write programs using function-oriented design principles.
4. Solve problems using data structures such as linear lists, stacks, queues, trees.

**Course outcomes:**

On successful completion of this course; the student shall be able to:

1. Develop suitable algorithm for any application
2. Analyze algorithm based on time and space complexity
3. Write efficient program to implement any data structure.
4. Use different kinds of data structures which are suited to different kinds of applications, and some are highly specialized to specific tasks.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2050 | CO1 | 3 | 3 | 3 | 3 | 2 | 0 | 2 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | 2 | 0 | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 2 | 0 | 0 | 2 | 2 | 3 | 2 |

**Course content**

**UNIT -I: 12 hours**

Introduction and Overview: Definition of Data Structures, Elementary data organization, data structures operations, String Processing: Definition, Pointers, Storing Stings, String operations. Arrays: Definition, Linear arrays, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting elements into arrays.

**UNIT - II: 12 hours**

Sorting: Bubble sort, Insertion sort, Selection sort, searching: Linear Search, Binary search, Multidimensional arrays, Matrices and Sparse matrices. Stacks – Definition, Array representation of stacks, Linked representation of stacks, Arithmetic Expressions: Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack.

**UNIT - III: 12 hours**

Queues – Definition, Array representation of queue, linked list representation of queues Types of queue: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on Queues. Linked list: Definition, Representation of Singly linked list in memory, traversing a Singly linked list, searching a Singly linked list, Insertion into a singly linked list, Deletion from a singly liked list.

**UNIT - IV: 12 hours**

Doubly liked list, Header liked list, Circular linked list. Tree – Definitions, Binary trees, representing binary trees in memory, Traversing binary trees. Graphs: Graph theory terminology, Sequential representation of Graphs: Adjacency matrix, traversing a Graph.

**Reference Book:**


1. Data Structures Using C – A M Padma Reddy, Sri Nandi Publications.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013.
3. Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogalla, "Data Structures and Program Design using C", Pearson Education, 2009.
4. Seymour Lipschutz, "Data Structures with C", Schaum'soutLines, Tata McGraw-Hill, 2011.


| Course Code | Environmental Studies | L | T | P | C | CH |
|---|---|---|---|---|---|---|
| B18MC2060 | | 2 | 0 | 0 | 2 | 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 behaviours 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2060 | 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 content**

**Unit-I: Multidisciplinary Nature of Environmental Studies: 6 hours**

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: Environmental pollution, degradation & Waste management: 6 hours**

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: Energy & Natural resources: 6 hours**

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: Ecology and ecosystem: 6 hours**

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 |
|---|---|---|---|---|---|---|---|
| B18MC2070 | | RULO | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Note: Music, Dance, and Theatre 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.

**Yoga & Theatre**

**Course objectives:**

Following are the Course Objectives.

1. To prepare the students for the integration of their physical, mental and spiritual faculties;
2. To enable the students to maintain good health;
3. To practice mental hygiene and to attain higher level of consciousness;
4. To possess emotional stability, self-control and concentration; and

**Course outcomes:**

On completion of the course learners will be able to:

1. Practice yoga for strength, flexibility, and relaxation.
2. Learn techniques for increasing concentration and decreasing anxiety
3. Become self-disciplined and self-controlled
4. Improve physical fitness and perform better in studies
5. 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.

**VOLLEYBALL**

**Course objectives:**

1. To learn the rules, fundamental skills, and strategies of volleyball
2. To develop skills in passing, setting, serving, spiking, and blocking.
3. To learn basic offensive and defensive patterns of play.
4. 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

**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, Overhead 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

**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:** 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

**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.


**DRAMATICS**

**Prerequisites:**

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.


**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:**

1. To develop an understanding about the Indian classical dance forms and its universal application.
2. To be able to understand the fine nuances of Classical dance.
3. To understand the importance of health through Indian classical dance, strengthen the body capacity.

**Course outcomes:**

1. To understand mythology and its characters in Indian classical dance form through lessons of Abhinaya.
2. To be able to identify and appreciate the classical dance forms.
3. To be able to execute basics of Adavus with finesse.

4. To be able to express through abhinaya.
5. 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


**PERCUSSION INSTRUMENT (TABLA AND MRIDANGAM)**

**Prerequisites:**

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 | Biochemistry and Microbiology Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC2090 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

Student should be familiar with basic knowledge of biology and microscopy

**Course objectives:**

The objective of this Course is to:

1. Familiarise the concept of biomolecules quantification.
2. Develop an ability to characterise microorganisms based on various techniques

**Course outcomes:**

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

1. Understand the basics structure and functions of biomolecules.
2. Acquire the knowledge of basic principles of biochemical techniques.
3. Understand the knowledge of culturing and preserving of microbial cells.
4. Develop the basic practical skills in microbiology.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2080 | CO1 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO3 | 2 | 1 | 4 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 2 | 1 | 5 | 2 | 2 | 1 | 1 | 2 | 3 | 3 |

**Course content:**

1. Preparation of buffers.
2. Estimation of glucose using DNS method.
3. Estimation of crude protein using Lowry's method.
4. Determination of amino acids by Bradford's method.
5. Determination of Iodine number, Iodine value.
6. Preparation of Medium-MRBA, NA and NB
7. Isolation of micro flora from air, soil and water samples. Establishment of pure culture
8. Staining Methods-Simple, negative, Gram and Endospore staining techniques
9. Estimation of microbes by turbidometry and haemocytometer
10. Biochemical Test-Starch and cellulose hydrolysis, Gelatin hydrolysis, Oxidase test, AST

**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.
5. David Plummer, An introduction to practical Biochemistry 7th edition, 2013

6. Manicam and Sadasivam, Biochemical methods 4th edition, 2006
7. Leininger Principles of Biochemistry 8th edition by David Nelson, Michael M.cox 2018
8. Biochemistry by Donald Voet, Judith G. Voet
9. Biochemistry by U. Satyanarayana
10. Biochemistry 6th edition by Lubert strayed

| Course Code | Mathematics Practical –II | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC2090 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**
Fundamental knowledge on the formulae on Differentiation

**Course objectives:**
The objective of this Course is to
1. Introduce Differentiation to the students
2. Demonstrate the Mathematical Models in Bio Informatics using Differential Equations

**Course outcomes:**
After the end of the Course students will be able to:
1. Formulate problems by using Successive Differentiation
2. Solve mathematically and interpret biologically simple problems using Differentiation
3. Explain and apply the concepts of Differential Equations
4. Develop the ability to explain mathematical results in language understandable by biologists.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2090 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |

**PART A**

**Using Maxima write, a**

1. Program on fundamental integration
2. Program to find the value of definite integral
3. Program to find the value of double integral
4. Program to find the solution of Differential Equations by Variable separable,
5. Program to find the solution of Differential Equations by linear method
6. Program to find the solution of Differential Equations by Bernoulli's method
7. Program to find the solution of exact Differential Equations
8. Program to plot the curves
9. Program to find the area under simple curves
10. Program to find the values of the given algebraic and transcendental functions

**Using Scilab write a**

11. Program to find the maximum value of the matrix
12. Program to find the row values of the matrix
13. Program to find the determinant of the matrix
14. Program to find the rank of the matrix
15. Program to find the echelon form of the matrix

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

| Course Code | Data Structures Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC2X10 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

Computer Programming knowledge

**Course objectives:**

The objectives of this course are to:

1. To develop skills to design and analyze simple linear and nonlinear data structures.
2. To strengthen the ability to identify and apply the suitable data structure for the given real world problem.
3. To gain knowledge in practical applications of data structures.

**Course outcomes:**

On successful completion of this course; the student shall be able to:

1. To learn elementary data structures such as stacks, queues, linked lists, trees and graphs
2. To design algorithms to solve the problems
3. To design and analyze the time and space efficiency of the data structure
4. To discuss different data structures to represent real world problems

Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC2X10 | CO1 | 3 | 3 | 3 | 3 | 0 | 0 | 2 | 3 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 3 | 3 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | 0 | 0 | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 2 |

**Course content:**

**PART – A**

1. Write a menu driven C program to perform the following string operations without using string functions: (i) String Length (ii) String Concatenation
2. Write a C program to search for an element in an array using Binary search
3. Write a C program to sort a list of N elements using Bubble Sort Algorithm
4. Write a C program to demonstrate the working of stack using an array.
5. Write a C program for Towers of Hanoi problem.
6. Write a C program to find GCD of two numbers using recursion
7. Write a C program to demonstrate the working of Queue using an array.
8. Write a C program to simulate the working of Circular Queue using an array.
9. Write a C program to construct a singly linked list and perform following operations

a. Inserting a node b. deleting the node c. searching a node d. displaying all the nodes

10. Write a C program to demonstrate binary tree traversal.

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

**Reference Books**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

## THIRD-SEMESTER

| Course code | Language: Kannada-III | L | T | P | C |
|---|---|---|---|---|---|
| B18MC3011 | | 2 | 1 | 0 | 3 |

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

**Course objectives:**

1. 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.
2. ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
3. ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
4. ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
5. ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

## Course outcomes:

1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವೋದಯ, ನವ್ಯ ಕಾವ್ಯ, ಸಣ್ಣಕಥೆಗಳು ಹಾಗು ನಾಟಕ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟ ಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.
2. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
3. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
4. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3011 | 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**

| | |
|---|---|
| ಬೆಳಗು | ದ.ರಾ. ಬೇಂದ್ರೆ |
| ಕಲ್ಕಿ | ಕುವೆಂಪು |
| ಕನ್ನಡ್ ಪದಗೊಳ್ | ಜಿ. ಪಿ. ರಾಜರತ್ನಂ |

**Unit-II: ನವೋದಯ ಹಾಗು ನವ್ಯ ಕವಿತೆಗಳು** **10 hours**

| | |
|---|---|
| ಅವಧೂತ | ಸು.ರಂ.ಎಕ್ಕುಂಡಿ |
| ಮನೆಯಿಂದ ಮನೆಗೆ | ಕೆ.ಎಸ್.ನ |
| ನನ್ನ ಹಣತೆ | ಜಿ.ಎಸ್.ಎಸ್. |

**Unit-III: ಸಣ್ಣ ಕಥೆಗಳು** **10 hours**

| | |
|---|---|
| ದಾಳಿ ನಡೆದಾವ ಅಣ್ಣಾ | ಅಮರೇಶ ನುಗಡೋಣಿ |
| ಕೊನೆಯ ಗಿರಾಕಿ | ನಿರಂಜನ |
| ಮಾನೀಟರ್ | ತೇಜಸ್ವಿ |

**Unit-IV: ನಾಟಕ** **09 hours**

| | |
|---|---|
| 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


| **Course code** | **Language – II: Hindi** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B18MC3012** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

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|

**Course objectives:**

पाठ्यक्रम उद्देश्य :

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

**Course outcomes:**

अधिगम परिणाम :

1. अध्ययन की समाप्ति पर अध्येता –
2. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
3. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
4. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3012 | 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 content**

इकाई –**1** :नाटक **:** एक और द्रोणाचार्य – डॉ. शंकर शेष **10 hours**
लेखक परिचय, प्रथम दृश्य, द्वितीय दृश्य

इकाई –**2** :नाटक **:** एक और द्रोणाचार्य **10 hours**
तृतीय दृश्य
चतुर्थ दृश्य

इका ई –**3** :नाटक **:** एक और द्रोणाचार्य **10 hours**

पंचम दृश्य
छठा दृश्य
इकाई –**4**: **09 hours**
अनुवाद : अंग्रेजी - हिन्दी - समाचार पत्र संबंध
हिन्दी - अंग्रेजी - समाचार पत्र संबंध
रिपोर्टिंग
सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

| **Course code** | **Language-II: Additional English** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B18MC3013** | | **2** | **1** | **0** | **3** |

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

**Course objectives:**
1. To outline the global and local concerns of gender and identity.
2. To identify the complexities of human emotions through literature.
3. To assess the struggles of human survival throughout history.
4. To compare and contrast between the various dimensions of childhood.
5. To compare and contrast between the various dimensions of childhood.

**Course outcomes:**
On completion of the course, learners will be able to:
1. Evaluate the pressing gender issues within our society.
2. Criticize human actions through a humane and tolerant approach.
3. Perceive the human conflicts with an empathetic perspective.
4. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3013 | 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:**


1. Sexton, Anne. The Complete Poems. Houghton Mifflin, 1999.
2. Namjoshi, Suniti. Feminist Fables. Spinifex Press, 1998.
3. Vanita, Ruth & SaleemKidwai (ed.) Same Sex Love in India. Penguin India, 2008.
4. Gilman, Charlotte Perkins. The Yellow Wallpaper. Rockland Press, 2017.
5. Gale, Cengage Learning. A Study Guide for Alfred Noyes's "The Highwayman". Gale, Study Guides, 2017. (Kindle Edition Available)
6. Shakespeare, William. Poems and Sonnets of William Shakespeare. Cosimo Classics, 2007.
7. Stockton, Frank Richard. The Lady, or the Tiger? Create space Independent Publications, 2017.
8. Wilde, Oscar. The Collected Works of Oscar Wilde. Wordsworth Editions Ltd., 1997.
9. Tennyson, Lord Alfred. The Complete Works of Alfred Tennyson. Forgotten Books, 2017.
10. Blake, William Erdman, David V. (ed.). The Complete Poetry and Prose (Newly revised ed.). Anchor Books, (1988).
11. Maupassant, Guy de. Guy de Maupassant-The Complete Short Stories. Projapati, 2015.
12. Manto, Sadaat Hasan. Manto: Selected Short Stories. RHI, 2012.
13. Ricks, Christopher. Metaphysical Poetry. Penguin, 2006.
14. Sewell, Anna. The Black Beauty. Maple Press, 2014.
15. Kipling, Rudyard. The Jungle Book. Amazing Reads, 2018.


| **Course code** | **Communicative English-I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B18MC3020** | | **2** | **1** | **0** | **3** |

**Prerequisites:**

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

**Course objectives:**

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

**Course outcomes:**

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

1. Identify pressing issues relating to society, environment and media.
2. Develop a process-oriented approach to writing.
3. Apply the grammatical skills developed during the course aptly.
4. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3020 | 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:**


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** | **Bioinformatics** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|
| **B18MC3030** | | **2** | **1** | **0** | **3** | **4** |

**Prerequisite:**

Students should have basic knowledge of biology, statistics and computer sciences.
Students should be familiar with the basic concepts of DNA, RNA and Protein.

**Course objectives:**

The objectives of this course are to:

1. Understand the scope of bioinformatics in interdisciplinary field of science.
2. Understanding the biological databases, data structures and formats.
3. Learn the fundamentals of accessing biological databases to solve biological problems.
4. Provide the student with a strong foundation on bioinformatics tools, software's to perform further research.

**Course outcomes:**

After completion of the course a student will be able to:

1. Understand the methodologies used for database searching, and determining the accuracy of database search.
2. Design and implement the algorithms used in sequence and structure prediction to solve biological problems.
3. Analyse and interpret the sequence and structure to predict the evolutionary relationships.
4. Predict the gene and protein structures using publicly available computational tools.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3030 | CO1 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 1 |
| | CO2 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO3 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 1 |

**Course content**

**Unit: I: Fundamentals of Bioinformatics** **12 hours**

Introduction to Bioinformatics, Goal, Scope, Applications, Limitations, Biological Databases: Types of Databases, Biological databases; Literature databases: Open access and open sources, PubMed, PLoS, Biomed Central, Information Retrieval from Biological Databases; Sequence Formats, Sequence databases, structural databases, Genome Databases: Viral genome database (ICTVdb, VirGen), Bacterial Genomes database (Genomes OnLine Database –GOLD, Microbial Genome Database-MBGD), Organism specific Genome database (OMIM / OMIA, SGD, Worm Base, PlasmoDB, FlyBase, TAIR), and ligand databases.

**Unit: II: Sequence Analysis:** **12 hours**

Basic concepts of sequence similarity, identity and homology, definitions of homologues, Orthologous, Paralogous and Xenologous, Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, matrix derivation methods and principles. Measurement of sequence similarity; Similarity and homology. Pairwise 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: III: Multiple sequence alignments (MSA):** **12 hours**

The need for MSA, basic concepts of various approaches for MSA. Algorithm of CLUSTALW and PileUP and their application for sequence analysis (including interpretation of results), concept of dendrogram and its interpretation, Use of HMM-based Algorithm for MSA, Phylogenetic Analysis: Definition and description of phylogenetic trees and various types of trees, Phylogenetic analysis algorithms such as maximum Parsimony, UPGMA, Transformed Distance, Neighbours-Relation, Neighbour-Joining, Probabilistic models and associated algorithms such as Probabilistic models of evolution and maximum likelihood algorithm, Bootstrapping methods, use of tools such as Phylip, Mega, PAUP.

**Unit: IV: Structure Predictions** **12 hours**

Gene structure prediction: Exons, introns, ORFs, regulatory regions, Prokaryotic gene prediction, Eukaryotic gene prediction, Gene structure prediction tools, Protein structure prediction: Protein classification, Protein structure prediction tools: Physico-chemical properties of proteins, motifs and patterns, protein fold prediction, Chou Fasman, GOR methods; Purpose of 3-D structure comparison and concepts; Algorithms such as FSSP, CE, VAST and DALI, Fold Classes. Databases of structure-based classification: CATH and SCOP. Structures of oligomeric proteins and study of interaction interfaces, Hidden Markov Model.

**Reference Books:**


1. Andreas D. Baxevanis, B.F. Francis Ouellette. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 2nd Edition, 2009.
2. David W. Mount., Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, New York. 2004.
3. Andrew R. Leach., Molecular Modelling Principles and Applications (2nd Ed.), Prentice Hall, USA. 2001.
4. G. E. Schulz., Principles of Protein Structure, Springer 2009.


| Course Code | Biostatistics– I | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC3040 | | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisites:**

Knowledge of basic mathematics, matrices, simple co-ordinate geometry, graph Theory

**Course objectives:**

The objective of this Course is to:

1. To Explain the students about basic concepts of Biostatistics
2. To study the concepts of Measures of Dispersion
3. To study the concepts of Different Distributions.

**Course outcomes:**

After the end of the Course students will be able to

1. Solve the examples of Measures of Central Tendency
2. Solve mathematically and interpret biologically simple problems using Measures of Central Tendency
3. Solve problems of Measures of Dispersion
4. Solve the ability to explain mathematical results in language understandable by biologists

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3040 | CO1 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 |
| | CO2 | 3 | 1 | 1 | 2 | | | | 1 | 2 | 1 |
| | CO3 | 3 | 1 | 1 | 1 | | | | 1 | 1 | 1 |
| | CO4 | 3 | 2 | | 1 | | | | 1 | | |

**Course contents:**

**Unit-I** **12 hours**

Introduction to biostatistics, types of data, methods of data collection, classification and tabulation of data. Diagrammatic and graphical representation of data, frequency distribution, cumulative frequency distribution and their graphical representation, histogram, frequency polygon, frequency curve and ogives.

**Unit-II** **12 hours**

Measures of Central tendency: Mean, Median & Mode. Measures of dispersion Variability: Range, Quartile deviation, Mean deviation, Standard deviation and Coefficient of variation.

**Unit-III** **12 hours**

Basic concepts of Probability – Sample space and events – Addition and Multiplication theorem –Baye's theorem and conditional probability

**Unit-IV** **12 hours**

Random Variables (discrete and continuous), probability mass function, probability density function, cumulative distribution function and their properties. Theoretical distribution: Binomial, Poison and Normal.

**Reference Books**

1. Palanichamy, S. and Manoharan, M., Statistical methods for biologist, Paramount publications.
2. Arora P.N and Malhon.P.K., Biostatistics, Himalaya publishing house, Mumbai, 1996.
3. Ramakrishnan, P., Bio statistics, Saras Publications, Nagercoil, 1996.
4. Sokal R.J. and Roflf. S.J., Introduction to Biostatistics, W.H.Freeman London, 1981.
5. Zar, J.H., Biostatistical analysis, McGraw Hill, London,1983.
6. S.C. Gupta, and V.K.Kapoor, Fundamentals of mathematical Statistics, S. Chand and Sons, New Delhi, 2002.

| **Course Code** | **RDBMS** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC3050** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

DBMS fundamentals, the proper understanding of data structures and algorithms will help you to understand the DBMS quickly.

**Course objectives:**

The objectives of this course are to:

1. Learn and practice data modelling using the entity-relationship and developing database designs.
2. Design and implement a database schema for a given problem-domain
3. Apply normalization techniques to normalize the database
4. Understand the use of Structured Query Language (SQL) and learn SQL syntax.

**Course outcomes:**

On successful completion of this course; the student shall be able to:

1. To describe data models and schemas in DBMS
2. To use SQL- the standard language of relational databases.
3. To understand the functional dependencies and design of the database.
4. To understand the concept of Transaction and Query processing

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3050 | CO1 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 3 | 2 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | 0 | 0 | 2 | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 0 | 0 | 2 | 0 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 2 | 0 | 0 | 2 | 3 | 3 | 2 |

**Course content**

**UNIT – I: 12 hours**

Introduction: Database and Database Users, Characteristics of the Database Approach, Different people behind DBMS, Implications of Database Approach, Advantages of using DBMS, when not to use a DBMS. Database System Concepts and architecture: Data Models, Schemas, and Instances. DBMS Architecture and Data Independence., Database languages and interfaces. The database system Environment, Classification of DBMS.

**UNIT - II: 12 hours**

Data Modelling Using the Entity-Relationship Model: High level conceptual Data Models for Database Design with and example., Entity types, Entity sets, attributes, and Keys, ER Model Concepts, Notation for ER Diagrams, Proper naming of Schema Constructs Functional Dependencies and Normalization for Relational Database: Informal Design Guidelines for Relational schemas, Functional Dependencies, Normal Forms Based on Primary Keys., General Definitions of Second and Third Normal Forms Based on Primary Keys, Boyce-Codd Normal Form.

**UNIT - III: 12 hours**

RDBMS: Relational database concepts – attribute, tuple, types of attributes – single, multi-valued, stored, derived etc., keys – primary, index, candidate, alternate, foreign, Relationships, Relational algebra operations– Union, Intersection, Difference, Cartesian Product, Selection, Projection, Join, Division, Additional Relational Operations, Examples of queries in the Relational Algebra.

**UNIT – IV: 12 hours**

Relational Database Language: DL and DML in SQL: DDL commands - create table/views/index, drop, alter, DML commands – select, insert, delete, update, etc., DCL commands – grant, revoke, commit, TCL commands, SQL – query, sub-query, nested query, Joins – natural, inner, outer join, aggregate functions in SQL.

**Reference Books:**


1. RemezElmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2007.
2. Abrahamsi. Silberschatz, Henry. F. Korth, S. Sudarshan, “Database System Concepts” 6th Edition, McGraw Hill, 2012.
3. C.J.Date, “Introduction to database systems”, Eight Edition, Addison Wesley .


| **Course code** | **Physics in Everyday Life** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **B20PC3060** | | **4** | **0** | **0** | **4** |

Prerequisites:
Basics of Physics and its importance in everyday life.

Course objectives
To have a clear understanding of the working and principles of home appliances
To understand phenomena of light and its application
To know the formation of clouds and cyclic process.
To implement and understand properties of smart materials for their application in various places.

Course outcomes
On successful completion of this course, the student is expected to be able to:
1. Postulate the basics of principles and working of electrical devices in our daily life
2. Explain the physical phenomena of sensors and electronic components
3. Analyse the formation of clouds and cyclic process
4. Compresence the properties of smart materials
5. Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B20PC3060 | CO1 | 3 | 3 | 3 | 3 | | | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 |
| | CO3 | 3 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | 2 | 2 | 3 | 3 |

**Course content**

**UNIT-I: Gadgets in Daily Life** **12 hours**

Principle of levers, Frictional force, Electric fans, motors and bulbs, Washing Machines, Kitchen Electronics, Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart elevator, Smart floor, Smart locks, batteries. working principle of Microphone, Loud speaker, AM and FM receiver and radio, Basics of Smart phones and Digital Cameras

**UNIT-II: Applications of Electromagnetic Waves** **12 hours**

Introduction to Electromagnetic waves and applications, scattering of light in atmosphere, LASER and application, Hologram and 3D pictures, Optical fibres and communication system, RADAR & navigation and its applications, display systems: CRT, LCD, LED and Photodiode, Mobile communication.

**UNIT-III: Atmosphere** **12 hours**

Clouds: Introduction, Atmospheric thermodynamics, Vapor pressure, Formation of Cloud droplets, Lightning, electrical properties of the fair, weather atmosphere, electrical properties of a thunderstorm, Benjamin Franklin's famous kite experiment, cloud-to-ground lightning, Intra-cloud lightning, other forms of lightning, thunder, lightning rods, lightning safety.

**UNIT-IV: Advanced Materials** **12 hours**

Super conductors, Semiconducting materials, physical principles of optical materials (Polaroids, goggles), dielectrics, piezoelectric, ferroelectric, pyroelectric, magnetic materials and their applications, Motion Sensors, Thermal Sensors and Image Sensors, and Water Level Sensors.

**Recommended Books:**


1. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
2. Jordan Frith, “Smartphones as Locative Media ", Wiley. 2014
3. M. I. Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
4. A Short Course in Cloud Physics; R. R. Rogers
5. The Physics of Clouds; B. J. Mason
6. Dennis C Brewer, " Home Automation", Que Publishing 2013
7. T. Pratt, C. Bostian and J. Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003

8. S.P Basavaraju- Engineering Physics -2016

| Course Code | Classical Optimization | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC3070 | | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisites:**
Knowledge of function, continuous function differentiable function and differential calculus.

**Course objectives**
The objectives of this course are to:
1. Make students to learn principles of optimization.
2. Implement the optimization concepts for the structural engineering problems.
3. Evaluate different methods of optimization.
4. Understand use of Structured Query Language (SQL) and learn SQL syntax.

**Course outcomes:**
After the completion of the course, the student will be able:
1. Achieve Knowledge of design and development of problem solving skills.
2. Understand the principles of optimization and the concept of Dynamic programming.
3. Design and develop analytical skills.
4. Summarize the Linear, Non-linear and Geometric Programming.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3070 | CO1 | 3 | 2 | 2 | 2 | | | | | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | | | | 3 | 2 |
| | CO3 | 3 | 2 | 2 | 2 | | | | | 3 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | | | | 2 | 3 |

**Course content**

**UNIT-I: 12 hours**

Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, Single variable optimization, Multivariable optimization with no constraints.

**UNIT-II: 12 hours**

Unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

**UNIT-III: 12 hours**

Non-linear programming, One dimensional minimization methods, Elimination methods, Fibonacci method, Golden section method, Interpolation methods, Quadratic and cubic methods, Unconstrained optimization methods, Direct search methods, Random search methods, Descent methods.

**UNIT-IV: 12 hours**

Constrained optimization techniques such as direct methods, The complex methods, Cutting plane method, Exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different techniques.

**Reference Books:**

1. Spunt, “Optimum Structural Design”- Prentice Hall
2. S.S. Rao, “Optimization – Theory and Practice”- Wiley Eastern Ltd.
3. Uri Krisch, “Optimum Structural Design”- McGraw Hill
4. Richard Bronson, “Operation Research”- Schaum’s Outline Series
5. Bhavikatti S.S.- “Structural optimization using sequential linear programming”- Vikas publishing house

| Course code | Chemistry in daily life | L | T | P | C |
|---|---|---|---|---|---|
| B20PC3080 | | 4 | 0 | 0 | 4 |

Prerequisites:
Basic knowledge of physics, chemistry and biology. Ores and minerals, milk products, oils and fats.

**Course objectives:**

1. Introduce the concept and discipline of chemistry in our daily life.
2. Acquire the knowledge of composition of milk products, beverages, additives, contaminants, flavouring agents used in day to day life.
3. Classification of pigments, dyes and drugs. Methods of application of dye to the fabrics.
4. Discuss the structure and functions of various drugs like paracetamol, aspirin, etc.,
5. Develop the skill of chemical processes that can be used to run our daily life.

**Course outcomes:**

1. Explain the composition of dairy products, beverages, food additives and flavours
2. Classify typical pigments, Dyes, Drugs, Oils, fats and Soaps & Detergents.
3. Predict the percentage of organic matter present in the soil and deduce the factors affecting decomposition of organic matter in soul.
4. Identify the physical properties of soil and its importance in soil fertility.
5. Mapping of Course Outcomes with programme Outcomes

| Course Code | POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B20PC3080 | CO1 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO2 | 3 | 2 | 2 | 2 | | 2 | | 3 | 2 | 2 |
| | CO3 | 3 | 2 | 2 | 1 | | 2 | | 3 | 2 | 3 |
| | CO4 | 3 | 3 | 2 | 2 | | 3 | 2 | 3 | 2 | 3 |

**Course content**

**UNIT-I** **12 hours**

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages. Food additives, adulterants and contaminants: Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food.

**UNIT-II** **12 hours**

Pigments & Dyes: a) White pigments (white lead, ZnO, lithopone, TiO2). Blue, red, yellow and green pigments. b) Colour and constitution (electronic concept) of dye. Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl organe. Drugs: Classification and nomenclature. Structure and function of: Analgesics – aspirin, paracetamol. Anthelmentic drug: mebendazole. Antiallergic drug: Chloropheneramine maleate. Antibiotics: Pencillin V, Chloromycetin, Streptomycin. Anti-infalmmatory agent: Oxypheno-butazone. Antimalarials: Primazuine phosphate & Chloroquine. Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like aregemone oil and mineral oils. Soaps & Detergents: Structures and methods of use of soaps and detergents.

**UNIT-III** **12 hours**

Soil forming Rocks and Minerals: Definition of soil, definition, classification and properties of rocks and minerals. Weathering: Definition and types, factors responsible for weathering. Soil profile: Definition, soil horizons and typical diagram of soil profile. Soil components- inorganic and organic components in soil-micro and macronutrients. Soil fertility and productivity: Definition, comparison between fertility and productivity and factors affecting them. Soil physical properties and their importance in soil fertility: 1. Soil texture and mechanical analysis of soil. 2. Soil structure. 3. Soil density and porosity. 4. Soil colour. 5. Soil temperature 6. Soil aeration.

**UNIT-IV** **12 hours**

Soil water: Importance, retention and movement of water in soil. Loss of water in soil and plants. Soil organic matter: Sources, composition and decomposition of soil organic matter. Influence of soil organic matter. Factors affecting decomposition of organic matter. Ion exchange properties of soil: Introduction, cation exchange process in soil. Anion exchange. Soil reaction and buffering of soil: Definition, factors controlling soil pH. Relation of soil pH and nutrient availability. Buffer capacity of soil. Fertilisers: Classification of Fertilizers- Straight Fertilizers, Compound/Complex Fertilizers, Fertilizer Mixtures. Manufacture and general prosperities of Fertilizer products- Urea and DAP.

**Reference Books:**


1. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharamaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
4. Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E.Cox and pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7 th Ed. 2002, Oxford University Press.
7. Handbook on Feritilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
8. Fundamental of soil science: Forth and Turk.
9. Principles of soil science: M. M. Rai.
10. Nature and properties of soil: Bookmann and Brady.
11. A textbook of soil science: Dr. J. A. Daji.


| **Course Code** | **Bioinformatics Practical** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC3090** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

Students should have basic knowledge on biology, statistics and computer sciences.

Students should know the basic concepts of DNA, RNA and Protein.

**Course objectives:**

The objectives of this course are to:

1. The basic objectives of the course are enable the students to understand biological databases and tools.
2. Understanding the biological databases, literature search methods and data formats.
3. Learn the technical skills on sequence analysis and structure prediction of genes and proteins.
4. Provide the student with a strong foundation on biological data structures.

**Course outcomes:**

After completion of the course a student will be able to:

1. Understand the biological databases and retrieve data structures for problem solving.
2. Design and implement the algorithms for DNA, RNA and protein sequence and structure analysis.
3. Analyse and interpret the sequence, structures and functions to predict the evolutionary relationships.
4. Prediction of gene and protein structures using publicly available biological tools.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3090 | CO1 | 3 | 3 | 3 | 2 | 1 | | 1 | 1 | 2 | 1 |
| | CO2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO3 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 |
| | CO4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |

**Course contents:**

1. Entrez and Literature Searches; PubMed, PubMed Central, OMIM / OMIA, Citation Matcher, Mundle,

2. SRS of Biological Databases; Nucleotide/ Genome Databases, Protein Sequence databases, structure databases, Protein patterns databases
3. File format conversion; FmtSeq, ReadSeq, Sequence manipulation suite
4. Sequence Analysis; Dot Plot, Pairwise sequence alignment: BLAST, FASTA, PSI-BLAST
5. Multiple Sequence Alignment: Clustal Omega, Kalign, Multalign, PAUP
6. Protein motif and domain analysis: MEME/MAST, eMotif, InterproScan, ProSite, ProDom, Pfam, Scanprosite.
7. Phylogenetic analysis
8. Gene structure Prediction: Glimmer, Agustus, MZEF, GenScan, Genome Scan, ORF Finder
9. Protein structure Prediction: Protparam, SOPMA, GOR, Chou Fasman, Swiss Model, Phyre2
10. Softwares; BioEdit, GeneDoc, MEGA, T-Cofee.

**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.

| Course Code | Mathematics Practical - III | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC3X10 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

Fundamental knowledge on Tabulation in Statistics from PU (or) (+2) Level mathematics

**Course objectives:**

1. To have the basic knowledge of collection and tabulation of data
2. To describe the univariate and bivariate data analysis
3. To understand the concepts of probability
4. To explore the basics of R software

**Course outcomes**

The student will be able to:

1. Tabulate the data and analyses them graphically
2. Summarize the analysis of univariate and bivariate data
3. Customize the data on the basis of probability
4. Acquire the knowledge of R software in statistical analysis.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3X10 | CO1 | 3 | 2 | 2 | 1 | | | | 1 | 1 | 1 |
| | CO2 | 3 | 1 | 1 | 2 | | | | 1 | 2 | 1 |
| | CO3 | 3 | 1 | 1 | 1 | | | | 1 | 1 | 1 |
| | CO4 | 3 | 2 | | 1 | | | | 1 | | |

**Course content**

1. (Demonstration of practicals using R-software)
2. Construction of frequency distribution andgraphical representation.
3. Measures of central tendency I (Mathematical averages).
4. Measures of central tendency II (Positional averages & Partition values).
5. Measures of dispersion I (Range, QD, MD,SD and CV).
6. Moments, skewness, and kurtosis for a frequency distribution.
7. Fitting of first, second, exponential and geometric curves.
8. Correlation and regression for ungrouped data and Spearman's rank correlation coefficient.

9. Correlation and regression for grouped data.
10. Computation of probabilities using combinatorial methods.
11. Application of addition rule, conditional probability, Baye's formula.

| Course Code | RDBMS Practical – III | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC3X20 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**
Sql, Domain types of sql, models.

**Course objectives:**
The objectives of this course are to:
1. Have a good understanding of how several fundamental algorithms work, particularly those concerned with creation and updating of tables.
2. Have a good understanding of the fundamental DBMS used in computer science be able to understand various queries and their execution.
3. be able to design new database and modify existing ones for new applications and reason about the efficiency of the result

**Course outcomes**
On successful completion of this course; the student shall be able to:
1. Infer database language commands to create simple database
2. Analyze the database using queries to retrieve records
3. Analyze front end tools to design forms, reports and menus
4. Develop solutions using database concepts for real time requirements.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC3X20 | CO1 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 3 | 3 | 1 |
| | CO2 | 3 | 3 | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 0 | 0 | 1 | 3 | 2 | 1 |
| | CO4 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 3 | 3 | 3 |

**PART – A**
1. The STUDENT detail databases has a table with the following attributes. The primary keys are underlined.
STUDENT (regno: int, name: string, dob: date, marks: int)

i) Create the above table.
ii) Remove the existing attributes from the table.
iii) Change the data type of regno from integer to string.
iv) Add a new attribute phoneno to the existing table.
v) Enter five tuples into the table.
vi) Display all the tuples in student table.

2. A LIBRARY database has a table with the following attributes.

LIBRARY (bookid:int, title:string, author:string, publication:string, yearpub:int, price:real)

i) Create the above table.
ii) Enter the five tuples into the table
iii) Display all the tuples in student table.
iv) Display the different publishers from the list.
v) Arrange the tuples in the alphabetical order of the book titles.
vi) List the details of all the books whose price ranges between Rs. 100 and Rs. 300

3. The SALARY database of an organization has a table with the following attributes.

EMPSALARY(empcode:int, empname:string, dob:date, department:string, salary:real)

i) Create the above table.
ii) Enter the five tuples into the table
iii) Display all the number of employees working in each department.
iv) Find the sum of the salaries of all employees.
v) Find the sum and average of the salaries of employees of a particular department.
vi) Find the least and highest salaries that an employee draws.

4. Consider the insurance database given below. The primary keys are underlined and the data types are specified.

PERSON(driver-id-no: string, name: string, address:string)
CAR(regno: string, model: string, year: int)
ACCIDENT(report-no: int, date: date, location: String)
OWNS(driver-id-no: string, regno: string)
PARTICIPATED(driver-id-no: string, regno: string, report-no: int, damage-amount: int)

i) Create the above tables by properly specifying the primary keys and the foreign keys
ii) Enter at least five tuples for each relation.
iii) Demonstrate how you
a) Update the damage amount for the car with a specific regno in the accident with report no 12 to 25000.
b) Add a new accident to the database.
iv) Find total number of people who owned cars that were involved in accidents in 2002
v) Find the number of accidents in which cars belonging to a specific model were involved

5. Consider the following database of students enrollment in courses and books adopted for each course.

STUDENT(regno: string, name: string, branch: string, bdate: date)
COURSE(course-no: int, cname: string, dept: string)
ENROLL(reg-no: string, course-no: int, sem: int, marks: int)
BOOK-ADOPTION(course-no: int, sem: int, book-isbn: int)
TEXT(book-isbn: int, book-title: string, publisher: string, author: string)

i) Create the above tables by properly specifying the primary keys and the foreign keys
ii) Enter at least five tuples for each relation.
iii) Demonstrate how you add a new text book to the database and make this book be adopted by some department.
iv) Produce a list of text books (include Course-no, book-isbn, book-title) in the alphabetical order for courses offered by the ‘Compute Science’ department that use more than two books.
v) List any department that has all its adopted books published by a specific publisher.

6. The following tables are maintained by a book dealer

AUTHOR(author-id: int, name: string, city: string, country: string)
PUBLISHER(publisher-id: int name: string, city: string, country: string)
CATLOG(book-id: int, title:string,author-id:int, publisher-id:int, category:int, year:int, price: int)
CATEGORY(category-id: int, description: string)
ORDER-DETAILS(order-no: int, book-id: int, quantity: int)
i) Create above tables by properly specifying the primary keys and the foreign keys.
ii) Enter atleast five tuples for each relation.

iii) Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2010.
iv) Find the author of the book which has maximum sales.
v) Demonstrate how to increase price of books published by specific publisher by 10%

7. Consider the following database for BANK.
BRANCH(branch-name: string, branch-city: string, assets: real)
ACCOUNT(accno: int, banch-name: string, balance: real)
DEPOSITOR(customer-name: string, accno: int)
CUSTOMER(customer-name: string, customer-street: string, customer-city: string)
LOAN(loan-no: int, branch-name: string, amount: real)
ORROWER(customer-name: string, loan-no: int)

i) Create the above tables by properly specifying the primary keys and foreign keys.
ii) Enter atleast five tuples for each relation.
iii) Find all the customers who have atleast two accounts at the main branch.
iv) Find all customer who have an account at all the branches located in a specific city.
v) Demonstrate how t0 delete all account tuples at every branch located in specific city.

8. Consider the following database for ORDER PROCEESING.

CUSTOMER(cust-no: int, cname: string, city: string)
ORDER(orderno: int, odate: date, ord-amt: real)
ORDER_ITEM(orderno: int, itemno:int, qty: int)
ITEM(itemno: int, UNITprice: real)
SHIPMENT(orderno: int, warehouseno: int, ship-date: date)
WAREHOUSE(warehouseno: int, city: string)

i) Create the above tables by properly specifying the primary keys and the foreign keys
ii) Enter at least five tuples for each relation.
iii) List the order number and ship date for all orders shipped from particular warehouse.
iv) Produce a listing: customer name, no of orders, average order amount
v) List the orders that were not shipped within 30 days of ordering.

**PART – B**
During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 6 Programs has to be prepared).

**Reference Books:**

1. "Database System Concepts" by Silberschatz, Korth, Sudarshan, 4th Edition, McGraw Hill Publication.
2. "Database Systems, Concepts, Design and Applications" by S.K.Singh, Pearson Education.
3. "Database Management Systems" by Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Publication.
4. "Fundamentals of Database Systems" by Elmsari, Navathe, 5th Edition, Pearson Education (2008).


## FOURTH – SEMESTER

| B18MC4011 | 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**

1. 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.
2. ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.
3. ವಿದ್ಯಾರ್ಥಿಗಳ ಸರ್ವತೋಮುಖ ಬೆಳವಣಿಗೆಗೆ ಅನುವಾಗುವಂತೆ ಹಾಗೂ ಅವರಲ್ಲಿ ಮಾನವ ಸಂಬಂಧಗಳ ಬಗ್ಗೆ ಗೌರವ, ಸಮಾನತೆ ಮೂಡಿಸಿ, ಬೆಳೆಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪಠ್ಯಗಳ ಆಯ್ಕೆಯಾಗಿದೆ.
4. ಅವರಲ್ಲಿ ಸೃಜನಶೀಲತೆ, ಶುದ್ಧ ಭಾಷೆ, ಉತ್ತಮ ವಿಮರ್ಶಾ ಗುಣ, ನಿರರ್ಗಳ ಸಂಭಾಷಣೆ, ಭಾಷಣ ಕಲೆ ಹಾಗೂ ಬರಹ ಕೌಶಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗುರಿಯಾಗಿದೆ
5. ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳಿಗೆ ಅನುಕೂಲವಾಗುವಂತಹ ವಿಷಯಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಸೂಕ್ತ ಪಠ್ಯಗಳನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಲಾಗಿದೆ.

**Course outcomes**

1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ನವ್ಯ–ನವ್ಯೋತ್ತರ ಕಾವ್ಯ, ವಿವಿಧ ಲೇಖನಗಳು ಹಾಗು ಕಾದಂಬರಿ ಸಾಹಿತ್ಯ ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟ ಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ.
2. ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವು ಬೆಳೆಯುತ್ತದೆ.
3. ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.
4. ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ.
5. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4011 | 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 content**

**Unit I: ನವ್ಯ–ಸ್ತ್ರೀವಾದಿ ಕವಿತೆಗಳು** **10 hours**

| | |
|---|---|
| ಬುದ್ಧಿವಂತರಿಗೆ ಕನಸು ಬಿದ್ದರೆ | ಎ.ಕೆ.ರಾಮನುಜನ್ |
| ಕುರಿಗಳು ಸಾರ್ ಕುರಿಗಳು | ನಿಸಾರ್ ಅಹಮದ್ |
| ಅಕ್ಕ ಹೇಳಿದು | ಸ. ಉಷಾ |

**Unit II: ದಲಿತ–ಬಂಡಾಯ** **10 hours**

| | |
|---|---|
| ನನ್ನ ಕವನಗಳಲ್ಲಿ ಹುಡುಕದಿರು ನನ್ನ | ಚಂಪಾ |
| ದಲಿತರು ಬರುವರು ದಾರಿಬಿಡಿ | ಸಿದ್ಧಲಿಂಗಯ |
| ಕಟ್ಟಡದ ಕೆಲಸಗಾರರು | ಎಚ್ ಎಸ್ ಶಿವಪ್ರಕಾಶ |

**Unit III: ಲೇಖನಗಳು** **10 hours**

| | |
|---|---|
| ಹಸಿರು ಹೊಸಕುವ ಗಣಿಗಳು | ಯಲ್ಲಪ್ಪ ರೆಡ್ಡಿ |
| ಜಾಗತೀಕರಣದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಗಾಂಧೀಜಿಯ ಪ್ರಸ್ತುತತೆ | ಸಿ. ನಾಗಣ್ಣ |
| ಚಾರ್ವಾಕರು : ಒಂದು ಟಿಪ್ಪಣಿ | ಪಿ ಎನ್ ರಂಗನ್ |

**Unit IV: ಕಾದಂಬರಿ** **09 hours**

| | |
|---|---|
| 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

| **B18MC4012** | **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 |

**Course objectives**
पाठ्यक्रम उद्देश्य :
1. संदर्भानुसार उचित भाषा का प्रयोग करने की दक्षता को छात्रों में उत्पन्न करना |
2. साहित्य के माध्यम से समाज एवं मानवीय मूल्यों को समझाकर, उन मूल्यों की रक्षा हेतु प्रेरित करना|
3. छात्रों में पुस्तक पठन एवं लेखन की अकृतिम प्रवृत्ति स्थापित करना |
4. अध्येताओं में साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास करना |

**Course outcomes**
अधिगम परिणाम :
अध्ययन की समाप्ति पर अध्येता –
1. सामाजिक मूल्य एवं नैतिक जवाबदेही को स्वीकार कर सकता है |
2. साहित्य की प्रासंगिकता को जीवन में समझने की दक्षता रखता है |
3. समाज में अंतर्निहित पद्दतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है |
4. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B20PC4012 | 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 content**
इकाई –**1**: खंड-काव्य – नहुष – मैथिलीशरण गुप्त **10 hours**
कवि परिचय
काव्य परिचय
शची सर्ग
नहुष सर्ग

इकाई –2: खंड-काव्य – नहुष – मैथिलीशरण गुप्त **10 hours**
उर्वशी सर्ग

स्वर्गभोग सर्ग

इका ई –3: खंड-काव्य – नहुष – मैथिलीशरण गुप्त **10 hours**
सन्देश सर्ग
मंत्रणा सर्ग
पतन सर्ग

इका ई –4 **09 hours**
सिनिमा रिव्यू :
सूपर 30, मिशन मंगल, थप्पड़, आर्टिकल 15
सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

| **B18MC4013** | **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.

**Course objectives:**
1. To infer the myths from the contemporary perspective.
2. To outline the idea of family represented in literature.
3. To interpret horror and suspense as a genre of literature.
4. To assess the impact of education in building a society.

**Course outcomes:**
On completion of the course, learners will be able to:
1. Examine the relevance of myths and mythology.
2. Demonstrate family values and ethics essential to live in the society.
3. Analyze horror and suspense as a significant genre of literature.
4. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4013 | 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 | | | | | 3 | 3 | 3 | 2 | | |

**Course content**

**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:**


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


| **B18MC4020** | **Communicative English-II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **Duration:14 Wks** | | **2** | **1** | **0** | **3** |

**Prerequisites**
The student must possess functional knowledge of LSRW skills.

**Course objectives:**
1. To build skills essential for corporate communication.
2. To enhance context specific language skills.
3. To discover the creative linguistic potential through language and literature.
4. To develop communication skills necessary for employability.

**Course outcomes**
After the completion of the course, students will be able to:
1. Apply acquired skills to communicate effectively in a corporate scenario.
2. Demonstrate command over rhetoric of language.
3. Develop critical and creative thinking through assimilated language skills.
4. Utilize the communication skills learnt to match industry standards.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4020 | 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 content**

**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 | Bio-Perl and Bio-Python | Course type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC4030 | | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisites:**
Students should know the basic concepts of C- programming, structures, scalars, conditional statements and loops.

**Course objectives**
The objectives of this course are to:
1. Understand the concepts of PERL and python programs.
2. Learn the fundamentals of scalar variables, conditional statements, File I/O
3. Develop and Apply the Perl and Python programming languages in Biological data interpretation
4. Analyse the algorithms in developing the bio-tools and software's.

**Course outcomes**
After completion of the course a student will be able to:
1. Understand Perl and Python program.
2. Apply the tools and software's in bioinformatics data.
3. Formulate step-wise implementation of a script (from developing a pseudo-code to execute a successful bug-free code) for a given problem in Bioinformatics.
4. Develop and implement tools and software's for biological data analysis.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4030 | CO1 | 3 | 3 | 3 | 2 | 1 | | 2 | 1 | 2 | 1 |
| | CO2 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 2 | 1 |
| | CO3 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 3 | 3 | 2 | 1 | | 2 | 1 | 1 | 1 |

**Course content**
**Unit: 1** **12 hours**

Data Structure: Command interpretation, Commands, Scalar strings, numbers and Variables, Assignments, Scalar Operations and Functions, Statements and Blocks, Array Variables, Literal Representation of Array, Array Operations and Functions, Scalar and List Context, Hash Variables, Literal Representation of a Hash, Hash Functions, Using Hashes for the Genetic Code, Gene Expression Data Using Hashes, operator precedence, Basic operators, Arithmetic operators, bitwise operators, string operators, string operators, File test operators, Conditionals and logical operators: True and false, Logical operators, binding operators, loops, Input/output (I/O).

**Unit-II** **12 hours**

Modular Programming: Subroutines, Advantage of Subroutines, Scoping and Subroutines, Arguments, Passing Data to Subroutines, Modules and Libraries of Subroutines, Concept about File handle, Opening and Closing a File handle, Opening and Closing a Directory Handle, Reading a Directory Handle, File and Directory Manipulation, Perl Debugger, Regular Expression and Pattern Matching: Concepts about Regular Expressions, Simple uses of Regular Expressions, Patterns, Matching Operator, Substitutions, Split and Join functions.

**Unit-III** **12 hours**

Bioperl: Introduction to Bioperl, Installing procedures, Architectures, General Bioperl Classes, Sequences (Bio::Seq Class, Sequence Manipulation), Features and Location Classes (Extracting CDS), Alignments (AlignIO), Analysis (Blast, GenScan), Databases (Database Classes, Accessing a local database), Implementing REBASE, Sequences and strings, representing sequence data, concatenating, transcription, calculating the reverse complementing in Perl, motifs and loops, mutations and randomization, genetic code.

**Unit-IV** **12 hours**

Biopython: basics on Biopython, installing Biopython, writing python programming, python values and variables, working with sequences, parsing sequence file formats, connecting with biological databases, sequence objectives, sequence input/output, Accessing NCBI's Entrez databases.

**Reference Books:**


11. Michael Moorhouse, Paul Barry., Bioinformatics, Biocomputing and Perl: An Introduction to Bioinformatics Computing Skills and Practice., 1st edition,Wiley, John & Sons, Incorporated., 2004.
12. James D. Tisdall., Mastering Perl for Bioinformatics, O'Reilly & Associates, 2003.
13. Rex A. Dwyer., Genomic PERL: From Bioinformatics Basics to Working Code., Cambridge University Press, 2002.
14. James D. Tisdall., Beginning Perl for Bioinformatics, O'Reilly & Associates, 2001.
15. Jeff Chang, Brad Chapman, Iddo Friedberg, Thomas Hamelryck, Biopython Tutorial and Cookbook, 2018.


| Course Code | Biostatistics – II | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC4040 | | HC | 2 | 1 | 0 | 3 | 4 |

**Prerequisites:**

Fundamental knowledge on basic Distribution functions

**Course objectives:**

The objective of this Course is to:

1. To explain the basic concepts of Biostatistics including Distributions
2. To study the concepts of Different Distribution functions
3. To study simple problems using Bayes' Theorem
4. To explain mathematical results in the language understandable by biologists

**Course outcomes**

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

1. Apply to the Data Sets by using the methods of data collection

2. Solve and relate to biological problems using Graphical Representation
3. Apply the concepts of Skewness, kurtosis
4. Relate the mathematical results in language understandable by biologists.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4040 | CO1 | 2 | 1 | 2 | 3 | | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 2 | 1 | 2 | | | 1 | 3 | 1 | 3 |
| | CO3 | 2 | 1 | 1 | 1 | | | 2 | 1 | 1 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 1 | 3 | 2 | 1 |

**Course content**

**Unit-I** **12 hours**

Estimation - Introduction – Relationship between population and sample – Estimation of mean of a distribution - Estimation of variance of a distribution - Estimation of a binomial distribution - Estimation of a normal distribution.

**Unit-II** **12 hours**

Hypothesis Testing – Introduction – General Concepts – One sample test for a mean of normal distribution: One sided, two sided alternatives. Sample size determination – Relationship between hypothesis testing and confidence level – Bayesian interface.

**Unit-III** **12 hours**

One sample chi-square test for a variance of a normal distribution – one sample inference for the Binomial distribution - one sample inference for the Poison distribution.

**Unit-IV** **12 hours**

Two sample inference – Introduction - the paired t-test – comparison of means- Tests of Significance: Small sample tests – Students‘t’ test for mean, difference of two means and test for Correlation – Chi Square test for goodness of fit – F test for equality of variance.

ReferenceBooks:

1. Introductory probability and statistical applications, P.L. Meyer, 1970
2. Sheldon Ross, ‘A first course in probability’, 6th edition, Pearson education Asia, (2002).
3. Biostatistics: A Foundation for analysis in the health sciences (2000), Wayne W. Daniel.
4. Fundamentals of Statistics, 7th ed., Vol I, Vol II, Goon Gupta, Das Gupta, 1998
5. Introduction to Biostatistics (1973) Sokal & Rohif – Toppan Co Japan.

| **Course Code** | **Operating Systems & Shell Programming Using LINUX** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC4011** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**

The basics of an operating system, knowing about computer organization and architecture, Memory management.

**Course objectives:**

The objectives of this course are to:

1. Enabling Knowledge: the operation, implementation and performance of modern operating systems, and the relative merits and suitability of each for complex user applications
2. Critical Analysis: Ability to compare, contrast, and evaluate the key trade-offs between multiple approaches to operating system design, and identify appropriate design choices when solving real-world problems
3. Throughout the course, practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows, and some instructional operating systems will be studied
4. To become familiar with the various commands of the Linux.
5. To understand the scripting language of Unix / Linux.

**Course outcomes**

On successful completion of this course; the student shall be able to:

1. Explain the objective and functions of modern operating systems.
2. Describe how computing resources are used by application software and managed by system software.
3. Implement the various filters of Unix / Linux.
4. Students will be create shared memory segments, pipes ,message queues and can exercise Interprocesses communication

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4011 | CO1 | 3 | 3 | 3 | 0 | 0 | 0 | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 2 | 3 | 1 |
| | CO3 | 3 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 3 | 2 |

**Course content**

**UNIT-I** **12 hours**

Introduction: Definition, Types of Operating Systems, Functions of Operating System, services, system components System call. Process Management: Process Concept, Process Scheduling, Inter
Process communication, CPU Scheduling Criteria, Scheduling algorithm, Multiple Processor Scheduling, Real time Scheduling.

**UNIT – II** **12 hours**

Dead locks – system model, Characterization, Dead lock prevention, avoidance and detection, Recovery from dead lock, combined approach to deadlock handling. Memory management: Functions, single contiguous, Partitioned memory management: multiple re-locatable partitioned memory management, paging, segmentation. Disk Management: Disk Structure & Scheduling methods, Disk management

**UNIT-III** **12 hours**

History of Unix, salient features, Unix Components, types of shell, Internal and External commands, Files and File Organization- Categories of files, Unix file system, directories, file related commands, Directory related commands, wild cards, Printing and Comparing files. Ownership of files, File attributes File permissions and Manipulations, Standard I/O, Redirection, pipe, filter.

**UNIT-IV** **12 hours**

Introduction to vi editor, The three modes of the vi editor, Invoking vi editor, Configuring the vi environment, Regular expressions, the grep command, The process - parent and child process, process creation, process related commands, Shell Programming - shell script features, shell variables, writing and executing a shell script, positional parameters, Branching control structures- if, case etc., Loop control structures – while, until, for, etc., Jumping control structures – break, continue, exit.

**Reference Books:**

1. A. Silberschatz, P.B. Galvin and G. Gagne, Operating System Concepts.8th Edn, New Delhi: Wiley India, 2011.
2. Sumithaba Das – UNIX: Concepts and Applications
3. Forouzan,"Unix and Shell Programming", 1st Edition,2008 Cengage Learning India
4. H.M.Deitel, "Operating Systems", Pearson Learning Solutions, 5th Edition,
5. William Stallings, "Operating Systems", 7th Edition, Pearson Education.

| Course Code | Soft Skill Training | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC4012 | | RULO | 1 | 1 | 0 | 2 | 3 |

Note: Soft skill Training course are organized by the Placement and Training Centre. The students have to undergo Soft Skill Course conducted by above said centre.

| Course Code | Bio-Perl and Bio-Python Practical's | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **B18MC4070** | | **HC** | **2** | **1** | **0** | **3** | **4** |

**Prerequisites:**
The students should know the basic concepts of c programming, structures, scalars, conditional statements and loops

**Course objectives:**
The objectives of this course are to:
1. Understand the concepts of PERL and python programs.
2. Learn the fundamentals of scalar variables, conditional statements, File I/O.
3. Develop and Apply, Perl and Python programming languages in Biological data interpretation.
4. Analyse the algorithms in developing the bio-tools and software's.

**Course outcomes**
After completion of the course a student will be able to:
1. Work on Perl programming.
2. Create a new algorithm to understand and access the sequences.
3. Develop the program to predict the genetic code table, to convert DNA to Protein.
4. Understand the python scripts to develop program to access and analyze DNA, RNA and Protein sequences.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4070 | CO1 | 2 | 3 | 3 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 |
| | CO3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |
| | CO4 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |

**Course content**
1. Programming to store a DNA sequences
2. Concatenation of Sequences, Reverse complement of DNA strand
3. Transcription: DNA to RNA, Mutate DNA,
4. Reading protein sequences data from a files (4 experiments), searching for motifs (2 Experiments), Generate random DNA,
5. Determining frequency of nucleotides, Genetic Code.
6. Subroutine to append ACGT to DNA, Counting the G's in some DNA on the command line, Subroutines: Pass by value, pass by reference, Calculate average % identity between pairs of random DNA sequences.
7. Concatenating and adding sequences, nucleotides and reverse complements
8. Transcription, Translation,
9. Parsing GenBank records from the databases,
10. Writing sequence files: Converting between sequence file formats, converting a file of sequences to their reverse complements, getting your SeqRecord objects as formatted strings, Sequence alignment.

**Reference Books:**
1. Mastering Perl for bioinformatics, O'Reilly & Associates, Inc. 2003
2. Beginning Perl for Bioinformatics: An introduction to Perl for biologists. James Tisdall, O'Reilly (2001),
3. Richard L. Halterman., Learning To Program with Python, 2011.
4. Jeff Chang, Brad Chapman, Iddo Friedberg and Thoma, Biopython Tutorial and Cookbook, 2015

| **Course Code** | **Mathematics** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC4080** | **Practical– IV** | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisites:**
Fundamental knowledge on basic statistics, inferential statistics

**Course objectives**

1. To characterize the sampling distributions
2. To classify the different techniques of point estimation for estimating the parameter values
3. To describe the interval estimation and simulation.

**Course outcomes**

The student will be able to:

1. Define the sampling distributions
2. Differentiate the different techniques of point estimation for estimating the parameter values
3. Compare the parameters of interval estimation and simulation
4. Compare random samples from discrete and continuous distributions

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4080 | CO1 | 2 | 1 | 2 | 3 | | 1 | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 2 | 1 | 2 | | | 1 | 3 | 1 | 3 |
| | CO3 | 2 | 1 | 1 | 1 | | | 2 | 1 | 1 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 1 | 3 | 2 | 1 |

**Course content**

**PART A**

(Demonstration using MS Excel and R Software)

1. Drawing random samples using random number tables.
2. Application of the central limit theorem.
3. Point estimation of parameters and obtaining estimates of standard errors.
4. Comparison of estimators by plotting mean square error.
5. Computing maximum likelihood estimates -1
6. Computing maximum likelihood estimates - 2
7. Computing moment estimates
8. Constructing confidence intervals based on large samples.
9. Constructing confidence intervals based on small samples.
10. Generating random samples from discrete and continuous distributions.

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 6 Programs has to be prepared).

| **Course Code** | **Linux Lab** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC4090** | | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisites:**

Operating systems, shell script, file system

**Course objectives:**

The objectives of this course are to:

1. To learn editors available in UNIX and the detailed working on the most Vi editor to implement shell programming, wild cards and how to write simple shell programs, introduce concepts of decision control, looping, nested looping and control flow clauses in shell programming
2. Basic to learn command structure of UNIX, various types of commands and familiarize students with some general commands.
3. Directory and file related commands, filters
4. Process related and user communication related commands in UNIX.

**Course outcomes**

On successful completion of this course; the student shall be able to:

1. Understand the basic commands of Linux operating system and can write shell scripts
2. Create file systems and directories and operate them
3. Describe and apply various command line utilities
4. Work with the file System and Write shell scripts

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC4090 | CO1 | 3 | 2 | 1 | 1 | 0 | 0 | 1 | 3 | 3 | 2 |
| | CO2 | 3 | 2 | 3 | 2 | 0 | 0 | 0 | 2 | 3 | 2 |
| | CO3 | 3 | 3 | 3 | 3 | 0 | 0 | 2 | 3 | 3 | 3 |
| | CO4 | 3 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 3 | 2 |

**Course content**

**PART – A**

1. Write a menu driven program to calculate (i) Simple interest (ii) Compound interest
2. To print all prime numbers between m and n (m<n).
3. Reverse a given number and check whether it is palindrome or not.
4. Shell script to find maximum and minimum of given set
5. To count the number of vowels in a given string.
6. To check whether a given string is a palindrome or not.
7. Write a shell script to generate and print the GCD and LCM of two integers.
8. Shell script to take two numbers as arguments and output their sum using (i) bc (ii) expr. Include error checking to test whether two arguments were entered.
9. Shell script to display all the file permissions.
10. To write a shell script that creates a file and compresses it using:

a) Compress b) pack

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

**Reference Books**


1. Unix System Programming using C++, T.Chan, PHI (Unit III to Unit VIII)
2. Unix Concepts and Applications, 4th Ed, Sumitabha Das, TMH
3. Unix Network Programming, W.R.Stevens,PHI.
4. Beginning Linux Programming, 4th Edition, N. Matthew, R.Stones, Wrox, Wiley India Edition.
3. Unix for Programmers 3rd Ed, Graham Glass & King Ables, Pearson Education.
5. System Programming with C and Unix, A.Hoover, Pearson.
6. Unix System Programming, communication, concurrency and Threads, K.A. Robbins and S.Robbins, Pearson Education.


## FIFTH SEMESTER

| Course Code | Genomics and Proteomics | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5010 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisites**

Student should be familiar with the concepts of DNA, RNA and proteins and their specific roles within the cell.

**Course objectives**

The objectives of this course are to:

1. Provide the understanding of genes and proteins.
2. Learn the techniques to identify genes and protein sequences and structures.
3. Introduce the sequencing techniques and gene expression experiments.
4. Analyse the techniques involved for quantifying differential gene/protein expressions.
5. Learn the publicly available tools and software's in genomic data science.

**Course outcomes**

After completion of the course a student will be able to:

1. Understand the concepts of genes, genomes and proteins.
2. Analyse and interpret genes and proteins using various genomic and proteomic techniques.
3. Develop pipelines to understand the gene expression profiles and functional protein expressions.
4. Qualitative and quantitative expression analysis and techniques of various genomic and proteomic data to predict expressions.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5010 | CO1 | 3 | 3 | 3 | 2 | 2 | | 3 | 2 | 3 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 2 |

**Course content**

**Unit: I** **9 hours**

Genomics and Metagenomics: Introduction: Genome, Genomics, Omics and importance, General features, C-value paradox, Gene identification; Annotation of genome. Genome diversity: taxonomy and significance of genomes; Structural, Functional and Comparative Genomics; Transcriptomics, proteomics, and metabolomics. HapMap Project, The 1000 genome project, and The ENCODE Project; Genome databases of Plants, animals and pathogens. Basic concepts on identification of disease genes, role of bioinformatics to identifying diseases-OMIM database, reference genome sequence, integrated genomic maps, gene expression profiling.

**Unit: II** **9 hours**

Fundamentals of Genomics: Basic concepts and applications, whole genome alignments: understanding the significance; Artemis, BLAST2, Mega Blast algorithms, PipMaker, AVID, Vista, MUMmer, applications of suffix tree in comparative genomics, synteny and gene order comparisons. Epigenetics: DNA microarray: database and basic tools, Gene Expression Omnibus (GEO), ArrayExpress, SAGE databases DNA microarray: understanding of microarray data, normalizing microarray data, detecting differential gene expression, correlation of gene expression data to biological process and computational analysis tools.

**Unit: III** **9 hours**

Understanding proteomics: Proteomics and the proteome, Overview of protein structure-primary, secondary, tertiary and quaternary structure; Relationship between protein structure and function; Tools of proteomics: proteomics and the new biology, overview of analytical proteomics, protein design techniques, mass spectrometers for protein and peptide analysis, protein identification by peptide mass fingerprinting, Peptide sequence analysis by Tandem Mass spectrometry, protein identification with tandem mass spectrometry data, SALSA: Tandem MS data mining specific feature algorithm.

**Unit: IV** **9 hours**

Application of Proteomics: Transcriptomes and analysis; SAGE, Analytical proteomics tools (1-D & 2-D gel electrophoresis); Mass spectrometry and analysis (ESI, MALDI and Hybrid), LC/MS-MS; Applications of mass spectrometry (PMF and PTMs), Interactomes and Proteomic interactions (Y2H approaches, Co-IP); Proteome- wide interaction maps; Protein structure determinations and Structural proteomics tools (experimental and computational); Concepts of protein engineering, Main online databases PRIDE, NextPro. Metabolic pathways resources: KEGG, Biocarta.

**Reference Books:**

1. Brown T. A. 2007, Genomes 3. Garland Science Publishing, New York.
2. Dunham, I., 2003. Genome Mapping and sequencing. Horizon Scientific
3. Graur, D and W H Li, 2000. Fundamentals of molecular evolution. Sinauer Associates.
4. Hartwell, L. H., L. Hood, M. L. Goldberg, A. E. Reynolds, L. M. Silver and R. G. Veres. 2004. Genetics from Genes to Genomes. McGraw Hill.
5. Lewin B. 2003. Genes VIII. Oxford University Press. Oxford.
6. Discovering Genomics, Proteomics and Bioinformatics 2nd edition - by A. Malcolm Campbell and Laurie J. Heyer. by Cold Spring Harbor Laboratory Press 2006.

| Course Code | Discrete Mathematical Structures | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5020 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisites**

Fundamental Knowledge on sets and graphs and its operation

**Course objectives:**

The objective of this Course is to

1. Interpret the concepts of Abstract Algebraic Chemistry
2. Explain the symmetries of Groups
3. Explain the Neural Network using graphs
4. Relate Graphs to different cell structures in Biology

**Course outcomes**

After the end of the Course students will be able to

1. Study the Group Theory concepts.
2. Define the Normal Sub groups
3. Apply the concepts of Graphs in Networking
4. Interpret the Biological Problems in graphical form

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5020 | CO1 | 3 | 2 | 2 | 1 | 1 | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 2 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 3 | 2 |
| | CO4 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 3 | 2 |

**Course content**

**Unit-I** **9 hours**

Groups – Types – simple properties of groups – cyclic Groups and subgroups

**Unit-II** **9 hours**

Cosets and Lagrange's Theorem – Normal sub groups and quotient Groups – Different types of Morphisms of Groups Fundamental Theorem of Homomorphism and Isomorphism

**Unit-III** **9 hours**

Basic concepts – Finite and infinite Graphs – Incidence and Degree ideas on vertices – Isomorphism, Subgraph, walks - paths and circuits

**Unit-IV** **9 hours**

Connected Graphs and Disconnected Graphs and components – Euler Graphs – Hamiltonian paths and circuits

**Reference Books:**

1. " Discrete Maths" , by B.S.Vatssa- wishwa Prakashan (A Division of wiley Eastern ltd -1993, - Chennai.
2. "Modern Algebra", by Dr.S.Ariumugam and Mr.S.Thanga pandi Issac – (section 3.8, 3.9 of Chapter 3 New Gamma Publicating House – Palayam Kottai, 1997.
3. Graph – Theory by Narsing – Deo - Prentice Hall of India Private Limited., 1997.
4. Transformation geometry
5. Modern Algebra by Sri S.Narayanan and Sri T.K.Manickavachagam (S.Viswanathan

Printers and Publishers Pvt.Ltd, 1993)
6.. Theory of Computing by John – C Martin – MC Graw – Hill series -1993.

| Course code | JAVA Programming | Course type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5030 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisites:**
Prior knowledge of using the computers and basics programming concepts in software.
Some experience in programming in C or C++, you can easily learn Java programming language

**Course objectives**
The objectives of this course are to:
1. Able to understand the four pillars of Object orientation.
2. Understand the concepts of classes and objects.
3. Able to understand the concepts of Exception handling.

**Course outcomes**
On successful completion of this course; the student shall be able to:
1. The students will have the competence in the use of Java Programming language.
2. Implement the concepts of classes with different types of inheritance.
3. Able to use the stream input and output.
4. Develop Java Program to store and retrieve data from the database.

Mapping of Course Outcomes with programme Outcomes

| Course Code | POS / COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5030 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |

**Course Content:**

**UNIT – I** **9 hours**

Introduction: History-Features of Java, How Java differs from C and C++-Java Environment-Structure of Java Program-Java Virtual Machine-Data Types-Constants-Variables-Declaration of Variables-Giving values to Variables-Scope of Variables-Symbolic Constants-Literals. Operators-Arithmetic, Boolean logical, Relational and Bitwise Operators-Operator Precedence. Classes and Objects - General form of a Class-Declaring Objects-Accessing class Members-Constructors-Parameterized Constructors-Overloading Constructors-Defining Methods-Overloading methods, Introducing Access Control-Understanding Static-Introducing Final-Garbage collection-finalize () method-this keyword.

**UNIT – II** **9 hours**

Arrays & String Handling: Introduction to Arrays-One Dimensional Arrays-Creation of Arrays-Array Initialization Multidimensional Arrays-array name, Command Line Arguments. String Constructors-String Length-String Literals-String Concatenation, String conversion and to String ()- Character Extraction- String Comparison-Searching Strings- Modifying a String- Data Conversion using value of ()-Changing the case of Characters-String Buffer.

**UNIT – III** **9 hours**

Inheritance: Basics-Member Access and Inheritance- Super class variable referring to a sub Class-Applications of keyword super- Creating a Multilevel Hierarchy-Order of calling Constructors-Method Overriding, Abstract classes-Using final with Inheritance. Defining an Interface - Implementing Interfaces-Variables in Interfaces-Extending interfaces.

**UNIT – IV** **9 hours**

Exception Handling, Multithreading and IO Package: Introduction-Types of Errors-Exception-Uncaught Exceptions - try and catch - Multiple catch - Nested Try - throw, throws and finally. Multithreaded

Programming-Creating Threads-Life cycle of a Thread- Thread Priorities. I/O Basics-Streams-Byte Streams and Character Streams-Reading console Input-Reading Characters-Reading Strings-Writing console output.

**Reference Books:**

1. Schildt Herbert, Java: The Complete Reference, 8th Edition,Tata McGraw- Hill,2011 .
2. E. Balagurusamy, Programming with JAVA a Primer, 4th Edition, 2010, Tata McGraw-Hill Publishing Company Limited, Delhi.
3. Patrick Naughton & Herbert Schildt, JAVA 2: The Complete Reference, TMH.

| Course code | Data Mining and Artificial Intelligence | Course type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5041 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Students should be familiar with the Biostatistics, Python and Data structure programmes.

**Course objectives**

The objectives of this course are to:

1. Understand of data structures and file types.
2. Understand Artificial Intelligence methodologies, techniques, tools and results.
3. Develop skills of using recent machine learning software for solving practical problems and gain experience of doing independent study and research.
4. Learn the concepts, techniques, design and applications of data mining and artificial intelligence.

**Course outcomes**

After completion of the course a student will be able to:

1. Develop a basic understanding of AI building blocks presented in intelligent agents.
2. Ability to choose an appropriate problem solving method and knowledge representation technique.
3. Analyse the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
4. Ability to develop and implement AI-techniques in neural network development.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5041 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |

**Course content**

**Unit: I** **6 hours**

Introduction to Data Mining: Importance of Data Mining, Data Mining Functionalities, Classification of Data mining systems, Data mining Architecture, Major Issues in Data Mining, Applications of Data Mining, Social impacts of data mining.

**Unit: II** **6 hours**

Data Pre-processing: Data cleaning, Data Integration and Transformation, Data reduction, Discretization and Concept Hierarchy Generation. Data Mining primitives, Languages and System Architectures, Concept Description: characterization and Comparison, Analytical Characterization, Mining Class Comparison.

**Unit: III** **6 hours**

Artificial intellegence: Introduction, Basic principles of AI, Problems: Reasoning, problem solving, knowledge representation, automated planing and scheduling, machine learning, Natural language processin, perception, motion and manipulation, Social intelligence, general intelligence.

**Unit: IV** **6 hours**

AI Approaches on Human Genome: Introduction, computational neuroscience, cybernetics, symbolic AI, cognitive simulation, sub-symbolic, statistical learning, integrating AI approaches, AI Tools, AI Applications.

**Reference Books**

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining Concepts and Techniques. Elsevier, 2012
2. Igor Kononenko, Matjaz Kukar., Machine Learning and Data Mining 1st Edition, Woodhead Publishing., 2007
3. Stuart Russell, Peter Norvig., Artificial Intelligence: A Modern Approach 3rd Edition, Pearson, 2014
4. Prateek Joshi., Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt Publishing., 2017.

| Course code | Data Mining and Data warehousing | Course type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5042 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Student should familiar with knowledge of understanding data collection and storage and interpretation.

**Course objectives:**

The objectives of this course are to:

1. Introduce the concepts, techniques, design and applications of data warehousing and data mining.
2. Enable students to understand and implement classical algorithms in data mining and data warehousing.
3. Analyse the data, identify the problems, and choose the relevant algorithms to apply.
4. Assess the strengths and weaknesses of the algorithms and analyze their behaviour on real datasets.

**Course outcomes**

After completion of the course a student will be able to:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Compare the various approaches to data warehousing and data mining implementations.
4. Design and deploy appropriate classification techniques, Cluster the high dimensional data for better organization of the data.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5042 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |

**Course content**

**Unit: I** **6 hours**

Introduction to Data Mining: Importance of Data Mining, Data Mining Functionalities, Classification of Data mining systems, Data mining Architecture, Major Issues in Data Mining, Applications of Data Mining, Social impacts of data mining.

**Unit: II** **6 hours**

Data Pre-processing: Data cleaning, Data Integration and Transformation, Data reduction, Discretization and Concept Hierarchy Generation. Data Mining primitives, Languages and System Architectures, Concept Description: characterization and Comparison, Analytical Characterization, Mining Class Comparison.

**Unit: III** **6 hours**

Overview and concepts of Data Warehousing and Business Intelligence: Why reporting and Analysing data, Raw data to valuable Information-Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The Building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.

**Unit: IV** **6 hours**

The Architecture of BI and DW: BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations.

**Reference Books:**

1. Paliouras, Georgios, Karkaletsis, Vangelis, Spyropoulos, Constantine D. Machine Learning and Its Applications, Springer-Verlag Berlin Heidelberg, 2001
2. Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, Data Mining: Concepts and Techniques, 3rd Edition., Morgan Kaufmann Series., 2011
3. Paul R. Cohen., Empirical Methods for Artificial Intelligence. A Bradford Book (MIT Press), 2005.

| Course Code | Biostatistics - III | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5051 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Fundamental knowledge of inferential statistics, test of hypothesis

**Course objectives:**

The Objective of this Course is to:

1. To introduce students about basic concepts of Biostatistics including Distributions and Probability
2. To study the concepts of Different Distribution functions
3. To study the concepts of correlation, Regression, Estimation and Testing of parametric and nonparametric Hypotheses.

**Course outcomes**

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

1. Understand the Variance and Covariance
2. Solve mathematically and interpret biologically simple problems using Distributions
3. Explain and apply the concepts of Regression Analysis, ANOVA
4. Develop the ability to explain mathematical results in language understandable by biologists

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5051 | CO1 | 3 | 2 | 1 | 2 | | | 1 | 2 | 3 | 2 |
| | CO2 | 2 | 2 | 1 | 1 | 1 | | 1 | 2 | 1 | 1 |
| | CO3 | 3 | 2 | 2 | 1 | | | 1 | 1 | 3 | 2 |
| | CO4 | 2 | 2 | 1 | 2 | | 1 | | 3 | 2 | 1 |

**Course content**

**Unit-I** **6 hours**

Analysis of variance, one-way and two-way classifications.Brief exposure of three basic principles of design of experiments, treatment, plot and block. The analysis of completely randomized design, randomized complete Block Design.

**Unit-II** **6 hours**

One way ANNOVA – Fixed effect models, testing hypothesis, Two way ANNOVA
Introduction to non-parametric:Sign test, Wilcoxon signed- rank test and mann-whitney test.

**Unit-III** **6 hours**

Correlation analysis: Types of correlation- Methods of studying correlation: Karl Pearson's coefficient of correlation and Rank correlation coefficient

**Unit-IV** **6 hours**

Regression analysis: Regression line and equations – Simple problems based on biological data.

**Reference Books:**

1. J.Crawshaw and J.Chamber,'Advanced level Statistics'.4th edition, MelsonThornes, (2002).
2. S.Dobbs and J. Miller. 'Statistics (Advanced Level Mathematics)', Cambridge University Press (2002).
3. P.S.S. Sunder Rao and J. Richard, Introduction to Biostatistics and Research Methods. Fourth Edition. Eastern Economic Edition, 2006
4. Biostatistics: A Foundation for analysis in the health sciences (2000), Wayne W. Daniel.
5. Fundamentals of Statistics, 7th ed., Vol I, Vol II, Goon Gupta, Das Gupta, 1999

| Course Code | Numerical Methods-1 | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5052 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Knowledge on the methods of differentiation and integration

**Course objectives**

The Objectives of this course is to:

1. Study the numerical methods particularly related to errors
2. Find Numerical Solutions
3. Identify the Numerical Methods of solving
4. Explain the methods on Numerical differentiation and Integration

**Course outcomes**

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

1. Obtain necessary information about the basic principles of numerical methods
2. Apply different formulae for finding the Numerical Solutions
3. Find the Interpolated Polynomials
4. Solve the problems using the methods on Numerical differentiation and Integration
5. Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5052 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 3 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 3 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 3 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 3 |

**Course content**

**Unit-I** **6 hours**

Basic concepts, round off errors, floating point arithmetic, Convergence

**Unit-II** **6 hours**

Numerical solution of Nonlinear Equations Bisection method, fixed-point iteration, Newton's method, Error analysis for Iterative Methods

**Unit-III** **6 hours**

Interpolation and Polynomial Approximation, Lagrange Polynomial, Divided Differences Hermite Interpolation

**Unit-IV** **6 hours**

Numerical Integration and Differentiation - Methods for Trapezoidal rule, Simpson Rules., Gaussian quadrature and Euler-Maclaurin formula.8hours

**Reference Books:**

1. Richard L. Burdenand J. Douglas Faires, Numerical Analysis, 8thEdition

2. Numerical Methods by Kurtis D.Fink
3. Numerical Methods by Remond P.Kenale

| Course Code | Graph Theory | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5053 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**
Knowledge on the types of graphs and operations

**Course objectives**
The Objective of this course is to:
1. Study Various types of graphs
2. Find the solutions by using graphs
3. Study Various properties of graphs
4. Relate Different graphs for the problems in Biology

**Course outcomes**
After the end of the course students will be able to:
1. Define the mathematical graph as an abstract representation of a set of objects
2. Model different Biological Networks using Graph Theory Techniques
3. Define the Challenges and Perspectives in the characteristics of Biological Networks
4. Relate graphs with computational biology.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5053 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |

**Course content**

**Unit-I** **6 hours**
Graph Theory Preliminaries and Network Topology, Power Law and Power Law Distribution, Network Models, Clustering Coefficients

**Unit-II** **6 hours**
Subgraphs and Motifs, Centrality and Essentiality, Random Network, Scale free Network

**Unit-III** **6 hours**
Models of Biological Networks, Gene Regulatory Networks, Protein Interaction and Metabolica Networks

**Unit-IV** **6 hours**
Challenges and Perspectives in Computational Biology

**Reference Books:**
1. Mathematics of Bio-Informatics by Mathew He Sergey Petoukhov
2. Introduction to Mathematical Methods in Bioinformatics byIsaev, Alexander
3. Mathematical Biology an Introduction, Murray, James D.

| Course Code | Web Programming | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5061 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**
Front-end includes user interaction whereas Back-end involves server side coding i.e. Data interaction. In Front-end Developer most important languages are HTML, CSS and JavaScript.

**Course objectives**

1. Understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
2. Develop skills in analyzing the usability of a web site
3. Learn techniques of responsive web design
4. Develop basic programming skills using JavaScript

**Course outcomes:**

1. Apply a structured approach to identifying needs, interests, and functionality of a website
2. Gain knowledge on XHTML, JavaScript and other programming tools
3. Develop website with basic HTML, CSS and JavaScript programming
4. write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different ways

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5052 | CO1 | 1 | | | 3 | 2 | 2 | 2 | 2 | 1 | 3 |
| | CO2 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 |
| | CO3 | 3 | 1 | 2 | 2 | 3 | | 1 | 2 | 2 | 3 |
| | CO4 | 2 | 2 | 2 | 2 | 1 | | 3 | 1 | 2 | 3 |

**Course content:**

**UNIT - I** **6 hours**

Fundamentals of Web: Internet, WWW, Web Browsers, and Web Servers, URLs. XHTML: Origins and evolution of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text mark-up, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic differences between HTML and XHTML.

**UNIT - II** **6 hours**

Java Script: Overview of JavaScript; Primitives, Operations, and expressions; Screen output and keyboard input; Control statements; Object creation and Modification; Arrays; Functions; Constructor; Examples

**UNIT - III** **6 hours**

Java Script and HTML Documents, Dynamic Documents with JavaScript, The JavaScript execution environment Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; Element visibility; Changing colors and fonts; Dynamic content;

**UNIT - IV** **6 hours**

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box model, Background images, The  and  tags. Conflict resolution.

**Reference Books:**


1. Robert W Sebesta, "Programming the World Wide Web", 4th Edition, Pearson Education,
2. M.Deitel, P.J.Deitel, A.B.Goldberg, "Internet & World Wide Web How to program", 4th Edition, Pearson Education / PHI,
3. Chris Bates, "Web Programming Building Internet Applications", 4th Edition, Wiley India,


| Course Code | Visual Programming | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5062 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisites:**

Working environment is Visual Studio, C Sharp, basic knowledge about C or Java, knowledge of HTML and CSS

**Course objectives:**

1. To introduce the concepts of visual programming.

2. To introduce GUI programming using Microsoft foundation classes.
3. To enable the students to develop programs and simple application using Visual Basic.

**Course outcomes:**

1. Incorporate programming control structures of sequence, selection and iteration using Visual Basic.
2. Create and manipulate variables.
3. Design forms by using various controls like labels, textbox, command button etc.
4. Use events and methods of visual basic objects.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5062 | CO1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 1 | 3 | 3 |
| | CO2 | 1 | 3 | 3 | 3 | 3 | | 3 | | 3 | 3 |
| | CO3 | 3 | 3 | 3 | | 3 | | 3 | 2 | 3 | 3 |
| | CO4 | 3 | 3 | 3 | 1 | 3 | 3 | | | 3 | 3 |

**Course content:**

**UNIT – I** **6 hours**

Introduction to Visual Programming: Features of Visual Basic, Advantages and Disadvantages of Visual Basic, Types of Visual Basic Applications, The Integrated Development Environment (IDE).A standard EXE Project: Title bar, Menu bar, Tool bar. Windows: Project Window, Form Designer Window, ToolBox, Properties Window, Form Layout Window. Form Object and Controls: Form Object, Control Menu, MinButton and MaxButton, Title Bar, Moveable, StartUpPosition, WindowState. Form Properties: Name, Caption, Back color, Border style, Height, Width, Scalemode, Forecolor, Font, Visible etc.Form Events – Load, Unload, Click. Form Methods – Show, Hide, Cls, Print Form.Intrinsic Controls: Adding and Removing Control.

**UNIT – II** **6 hours**

Properties and Events of Different Controls- Label, Command Buttons, Textbox, Frame, Option Button, Check Box, Combo Box, List Box, Picture Box, Image Box, Timer Control, ScrollBars, MM Controls. Predefined Dialog Boxes: MsgBox and InputBox. Programming in VB: Event-Driven Programming, Types of Events, Writing Event Procedures, Common Events-Mouse Events, Keyboard Events and Focus Events.

**UNIT – III** **6 hours**

Looping Structures: Entry-Controlled and Exit- Controlled, Do-Loop, While-Wend, For-Next. Functions, Built-In Functions-Numeric Functions, Formatting Functions, String Functions and Date Functions. Creating and calling Functions. Arguments: Passing Arguments By Value, Passing Arguments By Reference. Modules. Designing Menus: The Menu Editor, Menu Editor Properties, Designing Multiple Document Interface forms (MDI Forms).

**UNIT – IV** **6 hours**

Microsoft Common Controls: Date Time Picker, Common Dialog, Database Connectivity – Introduction, ADO Data Control (ADODC), Data Grid Control, Properties Methods and Events of ADO Data Control. Common Properties of Data Aware Controls: Data Source, Data Field, Data Format and Data Member. Methods: AddNew, Update, Delete, Edit, Refresh and Find Methods. Navigation Methods: MoveFirst, MoveLast, MovePrevious, MoveNext.

**Text Books:**

1. Gurumit Singh, "Visual Basic 6", First Edition, Firewall Media, 2007.
2. "Visual Basic 6.0 Complete Reference". Tata McGraw-Hill
3. Gottfried, "Programming with Visual Basic 6", PHI, 2000.

| Course Code | Computer Graphics | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **B18MC5063** | | **SC** | **2** | **0** | **0** | **2** | **2** |

**Prerequisites:**
Analytic geometry, Linear algebra (vector, matrix), Knowledge of C++ is not necessary but is helpful.

**Course objectives**
1. This course is designed to provide a comprehensive introduction to computer graphics.
2. Introduction to computer graphics techniques, focusing on 2D modelling.
3. Introduction to 3D modelling and graphics techniques.

**Course outcomes:**
1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Use of geometric transformations on graphics objects and their application in composite form.
3. Extract scene with different clipping methods and its transformation to graphics display device.
4. describe the fundamentals of animation, parametric curves and surfaces, and spotlighting

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5063 | CO1 | 2 | 1 | 3 | 2 | 2 | 3 | | 3 | 2 | 3 |
| | CO2 | 2 | 1 | 2 | 3 | 3 | 2 | | | 3 | 3 |
| | CO3 | 1 | 1 | 2 | 3 | 1 | | 2 | 3 | 3 | 2 |
| | CO4 | 1 | 1 | 2 | 2 | 3 | | 3 | | 2 | 2 |

**Course content**

**UNIT – I** **6 hours**
Graphics Systems: Application of CG, CRT Functioning- Factors Affecting CRT- Raster scan System– Shadow mask method, Output Primitives Line drawing methods-DDA and Bresenhams, line attributes,- Circle drawing-Direct and mid-point circle drawing.

**UNIT – II** **6 hours**
Two Dimensional Transformation: Basic Transformation, Translation, Rotation, Scaling-Reflection and Shear matrix representations- Homogeneous co-ordinates- composite transformation

**UNIT – III** **6 hours**
Windowing and Clipping: Viewing Transformations, Clipping process, Point clipping, Line Clipping, Cohen Sutherland line clipping algorithm, Midpoint Subdivision algorithm, Text clipping.

**UNIT – IV** **6 hours**
Three Dimensional Graphics: 3D-coordinate system,3D-Display techniques,3D-transformations, Octrees, Bezier curves. Graphical Input Techniques: Positioning techniques Gravity field, Rubber band, Selection technique, Menu, Pointing and selection by naming.

**Reference Books:**
1. Donald Hearn & M. Pauline Baker, Computer Graphics C version, PHI1990
2. Steven Harrington, Computer Graphics, MCGH.
3. Newman & Sproull, Principles of Interactive Computer Graphics, McGrawHill.
4. Yeshwant Kanetkar, Graphics under C, BPB publications.

| **Course Code** | **Soft Skill Training** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC5070** | | **RULO** | **1** | **1** | **0** | **2** | **3** |

Note: Soft Skill Training course are organized by the Placement and Training Centre. The students have to undergo Soft Skill Course conducted by the said Centre.

| **Course Code** | **Genomics and Proteomics Practical's** | **Course type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC5080** | | **HC** | **1** | **1** | **0** | **2** | **3** |

**Prerequisites:**

Students should be familiar with genes, genomes and protein structures as well functions and evolutionary studies.

**Course objectives:**
The objectives of this course are to:
1. Provide hands on experience on genomic techniques.
2. Learn the techniques to identify genes and protein sequences and structures.
3. Quantify differential gene/protein expressions.
4. Demonstrate the publicly available tools and software's in genomic data science.

**Course outcomes:**
After completion of the course a student will be able to:
1. Understand and access the genomic databases.
2. Access and analyse genomic data from genomic databases.
3. Develop pipelines to analyse the genomic data and understand the gene expression profiles.
4. Qualitative and quantitative gene expression analysis of various genomic and proteomic data.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5080 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |

**Course contents**
1. Nucleotide databases: HapMap Project, dbSNP database, 1000 Genome Project, ENCODE Project.
2. Biological data Formats: GenBank, EMBL, PIR, Flat file, SwissProt/TrEMBL format,MSA formats, Entrez, GFF2
3. Ensemble genome browser
4. Sequence similarity searching: BLAST for genome, 16s ribosomal genome,
5. Primer design, restriction enzymes identification,
6. RNA Structure Prediction
7. Comparative Genomics- Mummer, pepmarker, genome vista, PRIDE database, peptide design,

**Reference Books:**

1. Christoph W. Sensen.,Essentials of Genomics and Bioinformatics, 1st edition, Wiley, John & Sons, Incorporated, 2002.
2. Sandor Suhai, Genomics and Proteomics: Functional and Computational Aspects, Plenum Pub Corp, 1st Edition, 2000.
3. Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids, 2nd Edition, 2008.
4. Sudhir Srivastava, Informatics in Proteomics, CRC Press/Taylor & Francis Group, 1st Edition, 2005
5. Ingvar Eidhammer, Inge Jonassen, William R. Taylor., Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis, John Wiley & Sons, 2004.
6. Karl-Heinz Zimmermann, Introduction to Protein Informatics, Kluwer Academic Publishers, 1st edition, 2003.


| **Course code** | **Programming Using – R** | **Course type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC5090** | | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisites:**
Students should have familiar knowledge of general statistics and coding.

**Course objectives:**
The objectives of this course are to:

1. Understand critical programming language concepts.
2. Configure statistical programming software.
3. Make use of R loop functions and debugging tools.
4. Collect detailed information using R profiler.

**Course outcomes**

After completion of the course a student will be able to:

1. Understand the basics in R programming in terms of constructs, control statements, string functions.
2. Understand the use of R for Big Data analytics.
3. Learn to apply R programming for Text processing.
4. Able to appreciate and apply the R programming from a statistical perspective.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5080 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |

**Course content**

1. Getting data into R and R objects
2. Extracting subsets of data frames by value
3. Sorting data, Merging data, and Exporting data
4. Simple functions: tapply, sapply, summary, and table
5. Basic plotting tools
6. Revisiting the plot function
7. Loops
8. Functions and If Statements
9. Analysis of variance
10. Test of Significance

**Textbooks:**

1. Robert G, "R programming in Bioinformatics", CRC press, Taylor and Francis Group, USA, 2008.
2. Own J, Robert. M, and Andrew R., "Introduction to Scientific programming and simulation using R", CRC Press, Taylor and Francis Group, USA, 2014.

| Course Code | Mathematics Practical – V | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| **B18MC5X10** | | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisites:**

Knowledge of inferential statistics

**Course objectives:**

The Objective of this Course is to:

1. To introduce students about basic concepts of Biostatistics including Distributions and Probability.
2. To study the concepts of Different Distribution functions
3. To study the concepts of correlation, Regression, Estimation and Testing of parametric and nonparametric Hypotheses.

**Course outcomes:**

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

1. Understand the Variance and Covariance

2. Solve mathematically and interpret biologically simple problems using Distributions
3. Explain and apply the concepts of Regression Analysis, ANOVA
4. Develop the ability to explain mathematical results in language understandable by biologists

| Course Code | POS/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5X10 | CO1 | 3 | 2 | 2 | | | | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | | 1 | 1 | | 3 | 3 | 1 | 2 |
| | CO3 | 3 | 3 | | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |

**Course content**
**PART A**
1. Practical Problems based on correlation coefficient, spearman's rank correlation
2. Problems based on simple regression
3. Practical based on z- test and t-test (i.e. Testing of Mean in both cases when variance is known and when variance is unknown (one sample problem). Also to find the confidence interval of population mean.
4. Practical based on testing of single proportion and difference of proportions
5. Practical on association
6. Practical on Chi-square test of goodness of fit.

**PART – B**
During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

| **Course Code** | **Java Programming Lab** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC5X20** | | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisites:**
Basic knowledge of computer fundamentals
Student must have knowledge of some programming languages (such as C ,C++).

**Course objectives**
1. To understand object oriented programming concepts, and apply them in problem solving.
2. To learn the basics of java Console, GUIbased programming and networking programming.

**Course outcomes**
1. Understanding of OOP concepts and basics of Java programming (Console and GUI based).
2. The skills to apply OOP and Java programming in problem solving.
3. Should have the ability to extend his/her knowledge of Java programming further on his/her own.
4. Test and debug Java programs for errors and exceptions

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5X20 | CO1 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 2 | 3 |
| | CO2 | 3 | 3 | 3 | 2 | 2 | | 2 | 2 | 3 | 3 |
| | CO3 | 2 | 2 | 1 | 3 | 2 | | 2 | 3 | 3 | 2 |
| | CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | 3 | 1 |

**Course content**
**PART – A**
Write a program to find factorial of list of number reading input as command line argument.
Write a program to display all prime numbers between two limits.
Write a program to implement all string operations.
Implementation of super and this.
Implementation of static variables and methods.

Write a program to find area of geometrical figures using abstract method.
Write a program to implement constructor overloading by passing different number of parameter of different types.
Write a program to calculate bonus for different departments using method overriding.
To implement multithreading by extending Thread class
Write a program to sort list of elements in ascending and descending order and show the exception handling.

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

| Course Code | Web Programming Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5X30 | | HC | 0 | 0 | 2 | 2 | 3 |

## Prerequisites:

Comfortable using HTML and CSS
Modest facility with JavaScript

**Course objectives:**

To impart the design, development and implementation of Static and Dynamic Web Pages
To develop programs for Web using Scripting Languages as well as .net framework.
To give an overview of Server Side Programming in Web

**Course outcomes:**

1. To develop interactive web pages using HTML, CSS and image map.
2. To procure the knowledge of information interchange formats like XML.
3. To validate fields of web pages using scripting languages like JavaScript.
4. Compare the various types of web services and frameworks

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5X20 | CO1 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| | CO2 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 2 | 3 |
| | CO3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 3 |
| | CO4 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |

**Course content**

**PART – A**

1. Create a form having number of elements (Textboxes, Radio buttons, Checkboxes, and so on). Write JavaScript code to count the number of elements in a form
2. Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the textboxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.
3. Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.
4. Create a page with dynamic effects. Write the code to include layers and basic animation.
5. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)
6. Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.
7. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.
8. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.
9. Create a form consists of a two Multiple choice lists and one single choice list

a) The first multiple choice list, displays the Major dishes available.

b) The second multiple choice list, displays the Starters available.
c) The single choice list, displays the Soft drinks available.
10. Create a web page using two image files, which switch between one another as the mouse pointer moves over the image. Use the on Mouse Over and on Mouse Out event handlers.

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

| Course Code | Visual Programming Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5X30 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**

Basics on C, C++ and Java Programming

**Course objectives:**

1. This course introduces computer programming using the Visual BASIC programming language with object-oriented programming principles.
2. The objective of this course is to make the student to learn how to design, code, test and debug programs using VC++ and VB.

**Course outcomes**

1. Design, create, build, and debug Visual Basic applications.
2. Apply arithmetic operations for displaying numeric output.
3. Apply decision structures for determining different operations
4. Outline the design process, both in oral and written form

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5X30 | CO1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 |
| | CO2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 3 |
| | CO3 | 1 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 3 |
| | CO4 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 2 | 1 |

**Course content**

**PART – A**

1. Design a User Interface (UI) to accept the student details such as name, department and total marks. Validate the input data and calculate the percentage and division.
2. Write a VB Program to design a simple calculator to perform addition, subtraction, multiplication and division (Use functions for the calculations).
3. Design a small Alarm Clock Application.
4. VB program to Encrypt and Decrypt a string. (Use Rnd() to generate the Encryption and decryption keys).
5. Create a Vending machine application, that display images for four snacks and corresponding labels that indicates the number for each snack. The GUI should contain a text box in which the user specifies the number of desired snack. When the dispense snack button is clicked, it should display on a label the name of the snack dispensed. At end it should print (display) the bill of the product.
6. Design a VB application which has MDI and Child forms. Create a menu having the items such as file (New, Open), Format (Font, Regular, Bold, Italic) and Exit in the MDI form. also create a text box and use a Common Dialog Box control for changing the font, Fore Color and Back Color of the Text Box.
7. VB program to create a sequential file containing the fields name, address, city, pin code and phone number. Display the records in a neat format.
8. Write a VB Program to Validate the username and password form the database and display the appropriate message. (Use Data Control)

9. Design a VB application to accept the Item Details (Item ID, Item Name, MFD Date, UNIT Of measure and Rate Per UNIT). Item Id should be a system generated ID. The application should allow operations –Add, Modify, Delete, Update and Navigations of the items. Use ADO Data controls and Grid controls.
10. Design a VB application to record the employee details such as EmpId, EmpName, designation and Basic Pay. Calculate the DA, HRA, Deduction and Gross Salary. (Make the necessary assumptions).

**PART – B**

1. During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

| Course Code | Computer Graphics Lab | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC5X30 | | HC | 0 | 0 | 2 | 2 | 3 |

**Prerequisites:**
Knowledge of C Programming Lab

**Course objectives:**

1. To understand the need of developing graphics application
2. To learn algorithmic development of graphics primitives like: line, circle, polygon etc.
3. To learn the representation and transformation of graphical images and pictures.

**Course outcomes:**

1. To draw Geometric primitives
2. To execute scan line polygon filling
3. To implement basic transformations on objects
4. To understand the working of 3D objects in a plane.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC5X30 | CO1 | 1 | 1 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 1 |
| | CO2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| | CO3 | 1 | 2 | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 2 |
| | CO4 | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 3 |

**Course content**

**PART – A**

1. DDA technique to draw Straight line
2. DDA technique to draw circle
3. Bresenham's techniques to draw Straight line
4. Bresenham's techniques to draw circle
5. Pie chart depiction of the results of an election between four parties.
6. Transform a triangle and illustrate reflection, translation, rotation and scaling.
7. Clipping the triangle ABC against a window.
8. Animate a man walking with umbrella
9. Animate shadow of a pole as sun moves
10. Animate India National flag

**PART – B**

During practical examination the External and Internal examiners may prepare exam question paper related to theory syllabus apart from Part-A. (A minimum of 10 Programs has to be prepared).

# SIXTH SEMESTER

| Course code | Computer Aided Drug Discovery (CADD) | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6010 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisite:**
Student should have familiar with the knowledge of basics in chemistry and computational Biology.

**Course objectives:**
The objectives of this course are to:

1. Learn the basic concepts of computer based chemical design and drug discovery pipelines.
2. Learn the techniques to identify the disease and predict the targets.
3. Apply and analyse computational methods to predict the protein models and interpret interactions.
4. Explore the challenges in drug discovery and implement using computational methods.

**Course outcomes**
After completion of the course a student will be able to:

1. To understand the basic concepts of computational drug design and development.
2. Identify the disease targets and techniques to develop lead compounds.
3. Design and optimize drug active properties and active site prediction for lead binding.
4. Analyse and interpret lead interaction and virtual screening.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6010 | CO1 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 |
| | CO3 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| | CO4 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 2 |

**Course content**

**Unit: I** **9 hours**

Basics of Cheminformatics: Introduction to Cheminformatics, Evolution of Cheminformatics, High-Throughput Synthesis and Screening, Uses of Cheminformatics, Prospects of Cheminformatics. Chemical database design, Database Concepts, Chemical Database Design, Bio Catalyst Database, The MOS Database, The Failed Reaction Database, Protecting Groups Database, Solid-Phase Synthesis Database

**Unit: II** **9 hours**

Computational Chemistry: Introduction to Computational Chemistry, Classical Potential Energy Methods, Quantum Chemistry Introduction & Principles, Theories of Quantum Chemistry, Symmetry & Sample Z-Matrix, Geometry Optimization, Semi-Empirical Methods, Molecular Mechanics & Forces, Primary, secondary and tertiary sources of chemical information, Database search methods: chemical indexing, proximity searching, 2D and 3D structure and substructure searching.

**Unit: III** **9 hours**

Drug design: Drug discovery process. Target identification and validation, lead optimization and validation. Methods and Tools in Computer-aided molecular Design, Analog Based drug design: - Pharmacophore (3D database searching, conformation searches, deriving and using 3D Pharmacophore, constrained systematic search, Genetic Algorithm, clique detection techniques, maximum likelihood method) and QSAR, ADMET. Structure based drug design: - Docking, De Novo Drug Design (Fragment Placements, Connection Methods, Sequential Grow), Virtual screening.

**Unit: IV** **9 hours**

Structure Activity Relationship: Introduction to SAR, QSAR and QSPR, Various Descriptors used in QSARs: Electronics; Topology; Quantum Chemical based Descriptors. Regression Analysis, The Significance and Validity of QSAR Regression Equations, Partial Least Squares (PLS) Analysis, Multi

Linear Regression Analysis. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations.

**Reference Books:**

1. Tari, Leslie W., Structure-Based Drug Discovery., Humana Press, 2012
2. Jhoti, Harren, Leach, Andrew R., Structure-based Drug Discovery., Springer Netherlands., 2007
3. Pandi Veerapandian., Structure-Based Drug Design 1st Edition., 2012.
4. Mohammed Iftekhar, Shaik Jameel, Computational Drug Discovery: Drug Discovery Process & Methods, Createspace Independent Pub., 2015.
5. D.C. Young., Computational Drug Design: A Guide for Computational and Medicinal Chemists., 1st edition, Wiley-Interscience; 2009.

| Course Code | Operation Research -1 | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6020 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisites:**

Fundamental knowledge in Linear Algebraic Equations.

**Course objectives:**

1. The objective of this Course is to
2. To introduce Operation Research
3. To study the concepts of Inventory Problems

**Course outcomes:**

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

1. Understand the Techniques of Operation Research
2. Solve mathematically and interpret biologically simple problems using Graphical Methods
3. Develop the ability to explain mathematical results in language understandable by biologists
4. Solve mathematically and interpret biologically simple models

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6020 | CO1 | 3 | | | 1 | | | 1 | | 3 | |
| | CO2 | 2 | 3 | | | | | 1 | 1 | 2 | 2 |
| | CO3 | 1 | 2 | | 2 | | | | 3 | | |
| | CO4 | 1 | 1 | | 2 | | | | | 2 | 3 |

**Course Content**

**Unit-I** **9 hours**

Definition of the term Operation Research – Different Phases of O.R. Advantages and Limitations of O.R. Standard Linear Programming – Formulation of a Linear Programming Solving L.P.P. by Graphical Method Problem.

**Unit-II** **9 hours**

Simplex Methods - Sensitivity Analysis.

**Unit-III** **9 hours**

Inventory Models-Wilson's Model-Purchasing Model with shortage and without shortage.

**Unit-IV** **9 hours**

Integer programming

**Reference Books:**

1. "Operation Research", by Kanthiswarup, Gupta, Manmohan – Sultan chand and sons, Educational Publishers, New Delhi, 1996.
2. "Operation Research", by s. Darani venkata Krishnan Keerthi Publishing House 1997.
3. "Operation Research", by H.A.Taha Prentice Hall of India Ltd 1998.
4. "Operation Research", by S.D. Sharma Kedarnath Ramnath and co (Publishers) 1997

| Course Code | Software Engineering | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6030 | | HC | 1 | 1 | 0 | 2 | 3 |

**Prerequisite:**

Software development lifecycle: analyses, design, program, control.

**Course objectives**

1. To provide students an in depth understanding of software engineering principles.
2. To prepare the students to develop the skills necessary to handle software projects.
3. To make the students aware of the importance of software engineering principles in designing software projects.

**Course Outcomes:**

1. Understand the importance of the stages in the software life cycle.
2. Understand the various process models.
3. Be able to design software by applying the software engineering principles.
4. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6030 | CO1 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 3 | 2 |
| | CO2 | 2 | 2 | 3 | 1 | 0 | 0 | 3 | 2 | 2 | 3 |
| | CO3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| | CO4 | 2 | 2 | 3 | 3 | 0 | 0 | 3 | 0 | 3 | 2 |

**Course content**

**UNIT – I** **9 hours**

Software and Software Engineering Nature of software- Defining software, Software Application Domains, Legacy Software, Software Engineering, The software process, Software Engineering practice, The essence of Practice, General Principles, Software Myths. Process models A generic process model, defining a framework activity, identifying a Task Set, Process Patterns, Process Assessment and improvement, Prescriptive Process Models, The waterfall Model, Incremental Model, Evolutionary Process Model, Concurrent Models, Introduction about Agile methodology.

**UNIT – II** **9 hours**

Understanding Requirements: Requirements Engineering, Establishing the groundwork, Identifying Stakeholders, Recognizing multiple viewpoints, Working toward Collaboration, Asking the first questions, Eliciting requirements, Collaborative requirement gathering, Quality function Deployment, Usage Scenario Elicitation Work Products, Developing use cases, building the requirements model, Elements of the requirements Model, Analysis pattern, Negotiating requirements, validating requirements. Requirement Modelling Requirement Analysis, Data modelling concepts, Class-based modelling, Requirement modelling strategies, Flow oriented modelling.

**UNIT – III** **9 hours**

Design Concepts: The design within the context of Software Engineering, The design process, Software quality guidelines and attributes, The evolution of software design, Design concepts, Abstraction, Architecture, Patterns, Separation of concerns, Modularity, information hiding, Functional Independence, refinement, Aspects, Refactoring, Object Oriented design concepts Design classes, The design Model, Data Design elements, Architectural Design elements, Interface Design Elements, Component-Level Design elements, Deployment level Design elements. User Interface Design The golden rules- Place the User in Control, Reduce the User's Memory load, Make the interface Consistent, Interface Analysis and Design models, The Process, Interface Analysis User Analysis, Task Analysis, Analysis of Display Content, Analysis of the Work Environment, Interface design steps, Applying Interface Design steps, User Interface design patterns, Design Issues.

**UNIT – IV** **9 hours**

Quality Management: Introduction, Software quality, Achieving software quality, Review metrics and their use, Informal reviews, Formal technical reviews, SQA tasks, Goals and metrics, Formal approaches to SQA, Statistical Software quality assurance, Software Reliability, SQA plan.

**Reference books:**


1. Roger S. Pressman – Software Engineering, A Practitioner's approach, 7th Edn, TMH Publication, 2010.
2. Ian Sommerville – Software Engineering, 9th Edition, Pearson Education Ltd, 2010
3. Pankaj Jalote, "An integrated approach to Software Engineering", 3rd Edition, Narosa Publishing House, 2013.
4. Rumbaugh, James. Object Oriented Modeling and design, Pearson Education, New Delhi, 2005.


| Course code | Medical informatics | Course type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6041 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisite:**

Students should have basic knowledge of biostatistics and biology.

**Course objectives**

The objectives of this course are to:

1. Explore how technology can be used to improve health care delivery in health care organizations and in public health.
2. Acquire breadth of knowledge of the principles of medical informatics.
3. Develop basic skills in medical health informatics to improve practice.
4. Acquire a conceptual and theoretical framework of the design, development, and implementation of health information systems.

**Course outcomes**

After completion of the course a student will be able to:

1. Demonstrate the skills necessary to integrate technology and use information systems to support evidence-based decision making.
2. Analyse current regulations and practices around healthcare and clinical data.
3. Analyse, evaluate and interpret both patient and/or system outcomes.
4. Manage communications and relationships between system developer and Interprofessional clinical users to support system and patient outcomes.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6041 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |

**Course content**

**Unit: I** **6 hours**

Overview of Medical Informatics: Introduction to Data Science and Biostatistics, Data Management for Clinical Research, current issues in medical informatics, principles of information storage and retrieval, resources for clinical practice.

**Unit: II** **6 hours**

Managing patient information: mobile medicine, health literacy and consumers, patient education, E-health, refWorks, doing research on medical health, NCBI Databases, Internet search tools, web tools for communication and collaboration, managing patient information, consumer health informatics.

**Unit: III** **6 hours**

Clinical Research Informatics: Clinical Decision Making, Machine Learning / NLP, Telehealth and Remote Monitoring, Enterprise Data Strategy, HIPAA, Privacy, IRBs, and Ethical Issues, Distributed Research Networks, Population Data and Public Health Informatics, Human Factors in User Interface Design, Quality Improvement Primer,

**Unit: IV** **6 hours**

Introduction to Medical Networks: Introduction to Medical Network Design & Development, Contemporary Decision-Making Structures, Protocols, Algorithms and Theories, Contemporary Decision-Making Structures, Protocols, Algorithms and Theories.

**Reference Books:**


1. Ramona Nelson PhD RN-BC ANEF FAAN, Nancy Staggers PhD RN FAAN., Health Informatics: An Interprofessional Approach,Mosby; 2 edition., 2017
2. Mervat Abdelhak, Sara Grostick, Mary Alice Hanken., Health Information - E-Book: Management of a Strategic Resource 5th Edition,Saunders., 2017
3. Shortliffe, Edward H., Cimino, James J. Biomedical Informatics: Computer Applications in Health Care and Biomedicine., springer., 2014.


| **Course code** | **Structural Chemistry** | **Course type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC6042** | | **SC** | **2** | **0** | **0** | **2** | **2** |

**Prerequisite:**

The students should have basic knowledge on chemistry and bioinformatics.

**Course objectives**

The objectives of this course are to:

1. Understand the chemical structures and reactions.
2. Introduce the basic understanding of chemical structures, and computational methods on structural chemistry.
3. Understand the mechanism of thermodynamic principles and kinetic energy with their applications.
4. Understand the use of software's to predict chemical structures, bonds, bonding interactions, molecular orbital's etc.,

**Course outcomes**

After completion of the course a student will be able to:

1. Understand the basic concepts of structural chemistry, bonding interactions, bonding energy, kinetics.
2. Design and analyse the molecular mechanics and quantum mechanics of chemical structures.
3. Analyse and interpret the physicochemical properties of various chemical properties within biological system
4. Develop thermodynamic principles in chemical structure design.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6042 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | 2 | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | 2 | 2 | | | 3 | 1 | 2 | 2 |

**Course content**

**Unit: I** **6 hours**

Structural chemistry: introduction, Atoms and Molecules, Survey of Quantum Mechanical Principles, Angular Momentum, the hydrogen atoms, hydrogen bonding, Wave functions and cahrge densities, Atomic Orbital's, Diatomic Molecules, Heteronuclear Diatomics, Polyatomics, van der Waals forces. The periodic table, elements and compounds, chemical formulas. Evolution of atomic theory: Thomson & Rutherford, Bohr model of hydrogen, Bohr-Sommerfeld model and multi-electron atoms, atomic spectra, Schrödinger equation. Electron orbital's: Aube principle, Pauli exclusion principle, and Hund's rules.

**Unit: II** **6 hours**

Bonding and Molecules - Primary bonding: ionic, covalent, metallic. Secondary bonding: dipole-dipole, induced dipole-induced dipole, London dispersion/van der Waals, hydrogen. Shapes of molecules: hybridization, LCAO-MO, VSEPR theory. Reactions and Kinetics - Reaction kinetics: rate laws, thermal activation, and the Arrhenius equation. Diffusion: Fick's first and second laws.

**Unit: III** **6 hours**

Reactions and Kinetics - Reaction kinetics: rate laws, thermal activation, and the Arrhenius equation. Diffusion: Fick's first and second laws. Molecular Orbital's; Basis set; Spin, Electron density; Density functional theory, Molecular Properties (density, electrostatic potential, dipole moment, partial charge), Chemical properties and reactivity, Potential energy surface; geometry optimizations; Molecular Mechanics, Reaction Coordinate.

**Unit: IV** **6 hours**

Quantum mechanical calculations: Ab initio methods, Density functional methods, Softwares for quantum mechanical calculations, Different forms of inputs for Ab initio calculations, Computation of single point energies, Geometry optimization, Electron densities and electrostatic potentials, Analysis of output for Gausian programmes, Molecular frequencies, Modeling in solutions, Thermodynamic functions, NMR frequencies, QSAR, Transition states.

**Reference Books:**

1. Claudio N. Cavasotto., In Silico Drug Discovery and Design: Theory, Methods, Challenges, and Applications, CRC Press, 2017
2. Ulrich Müller., Inorganic Structural Chemistry 2nd Edition., Wiley; 2006
3. Stepan S. Batsanov, Andrei S. Batsanov., Introduction to Structural Chemistry., Springer., 2012th Edition
4. Milan Randic, Marjana Novic, Dejan Plavsic., Solved and Unsolved Problems of Structural Chemistry., CRC Press., 2016.

| Course Code | Biostatistics – IV | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6051 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisite:**

Fundamental knowledge of inferential statistics.

**Course objectives**

Objective of this Course is to:

1. To introduce students about basic concepts of Measures of Tendency
2. To study the concepts of Regression
3. To study the concepts of correlation

**Course outcomes**

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

1. Understand the Measures of Tendency
2. Solve mathematically and interpret biologically simple problems using Correlation and Regression
3. Explain and apply the concepts of Regression Analysis
4. Develop the ability to explain mathematical results in language understandable by biologists

**Mapping of Course Outcomes with programme Outcomes**

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6051 | CO1 | 2 | 1 | | 2 | | | 1 | 2 | 2 | 1 |
| | CO2 | 3 | 1 | | 3 | 1 | | | 2 | 1 | 1 |
| | CO3 | 2 | 1 | | 2 | 2 | | 1 | 1 | 2 | 1 |
| | CO4 | 2 | 2 | | 1 | 2 | | 1 | 3 | 1 | 1 |

**Course content**

Unit-I **6 hours**

Design and Analysis Techniques: Introduction – Study Design – Measure of effect for categorical data – Attribute risk

**Unit-II** **6 hours**

Confounding and Standardization – Method of inference for Stratified Categorical Data – The Mentel-Haenszel Test.

**Unit-III** **6 hours**

Power and sample size estimation for stratified categorical data – Multiple logistic Regression – Extension to Logistic Regression.

**Unit-IV** **6 hours**

Meta-Analysis – Equivalence studies – The Cross Over Design – Clustered Binary Data – Longitudinal Data Analysis.

**Recommended Books:**

1. Palanichamy, S. and Manoharan, M., Statistical methods for biologist, Paramount Publications.
2. Arora P.N and Malhon.P.K., Biostatistics, Himalaya publishing house, Mumbai, 1996.
3. Ramakrishnan, P., Bio statistics, Saras Publications, Nagercoil, 1996.
4. Sokal R.J. and Roflf. S.J., Introduction to Biostatistics, W.H.Freeman London, 1981.
5. Zar, J.H., Biostatistical analysis, McGraw Hill, London,1983.
6. S.C. Gupta, and V.K.Kapoor, Fundamentals of mathematical Statistics, S. Chand and Sons, New Delhi, 2002.

| Course Code | Numerical Methods-II | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **B18MC6052** | | **SC** | **2** | **0** | **0** | **2** | **2** |

**Prerequisite:**
Fundamental knowledge of matrices, calculus

**Course objectives:**
The Objectives of this course is to:

1. Explain the Eigen values of the Matrices
2. Study the Initial Value Problems
3. Study least square approximation
4. Explain different Methods of solving ODE

**Course outcomes**
By the end of the Course, Students will be able to:

1. Utilize the necessary information to form eigen Value Problems
2. Apply different formulae for finding the Numerical Solutions for Initial Value Problems
3. Find the solution for Least Square Approximation
4. Find the solutions by using different methods

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6052 | CO1 | 3 | 3 | 2 | | | | 2 | 2 | 2 | 2 |
| | CO2 | 3 | 3 | 1 | 1 | 1 | | 3 | 3 | 3 | 2 |
| | CO3 | 3 | 3 | 1 | | | | 2 | 1 | 2 | 2 |
| | CO4 | 3 | 3 | 1 | | 2 | 1 | 1 | 2 | 2 | 1 |

**Course content**

**Unit-I** **6 hours**
Applied Linear Algebra Direct methods for solving linear systems, numerical factorizations Eigenvalue problems.

**Unit-II** **6 hours**
Initial Value Problems, problems for ODE Euler's, Taylor, Runge- Kutta, and multistep methods, Stability.

**Unit-III** **6 hours**
Approximation theory, least square approximation

**Unit-IV** **6 hours**
Approximating Eigenvalues, Power method, Householder's method BVP for ODE Shooting methods

**Reference Books:**
1)Richard L. Burdenand J. Douglas Faires, Numerical Analysis, 8thEdition
2) Numerical Methods by Kurtis D.Fink
3) Numerical Methods by RemondP.Kenale

| **Course Code** | **Operation Research-II** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC6053** | | **SC** | **2** | **0** | **0** | **2** | **2** |

**Prerequisite:**
Fundamental knowledge of calculus

**Course objectives:**

The objective of this Course is to:

1. To introduce Operation Research
2. To study the concepts of Assignment Problems
3. To study the concepts of Networks.

**Course outcomes:**

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

1. Understand the Techniques of Operation Research
2. Solve mathematically and interpret biologically simple problems using Graphical Methods
3. Explain and apply the concepts of PERT/CPM
4. Develop the ability to explain mathematical results in language understandable by biologists

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6053 | CO1 | | 2 | | 2 | | | 2 | 2 | 2 | 1 |
| | CO2 | 2 | 1 | | 2 | | | 1 | 1 | 1 | 2 |
| | CO3 | 3 | 2 | 1 | 3 | | 2 | 2 | | 2 | 3 |
| | CO4 | 1 | 2 | 2 | 2 | | 1 | 2 | 1 | 3 | 2 |

**Course content**

**Unit-I** **6 hours**

Transportation, finding initial Basic feasible solution MODI method of finding the optimum solution assignment models Hungerian method

**Unit-II** **6 hours**

Game Theory maximin and minimax principle, Game with or without saddle point

**Unit-III** **6 hours**

Sequencing Problems

**Unit-IV** **6 hours**

PERT-CPM-Networks duration schedule, probabilistic decisions

**Reference Books:**


1. "Operation Research", by Kanthiswarup, Gupta, Manmohan – Sultan chand and sons,Educational Publishers, New Delhi, 1996.
2. "Operation Research", by s.DaranivenkatakrishnanKeerthi Publishing House 1997.
3. "Operation Research", by H.A.Taha Prentice Hall of India Ltd 1998.
4. "Operation Research", by S.D.SharmaKedarnathRamnath and co (Publishers) 1997


| Course Code | Computer Networks | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6061 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisite:**

Data communications, digital transmissions, Protocols, Layers.

**Course Objectives:**

To study about network components.
To study about topologies and network models.
To study about various network protocols.

**Course Outcomes:**

Recognize the technological trends of Computer Networking.

Discuss the key technological components of the Network.

Evaluate the challenges in building networks and solutions to those.

Explain the way protocols currently in use in the Internet work and the requirements for designing network protocols.

Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6061 | CO1 | 3 | 2 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 2 |
| | CO2 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| | CO3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 |
| | CO4 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |

## Course Content

**UNIT-I** **6 hours**

Physical Layer: Data communications: components – Network criteria – physical structures – network models – categories of networks –interconnection of networks – inter network Protocols and standards: protocols-standards-standards organizations- internet standards Network models: Layered tasks – OSI model – layers in the OSI model – TCP/IP protocol suite.

**UNIT-II** **6 hours**

Digital Transmission: Digital to digital conversion: Line coding – line coding schemes – block coding - analog to digital conversion – PCM - transmission modes: serial transmission – parallel transmission Analog Transmission: Digital to analog conversion: FSK-ASK-PSK Analog to Analog conversion: Amplitude modulation – Frequency modulation – phase modulation.

**UNIT-III** **6 hours**

Data Link Layer: Error correction and detection: Introduction- block coding-linear block cods-cyclic codes-checksum. Data link Control: protocols-simplest protocol- stop and wait protocol- stop and wait automatic repeat request-go back n automatic repeat request-selective repeat-automatic repeat request-piggybacking. Multiple Access: Random access-Aloha-CSMA-CSMA/CD-CSMA/CA Controlled access: reservation, polling, token passing. Channelization: FDMA, TDMA, CDMA.

**UNIT-IV** **6 hours**

Network Layer: AddressingIPV4 addresses - IPV6 Addresses Internet Protocol: IPv4 –IPv6 Address mapping protocols: ARP – RARP. Routing protocols: Unicast routing protocols: distance vector routing, Link State routing Multicast Routing protocols (Any two) Transport Layer: Process to process delivery – UDP – TCP Congestion control and QOS: Data traffic – congestion – congestion control – quality of service – techniques to improve quality of service.

**Reference Books:**

1. Behrouz. A. Forouzan, Data communication and networking, McGraw-Hill, 5th edition, 2011.

2. Andrew. S. Tanenbaum, Computer Networks, PHI publications, 5th edition, 2011.

| Course Code | Design and Analysis of Algorithms | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6062 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisite:**

Discrete Mathematics - sets, functions, relations; proofs, and proofs by induction, Boolean logic, Basic probability.

**Course Objectives**

1. Analyse the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.

**Course Outcomes:**

1. Ability to Understand, Analyze the performance of recursive and non-recursive algorithms and use of asymptotic notations to measure the performance of algorithms.
2. Identify and analyze various algorithm design techniques
3. Understand and evaluate algorithms using various algorithm design techniques
4. Ability to understand the limitations of Algorithm power and identify algorithm design
5. Techniques to cope up with the limitations.

**Mapping of Course Outcomes with programme Outcomes**

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6062 | CO1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |

## Course Content

**UNIT – I** **6 hours**

Introduction: Performance Analysis - Space complexity and Time complexity (posteriori testing, and a priori approach), Asymptotic Notations (O, Ω, Θ). Average, Best and Worst case complexity.

**UNIT – II** **6 hours**

Introduction to Divide and Conquer Algorithms - Finding the Maximum and Minimum, Quick sort (Derivation of Average case analysis and Worst case analysis), Binary Search (Derivation of Average case analysis).

**UNIT – III** **6 hours**

Introduction to Greedy Algorithms – Knapsack Problem and Fractional Knapsack problem, minimum cost spanning trees, Kruskal's Algorithm and Prim's Algorithm, Single-Source Shortest Paths.

**UNIT – IV** **6 hours**

Dynamic Programming: Definition - All-pairs shortest paths, Travelling salesman problem, Multistage graphs. Back Tracking - N-Queens, Sum of Subsets, Graph colouring.

**Text Books:**

Horowitz, Sahni, Rajasekaran, Fundamentals of Computer Algorithms, Universities Press Pvt Ltd.

**Reference Books:**

1. Design & Analysis of Algorithms-Horowitz & Sahni
2. GAV PAI, Data structures and Algorithms, Tata McGraw Hill.

| Course Code | Computer Architecture | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6063 | | SC | 2 | 0 | 0 | 2 | 2 |

**Prerequisite:**

Combinational circuits and assembler programming, Memory hierarchy and memory caches

**Course objectives**

1. Discuss the basic concepts and structure of computers.
2. Understand concepts of register transfer logic and arithmetic operations.
3. Explain different types of addressing modes and memory organization.
4. Learn the different types of serial communication techniques.
5. Summarize the Instruction execution stages.

**Course outcomes**

1. Understand the functional units of the processor such as the register file and arithmetic-logical unit, and with the basics of systems topics.
2. Interpret the design trade-offs in designing and constructing a computer processor.
3. Implement the basic knowledge of I/O devices and interfacing of I/O devices with computer.
4. Understand the Direct Memory Access Transfer and CPU-IOP communication

**Mapping of Course Outcomes with programme Outcomes**

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6063 | CO1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| | CO2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |
| | CO3 | 3 | 3 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 2 |
| | CO4 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 2 | 2 | 2 |

## Course content

**UNIT – I** **6 hours**

Basic Computer Organization and Design: Instruction codes, computer instruction, timing and control, execution and instruction, input-output and interrupt, design of computer.

**UNIT – II** **6 hours**

Central Processor Organization: Processor bus organization, arithmetic logic UNIT (ALU) instruction formats, addressing modes, data transfer and manipulation, program control, microprocessor organization.

**UNIT – III** **6 hours**

Input-Output Organization: Peripheral devices. asynchronous data transfer, direct memory access (DMA), priority interrupt, input –output processor (IOP).

**UNIT – IV** **6 hours**

Memory organization: Auxiliary memory, microcomputer memory hierarchy, associative memory, virtual memory, cache memory.

**Reference Books:**

1. M. Moris Mano, Computer System, Architecture, 2nd Edition Prentice Hall of India.
2. William Stallings, Computer Organization and Architecture, Pearson Education
3. Andrew S. Tenenbauam, Structured Computer Organization, 3rd Edition; Prentice Hall of India

| Course Code | MOOC / SWAYAM / Internship | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6070 | | RULO | 0 | 0 | 2 | 2 | 3 |

**MOOC/ SWAYAM:**

Globally, MOOC (Massive Open Online Course) platforms are gaining much popularity. Considering the popularity and relevance of MOOCs, Government of India has also launched an indigenous platform, SWAYAM. SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) is basically an integrated MOOCs platform for distance education that is aimed at offering all the courses from school level

(Class IX) to post-graduation level. The platform has been developed collaboratively by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) with the help of Microsoft and is capable of hosting 2,000 courses. There are many other international agencies, foreign universities offering OOC courses.

A student shall register and successfully complete any of the courses available on SWAYAM. Student shall inform the MOOC/SWAYAM coordinator of the school about the course to which he/she has enrolled. The minimum duration of the course shall be not less than 40 hours and of 4 credits. The student should submit the certificate issued by the SWAYAM to the MOOC/SWAYAM coordinator of the school, the grades obtained in the course shall be forwarded to concerned authority of the University.

| **Course Code** | **Skill Development Courses** | **Course Type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC6080** | | **RULO** | **0** | **0** | **2** | **2** | **3** |

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

| **Course code** | **Computer aided drug discovery Practical's** | **Course type** | **L** | **T** | **P** | **C** | **CH** |
|---|---|---|---|---|---|---|---|
| **B18MC6090** | | **SC** | **2** | **0** | **0** | **2** | **2** |

**Prerequisite:**

The basic knowledge of molecular biology and bioinformatics.

## Course Objectives:

The objectives of this course are to:

1. Learn the basic concepts of designing chemical structures.
2. Understand and implement physicochemical properties of chemicals
3. Explore the disease target prediction and homology modelling of protein structures.
4. Explore the challenges in drug discovery and implement using computational methods.

## Course Outcomes:

After completion of the course a student will be able to:

1. Understand and design the chemical structures based on 2D and 3D structures.
2. Analyse and interpret physicochemical properties to predict drug like properties.
3. Analyse and implement drug active properties and drug docking studies.
4. Analyse and interpret virtual screening of compounds and medicinal chemistry.

## Mapping of Course Outcomes with programme Outcomes

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6090 | CO1 | 3 | 2 | 2 | 2 | | | 3 | 2 | 3 | 2 |
| | CO2 | 2 | 3 | 3 | 3 | | | 3 | 1 | 3 | 1 |
| | CO3 | 2 | 3 | 3 | | | | 2 | | 3 | 2 |
| | CO4 | 2 | 2 | | 2 | | | 3 | 1 | 2 | 2 |

## Course Contents

1. Chemical structure design, Visualization of 2D and 3D chemical structures
2. Study physical and chemical properties of chemical structures
3. Chemical structures accession, PubChem compound, Chemspider, ZINC, Drug Bank
4. Molecular Visualization Softwares: Pymol and Rasmol

5. Molecular Modeling
6. Tutorial on Molecular Dynamics: Gromacs
7. Binding Site Identification
8. Pharmacophore analysis, ADMET
9. Structure based Drug Design:- Molecular Docking
10. Ligand based Drug Design:- QSAR

## Reference Books:


1. Christopher J. Cramer, Essentials of Computational Chemistry: Theories and Models, Wiley, John & Sons, Incorporated, 1st edition, 2002.
2. C. Stan Tsai, An Introduction to Computational Biochemistry., Wiley, John & Sons, Incorporated 1st Edition, 2002
3. Mohammed Iftekhar, Shaik Jameel, Computational Drug Discovery: Drug Discovery Process & Methods, Createspace Independent Pub., 2015.
4. D. C. Young., Computational Drug Design: A Guide for Computational and Medicinal Chemists., 1st edition, Wiley-Interscience; 2009.


| Course Code | Project Work | Course Type | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|
| B18MC6X10 | | HC | 0 | 0 | 4 | 4 | 6 |

**Objectives**

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.

**Mapping of Course Outcomes with Programme Outcomes**

| Course code | PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6X10 | **CO1** | 2 | 3 | | 3 | | | | | 3 | 2 |
| | **CO2** | 2 | 2 | 3 | 3 | 3 | 3 | | | 2 | 3 |
| | **CO3** | 2 | 2 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 |
| | **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Project**

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.

| Course Code | | Course | L | T | P | C | CH |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Computer Science** | **Type** | | | | | |
| **B18MC6X20** | **Project** | **HC** | **0** | **0** | **2** | **2** | **3** |

**Prerequisite:**

Basic Knowledge of the programming concepts studied in previous semesters.

**Course Objectives:**

1. Knowledge Application: Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2. Communication: Students will acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
3. Collaboration: Students will acquire collaborative skills through working in a team to achieve common goals.
4. Independent Learning: Students will be able to learn on their own, reflect on their learning and take appropriate action to improve it.
5. Management and Finance: Students will prepare schedules and budgets, they along with the guide keep track of the progress and expenditure.

**Course Outcomes:**

1. Perform literature review, identify state of the art in that field and be able define the problem.
2. Establish a methodology using advanced tools / techniques for solving the problem including project management and finances.
3. Design, Develop Analytical models, Perform Numerical Analysis and interpret the results.
4. Prepare quality document of project work for publications, patenting and final thesis.

**Mapping of Course Outcomes with programme Outcomes**

| Course code | POs/ COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B18MC6X20 | CO1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 3 | 3 |
| | CO2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 3 |
| | CO3 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| | CO4 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 3 |

## 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 Counselling and Placement division, namely Career Development Centre (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counsellors 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 Physics, Mathematics and Statistics is not 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 centre 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.

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