10 YEARS OF UNIVERSITY RECOGNITION

20 YEARS OF ACADEMIC EXCELLENCE

REVA UNIVERSITY

Bengaluru, India

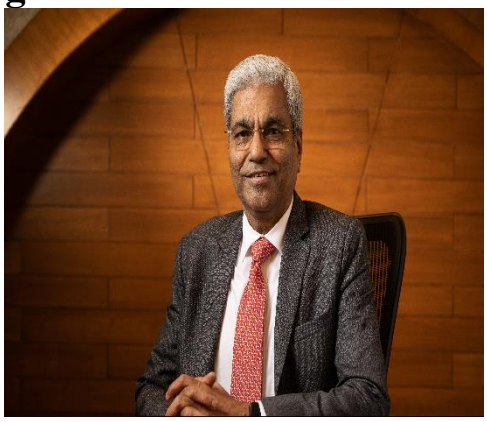
SCHOOL OF APPLIED SCIENCES

B.Sc. – MATHEMATICS, STATISTICS, COMPUTER SCIENCE

HANDBOOK: 2021-24

Rukmini Educational Charitable Trust

Chancellor's Message



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

- Nelson Mandela.

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

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

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

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

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me, and I believe, it takes 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 up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.

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

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

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

industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

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

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

Welcome to the portals of REVA University!

Dr. M. Dhanamjaya

Vice-Chancellor, REVA University

Director's – message

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

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

The program has been developed with an emphasis on knowledge assimilation, application, national and international job market and its social relevance. The outcome based curriculum designed and followed imbibes required theoretical concepts and practical skills in the domain. 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. The curriculum caters to and has relevance to local regional, national and global developmental needs. Maximum number of courses are integrated with crosscutting issues with relevant to professional ethics, Gender, Human values, Environment and sustainability.

This handy document containing brief information about B.Sc. (M St Cs) 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.

Prof.Shilpa B R

Deputy Director
School of Applied Sciences

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RUKMINI EDUCATIONAL CHARITABLE TRUST

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

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

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

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27th 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 centre, the well-planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

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 so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, 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 recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal VikasYojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with 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 RatnaProf. 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.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised 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's everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

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

Objectives

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

ABOUT SCHOOL OF APPLIED SCIENCES

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

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

Vision

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

Mission

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

S.no	Name of the Member	Position
1	**Dr. Biradar Kashinath** Principal Govt. First Grade College for women, Jewaragi Coloney Kalburagi 585102	External Members
2	**Dr. R Sumithra** PG Coordinator &Head, Research Cente Associate Professor Department of UG, PG studies & Research in Mathematics Government Science College Autonomous, Nrupathunga University ,Bengaluru	
3	**Dr.Subramanyam T** AssistantProfessor Department of Mathematics M.S Ramaiah University of Applied Sciences, Bengaluru	

S.no	Name of the Member	Position
1	**Dr. Vishu Kumar.M.** Professor, Co ordinator & Asst.Director	Chairman
2	**Dr.Hanuma Gowda B.N.** Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
3	**Dr.Madhusudhana Zalki** Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
4	**Dr.Murugesan.R.** Associate Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
5	**Dr. Uday Kumar. K.N.** Associate Professor	Member

	Department of Mathematics SCHOOL OF APPLIED SCIENCES	
6	**Dr. Brinda Halambi** Assistant Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
7	**Dr.Sridevi.P** Assistant Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
8	**Prof. Narayana Gowda** Assistant Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member
9	**Dr.Ranjitha Kumar** Assistant Professor Department of Mathematics SCHOOL OF APPLIED SCIENCES	Member

B. Sc – MStCs (Mathematics, Statistics Computer Science)

Programme Overview

Mathematics is a part of physical sciences belong to the group of natural science. Natural science is concerned with description, prediction and understanding of natural phenomenon based on empirical evidence from observation and experimentation. Statistics and Computer science helps in interpretation and analysis of data and computer science helps in developing the programming skill in analysis of data.

The School of Applied Sciences at REVA UNIVERSITY has designed to offer B.Sc. in Mathematics,Statistics and Computer Science as an undergraduate degree programme to create motivated, enthusiastic, thinking and creative graduates to fill the roles as teachers, professors, scientists, data analysists , professionals and administrators.

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, further necessitating a greater number of teachers and professors to work in schools and colleges. The proposed B.Sc. (MStCs) programme designed will act as a foundation and first degree to prepare teachers, professors, scientists, professionals, and administrators to meet the challenges of growing economy as well as to meet the growing aspirations of the youth.

The B.Sc. (MStCs) 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 imbibes 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 (PEO's)

The programme educational objectives of the **B Sc (M.St.Cs)** course is to prepare graduates to

PEO-1	Demonstrate problem solving skills in Mathematics,, statistics and Computer Science by communicating effectively either leading a team or as a team member.
PEO-2	Express oral and written interpersonal skills in order to understand, learn and advance their careers through research developments and seeking higher education.
PEO-3	Understand the professional, ethical and social responsibilities through lifelong learning skills

Program Outcomes (POs)

1. Demonstrate the knowledge in the areas of physics, Mathematics, and Computer Science.
2. Apply the fundamentals of physics, mathematics to formulate, solve and interpret complex problems.
3. Comprehend, analyze, model and solve complex problems in the areas of physics, Mathematics and computer science.
4. Recognize the need to expertise in the areas of physics, mathematics, and Computer Science by self-upgradation through lifelong learning.
5. Communicate with clarity and coherence, both written and verbally.
6. Exhibit professional and ethical responsibility.
7. Encourage collaborative learning through group activities and hands-on learning.
8. Use latest computer techniques and tools to carry out scientific investigations and develop new solutions and solve problems related to environment and society.

Programme Specific Outcomes (PSOs)

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

1. Acquire a strong conceptual foundation in physics, mathematics and Computer Science using latest software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions.

Implant the capacity to apply theoretical concepts to design and develop solutions.

Eligibility for B. Sc (MStCs) program

Pass in PUC/10+2 examination with physics, Mathematics and Computer Science as compulsory subjects and obtained minimum 45% marks (40% in case of candidate belonging to SC/ST

category) in the above subjects taken together of any Board recognized by the respective State Government /Central Government/Union Territories or any other qualification recognized as equivalent thereto.

Mapping of Course Outcomes with programme Outcomes

Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0101	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	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0101	CO1	3	3	2	1			1	1	2	3
	CO2	3	2	2	1			1	2	3	3
	CO3	2	3	2	2		1		2	3	2
	CO4	3	3	2	1					3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0101	CO1	3	2	2						2	3
	CO2	3	2	2						2	3
	CO3	3	2	2						3	3
	CO4	3	2	1	1					2	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS111	CO1	3	2	2		1				3	3
	CO2	3	2	2		1				3	3
	CO3	2	2	2		1				3	2
	CO4	3	2	2		1				2	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS112	CO1	2			3		2	2	2	2	2
	CO2	3	2		3		2	1	3	3	3
	CO3	3	3	3	3			2	2	3	2
	CO4	3	3	2	2		2	2	3	3	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS113	CO1	3	2	2		1				3	3
	CO2	3	2	2		1				3	3
	CO3	2	2	2		1				2	3
	CO4	3	2	2		1				3	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0102	CO1	3	2	2	3					3	2
	CO2	2	2	2	2					3	3
	CO3	3	2	2	3					3	3
	CO4	3	2	2	2					3	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0102	CO1	3	3	2	3			2	1	2	2
	CO2	3	3	3	2			1	2	2	3
	CO3	3	2	2	2			2	1	2	3

	CO4	3	2	1	2			2	3	3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21SG0207	CO1	3	2	2						3	2
	CO2	2	2	2						3	3
	CO3	3	2	2						3	3
	CO4	3	2	2						3	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0102	CO1	3	2	2		1				3	3
	CO2	3	2	2	1	1				3	3
	CO3	2	2	2	2	2				3	3
	CO4	3	2	2		1				3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0201	CO1	2	2	3	2	1		2	2	1	3
	CO2	3	3	3	3	1		2	3	2	2
	CO3	3	2	2	3			2	2	3	2
	CO4	2	3	2	2	1		2	3	2	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0201	CO1	3	2	2		1				3	3
	CO2	3	2	2	1	1				3	3
	CO3	2	2	2	1	1				3	3
	CO4	3	2	2		1				3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0201	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	PSO1	PSO2
B21STS211	CO1	1	2	1	1	1	1	1	1	2	2
	CO2	2	2	1	1	1	1	1	1	2	2
	CO3	1	2	1	2	2	2	2	1	1	1
	CO4	2	1	1	2	1	2	2	1	1	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21STS212	CO1	3	3	3	3			1	2	3	3
	CO2	3	3	3	3			1	2	3	3
	CO3	3	2	2	2			2	2	3	3
	CO4	3	2	2	2			2	2	3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0202	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	PSO1	PSO2
B21ST0202	CO1	1	2	1	1	1	1	1	1	2	1
	CO2	2	2	1	1	1	2	1	2	2	2
	CO3	1	2	1	2	2	2	1	1	1	1
	CO4	2	1	2	2	1	2	2	2	1	2

Course Code	POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0202	CO1	3	2	2	1			1	1	3	2
	CO2	3	2	2	1			1	1	3	3
	CO3	3	2	2	1			1	1	3	2
	CO4	3	2	2	1			1	1	2	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0301	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	PSO1	PSO2
B21ST0301	CO1	1	2	1	1	1	1	1	1	2	1
	CO2	2	2	1	1	1	2	1	1	2	2
	CO3	1	2	1	2	1	2	1	1	1	1
	CO4	2	1	1	2	1	1	2	1	1	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0301	CO1	3	3	3	3			1	3	3	3
	CO2	3	2	1	2			1	2	3	3
	CO3	3	2	2	2			1	2	3	3
	CO4	3	3	3	3			1	3	3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CPS311	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	PSO1	PSO2
B21CPS312	CO1	1	2	1	1	1	1	1	1	2	1
	CO2	2	2	1	1	1	2	1	1	2	2
	CO3	1	2	1	2	1	2	1	1	1	1
	CO4	2	1	1	2	1	1	2	1	1	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ASO301	CO1	3	2	2	1			1	1	3	2
	CO2	3	2	2	1			1	1	3	3
	CO3	3	2	2	1			1	1	3	2
	CO4	3	2	2	1			1	1	2	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0401	CO1	3	3	2	3	2				2	1
	CO2	3	3	2	3	2				3	3
	CO3	3	3	1	3	2				3	2
	CO4	3	3	2	3	2				3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0401	CO1	2	1	1	1			1	2	1	2
	CO2	3	2	2	1			1	2	2	2
	CO3	2	1	1							2
	CO4	2	1	1	1			1	1	2	2

Course Code	POs/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0401	CO1	3	3	2	3	2				2	1
	CO2	3	3	2	3	2				3	3
	CO3	3	3	1	3	2				3	2
	CO4	3	3	2	3	2				3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0501	CO1	3	3	2	3	2				3	3
	CO2	3	3	2	3	2				3	3
	CO3	3	3	2	3	2				3	2
	CO4	3	2	1	2	2				3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0501	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										
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0501	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										
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0601	CO1	1	2	2	1			2		3	1
	CO2	1	2	1	3			3		3	1
	CO3	1	2	2	2			2		3	1
	CO4	1	1	2	1			2	2	3	1
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0601	CO1	1	2	2	3			2		3	1
	CO2	1	2	2	3			3		3	1
	CO3	1	2	1	2			3	2	3	1
	CO4	1	3	3	2			2	3	3	1
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0601	CO1	3	3	2	2	1				3	3
	CO2	3	3	2	1	1				3	3
	CO3	3	3	2	1	1				3	2
	CO4	3	2	2		1				3	2
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0602	CO1	2	2	2	1		1		1		1
	CO2	3	2	1	1				2	1	1
	CO3	2	1	2	2		1		1	2	1
	CO4	2	3	1	2		1	1	1	1	
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0602	CO1	3	3	2	3					3	2
	CO2	3	3	3	3					3	3
	CO3	3	2	3	2					3	2
	CO4	3	2	3	3					3	3
Course Code	**POs/COs**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2

B21SG0601	CO1	3	2	2		1				3	3
	CO2	3	2	2	1	1				3	3
	CO3	2	2	2	1	1				3	3
	CO4	2	2	2	1	1				2	2

Note: 3=H=High, 2=M=Medium and 1=L=Low

Mapping of PEOs with Respect to POs

	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PSO1	PSO2
PEO1	√	√	√	√	√	√	√	√	√	√
PEO2	√	√	√	√	√	√	√	√	√	√
PEO3	√	√	√	√	√	√	√	√	√	√

REVA University Academic Regulations

Bachelor Degree (3 years) Programs

(Applicable for the programs offered from 2021-22 Batch)

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

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – Bachelor Degree Programs 2021-22 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management''.**

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

2. The Programs:

These regulations cover the following Bachelor Degree Programs of REVA University offered during 2021-22:

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

3. Duration and Medium of Instructions:

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

3.2 The medium of instruction shall be English.

4. Definitions:

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

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

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

Where:

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

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

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

4.2 Classification of Courses

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

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

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

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

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

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

4.2.5 Open Elective Course (OE):

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

4.2.6 Project Work / Dissertation:

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

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

5. Eligibility for Admission:

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

Sl. 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 (Honours)		Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
3	Bachelor of Business Administration (Industry Integrated)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 50% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
4	Bachelor of Business Administration (Honours)	6 Semesters (3 years)	Pass in PUC/10+2 with minimum 75% marks of any recognized Board / Council or any other qualification recognized as equivalent there to.
5	Bachelor of Business Administration (Entrepreneurship)	6 Semesters	

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

Table -2: 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 C**ourses of Study**:

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

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

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

These are defined under Section 4 of these regulations.

8. Credits and Credit Distribution

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

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

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

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

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

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

curriculum of a particular program.

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

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

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

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

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

9 Assessment and Evaluation

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

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

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

9.3 The 50 marks of internal assessment shall comprise:

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

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

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

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

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

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

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

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

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

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

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

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

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

9.14 There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets

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

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

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

9.17 There shall also be an **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. **Program Assessment Committee (PAC)** shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

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

9.19 During unforeseen situation like the Covid-19, 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

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

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

9.22 Online courses may be offered as per BACHELOR norms.
For online course assessment guidelines would be as follows:

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

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

9.23 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.

9.24 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

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

Summary of Internal Assessment and Evaluation Schedule

S. No	**Type of Assessment**	**when**	**Syllabus Covered**	**Max Marks**	**Reduced to**	**Date by which the process must be completed**
1	Test-1	During 8th week	First 50%	30	15	8th week
2	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 8th week (10 marks)				
3	Test -2	During 16th Week	Second 50%	30	15	16th Week
4	Assignment / quiz / presentation / any other assessment method as decided by the School	On or before 16th Week (10 marks)				
5	SEE	19/20th Week	100%	100	50	20th Week

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

2. Practical examination wherever applicable shall be conducted after 2nd test and 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 includes 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 Online Courses assessment shall be decided by the BOS of the School.

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

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

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

All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final

examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

12. Requirements to Pass a Course:

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

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

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

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

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

a. Computation of SGPA and CGPA

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

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

Examples on how SGPA and CGPA are computed

Example No. 1

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

Thus, **SGPA = 129 ÷ 16 = 8.06**

Example No. 2

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

Thus, **SGPA = 141 ÷ 20 = 7.05**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits for the respective programs are calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : **CGPA = ∑(Ci x Si) / ∑Ci**

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

Example:

CGPA after Final Semester

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

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

c. Conversion of grades into percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Example: CGPA Earned 7.75 x 10=77.5

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

13. Classification of Results

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

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

Overall percentage=10*CGPA

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

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

14. Attendance Requirement:

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

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

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

15. Re-Registration and Re-Admission:

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

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

16. Absence during Internal Test:

In case a student has been absent from an internal 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 25% (13 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

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

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

Challenge Valuation:

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

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

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

B. Sc – MStCs
(Mathematics, Statistics and Computer Science)
Scheme of Instruction and Detailed Syllabus
(Effective from the Academic Year 2021-24)

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

Sl.	Course Code	Title of the Course	CC/FC	Credit Pattern				
				L	T	P	Tota	Hour
FIRST SEMESTER								
1	B21AHK101	Language – II: Kannada	C	2	0	0	2	3
2	B21AHH101	Language – II: Hindi						
3	B21AHA101	Language – II: Additional English						
4	B21AHE101	Communicative English - I	C	2	0	0	2	3
5	B21MT0101	Mathematics-I	H	3	0	0	3	4
6	B21ST0101	Basic statistics and introduction to python programming	H	3	0	0	3	4
7	B21CP0101	Programming In C	H	3	0	0	3	4
8	B21MTS111	Elementary Number Theory	S	3	0	0	3	3
9	B21MTS112	Discrete Mathematics and Graph theory						
1	B21MTS113	Fuzzy Mathematics						
1	B21LSM101	Constitution of India and Professional Ethics	F	2	0	0	0	2
		Practicals						
1	B21LSM101	Mathematics practical-I	H	0	0	1	1	3
1	B21ST0102	Basic statistics and introduction to python programming lab	H	0	0	1	1	3
1	B21CP0102	C Programming Lab	H	0	0	1	1	3
Total Credits				**1**	**0**		**2**	**32**

						4		
SECOND SEMESTER								
1	B21AHK201	Language – II: Kannada	C	2	0	0	2	3
1	B21AHH201	Language – II: Hindi						
1	B21AHA201	Language – II: Additional English						
1	B21AHE201	Communicative English - II	C	2	0	0	2	3
1	B21MT0201	Mathematics-II	H	3	0	0	3	4
2	B21ST0201	Random variable, probability distributions and limit theorems	H	3	0	0	3	4
2	B21CP0201	Programming in Python	H	3	0	0	3	4
2	B21STS211	Applied Statistics	S	3	0	0	3	3
2	B21STS212	Statistical Quality Control						
2	B21ASM201	Environmental Science	F	2	0	0	0	2
		Practicals						
2	B21MT0202	Mathematics practical-II	H	0	0	1	1	3
2	B21ST0202	Random variable, probability distributions and limit theorems lab	H	0	0	1	1	3
2	B21CP0202	Programming in Python - LAB	H	0	0	1	1	3
		Total Credits		**1**	**0**	**4**	**2**	**32**

THIRD SEMESTER								
29	B21AHK301	Language – II: Kannada	CC	2	0	0	2	3
30	B21AHH301	Language – II: Hindi						
31	BB21AHA301	Language – II: Additional English						
32	B21MT0301	Mathematics-III	HC	3	0	0	3	4
33	B21ST0301	Sampling distributions, estimation theory and simulation	HC	3	0	0	3	4
34	B21CP0301	Relational Data Base Management Systems	HC	3	0	0	3	4
35	B21CPS311	Data Communication and Networks	SC	3	0	0	3	3
36	B21CPS312	Multimedia Computing						
38		NCC	OE	3	0	0	3	3
39	B21ASO301	Classical Optimization						
40	B21ASO303	Physics in Everyday Life						
41	B21ASO304	Water Technology						
42	B21SCM301	Skill Enhancement Course (Mandatory course)	SC	2	0	0	0	2
		Practicals						
43	B21MT0302	Mathematics practical-III	HC	0	0	1.5	1.5	3
44	B21ST0302	Statistical Inference lab-I	HC	0	0	1.5	1.5	3
45	B21CP0302	RDBMS LAB	HC	0	0	1.5	1.5	3
Total Credits				**19**	**0**	**4.5**	**21.5**	**32**
FOURTH SEMESTER								
46	B21AHK401	Language – II: Kannada	CC	2	0	0	2	3
47	B21AHH401	Language – II: Hindi						
48	B21AHA401	Language – II: Additional English						
49	B21MT0401	Mathematics-IV	HC	3	0	0	3	4
50	B21ST0401	Testing of hypothesis, tests of significance and non-parametric tests	HC	3	0	0	3	4
51	B21CP0401	Unix and Shell Programming	HC	3	0	0	3	4
52	B21MTS411	Complex Analysis	SC	3	0	0	3	3
53	B21MTS412	Operations Research						
54	B21MTS41	Topology						
55	B21PTM401	Soft Skill Training	SC	2	0	0	0	2
56	B21SCM401	Skill Enhancement Course (Mandatory course)	SC	2	0	0	0	2
		Practicals						
57	B21MT0402	Mathematics practical-IV	HC	0	0	1.5	1.5	3
58	BB21ST0402	Testing of hypothesis, tests of significance and non-parametric tests lab	HC	0	0	1.5	1.5	3

59	B21CP0402	Unix and Shell Programming- LAB	HC	0	0	1.5	1.5	3
		Total Credits		**18**	**0**	**4.5**	**18.5**	**31**
FIFTH SEMESTER								
60	B21MT0501	Mathematics-V	HC	3	0	0	3	4
61	B21ST0501	Design and analysis of experiments	HC	3	0	0	3	4
62	B21CP0501	Basics of Web Programming	HC	3	0	0	3	4
63	B21MTS511	Sampling Theory	SC	3	0	0	3	3
64	B21PHS512	Basic econometrics						
65	B21SC0N01	MOOC/SWAYAM	SC	2	0	0	2	2
67	B21SGM501	Skill Enhancement Course (Mandatory course)	SC	2	0	0	1	2
		Practicals						
68	B21MT0502	Mathematics practical-V	HC	0	0	0	1.5	3
69	B21ST0502	Design and analysis of experiments lab	HC	0	0	0	1.5	3
70	B21CP0502	Web Programming-LAB	HC	0	0	0	1.5	3
		Total Credits		**16**	**0**	**4.5**	**19.5**	**28**
	SIXTH SEMESTER							
71	B21MT0601	Mathematics-VI	HC	3	0	0	3	4
72	B21ST0601	Advanced operation research	HC	3	0	0	3	4
73	B21CP0601	Data Mining and Data Warehousing	HC	3	0	0	3	4
74	B21CPS611	Software Engineering	SC	3	0	0	3	3
75	B21CPS612	Cryptography and Network Security						
77	B21SG0601	Project	HC	0	0	3	3	6
		Practicals						
78	B21MT0602	Mathematics practical-VI	HC	0	0	1.5	1.5	3
79	B21ST0602	Advanced operation research lab	HC	0	0	1.5	1.5	3
80	B21CP0602	Machine Learning LAB	HC	0	0	1.5	1.5	3
		Total Credits		**12**	**0**	**7.5**	**19.5**	**30**
		Total Credits of all Semesters					**120**	**195**

Semester-wise Summary of Credit Distribution

Semester	L	T	P	Total	Total Hours
I	18	0	4.5	20.5	32
II	18	0	4.5	20.5	32
III	19	0	4.5	21.5	32
IV	18	0	4.5	18.5	31
V	16	0	4.5	19.5	28
VI	12	0	7.5	19.5	30
Total Credits	101	0	30	120	185

B. Sc –Mathematics, Statistics and Computer science(MStCs) Detailed Syllabus

(effective from Academic Year 2021)

FIRST SEMESTER

Course Code	Language-II: Kannada	Type	L	T	P	C	Hrs/Week
B21AHK101		CC	2	0	0	2	3

Course Objectives:

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

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

Course Outcomes:

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

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

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

Course Contents:

Unit-I: **9 Hrs**

1. ಸತ್ಯವಂತೆ ಹಡೆದವ್ವ – ಜನಪದ ಗೀತೆ
2. ನೆಲಕಿರಿವೆನೆಂದು ಬಗೆವಿರೆ ಛಲಕಿರಿವೆಂ– ರನ್ನ
3. ಚಿತ್ರಮಪಾತ್ರೆ ರಮತೇ ನಾರಿ– ಜನ್ನ

Unit-II: **9 Hrs**

1. ಅಬ್ಧಿಯುಮೊರ್ಮೆ ಕಾಲವಶದಿಂ ಮರ್ಯಾದೆಯಂ ದಾಂಟದೇ.... – ನಾಗಚಂದ್ರ
2. ವಚನಗಳು – ಬಸವಣ್ಣ
3. ಗುಂಡಯ್ಯನ ರಗಳೆ – ಹರಿಹರ

Unit-III: **9 Hrs**

1. ಕಲ್ಮಾಡಿಯ ಕೋಣ – ಮಾಸ್ತಿ
2. ಯಾರೂ ಅರಿಯದ ವೀರ – ಕುವೆಂಪು
3. ಸಮಸ್ಯೆಯ ಮಗು – ತ್ರಿವೇಣಿ

Unit-IV: **9 Hrs**

1. ಟೊಳ್ಳುಗಟ್ಟಿ – ಟಿ.ಪಿ. ಕೈಲಾಸಂ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು:

1. ಮುಗಳಿ ರಂ.ಶ್ರೀ., ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2014
2. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಚಾರಿತ್ರಿಕ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2008
3. ಸೀಮಾತೀತ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ ಸಂಪುಟ 1,2,3,4,5 ಮತ್ತು 6, ಕುವೆಂಪು ಕನ್ನಡ ಅಧ್ಯಯನ ಸಂಸ್ಥೆ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ಮೈಸೂರು. 2014
4. ಸಂಗ್ರಹ. ನಾಗೇಗೌಡ ಎಚ್.ಎಲ್., ಕನ್ನಡ ಜನಪದ ಕಥನ ಕಾವ್ಯಗಳು, ಪ್ರಕಾಶಕರು ಕರ್ನಾಟಕ ಜಾನಪದ ಪರಿಷತ್ತು, ಬೆಂಗಳೂರು. 2007
5. ಹಂಪ ನಾಗರಾಜಯ್ಯ, ಸಾಂಗತ್ಯ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
6. ನಾರಾಯಣ ಪಿ.ವಿ, ಚಂಪೂ ಕವಿಗಳು, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
7. ಕಾಳೇಗೌಡ ನಾಗವಾರ, ತ್ರಿಪದಿ, ರಗಳೆ ಮತ್ತು ಜಾನಪದ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2010
8. ಸಂ. ಬೆನಗಲ್ ರಾಮ ರಾವ್ ಮತ್ತು ಪಾನ್ಯಂ ಸುಂದರ ಶಾಸ್ತ್ರೀ, ಪುರಾಣ ನಾಮ ಚೂಡಾಮಣಿ, ಪ್ರಕಾಶಕರು ಪ್ರಸಾರಾಂಗ, ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ. 2010
9. ಡಾ. ಚಿದಾನಂದ ಮೂರ್ತಿ, ವಚನ ಸಾಹಿತ್ಯ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2013
10. ಸಂ. ಬಸವರಾಜು ಎಲ್. ಸರ್ವಜ್ಞನ ವಚನಗಳು, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 2012
11. ಸಂ. ಬಸವರಾಜು ಎಲ್. ಅಕ್ಕನ ವಚನಗಳು, ಪ್ರಕಾಶಕರು ಗೀತಾ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು. 1997

12. ಸಂ ಮರುಳಸಿದ್ದಪ್ಪ ಕೆ, ನಾಗರಾಜ ಕಿ.ರಂ. ವಚನ ಕಮ್ಮಟ, ಪ್ರಕಾಶಕರು ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. 2016
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

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHK101	CO1					2	3				
	CO2					2	3				
	CO3						3				
	CO4							3	2		

Course Code	Language-II: Hindi	Type	L	T	P	C	Hrs/Week
B21AHH101		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the student to

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 पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है।

Course Contents:

इकाई – 1: कहानी, संस्मरण **9 hrs**.

कहानी – नशा – प्रेमचंद
कहानी – सुखमय जीवन – चंद्रधर शर्मा गुलेरी
संस्मरण – शरत के साथ बिताया कुछ समय – अमृतलाल नागर

इकाई – 2: कहानी, आत्मकथा **9 hrs**.

कहानी – मरने से पहले – भीष्म साहनी

कहानी – लाल हवेली – शिवानी

रेखाचित्र – घीसा – महादेवी वर्मा

इकाई – 3: एकांकी, व्यंग्य रचना **9 hrs**.

एकांकी – आवाज का नीलाम – धर्मवीर भारती

व्यंग्य रचना – भेड़े और भेडियें – हरिशंकर परसाई

इकाई – 4: अनुवाद **9 hrs**.

अनुवाद : अंग्रेज़ी – हिन्दी (शब्द एवं अनुच्छेद)

सूचना : प्रत्येक इकाई 25 अंक केलिए निर्धारित है |

References:

1. सुबोध व्यवहारिक हिन्दी – डॉ. कुलदीप गुप्त
2. अभिनव व्यवहारिक हिन्दी – डॉ.परमानन्द गुप्त
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका
8. संक्षेपण और पल्लवन - के.सी.भाटिया&तुमन सिंग

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHH101	**CO1**					2	3	2			
	CO2					2	2	3			
	CO3					3	3	3			
	CO4					3	2	3			

Course Code	Language-II: Additional English	Type	L	T	P	C	Hrs/Week
B21AHA101		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the student

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:

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

1. Demonstrate a thorough understanding of sensitive and critical social issues.

2. Develop reading skills and a wide range of vocabulary.
3. Critically analyze a piece of prose or poetry.
4. Explain their opinion in a coherent and communicable manner.

Course Contents:

Unit-I: Values and Ethics **9 Hrs**

Literature: Rabindranath Tagore - Where the Mind is Without Fear; Saki – The Lumber-room; William Shakespeare – Extract from *Julius Caesar* (Mark Antony's Speech); **Language**: Vocabulary Building.

Unit-II: Natural & Super Natural **9 Hrs**

Literature: John Keats – La Belle Dame Sans Merci; Charles Dickens – The Signal Man; Hans Christian Anderson - The Fir Tree; **Language**: Collective Nouns.

Unit-III: Travel and Adventure **9 Hrs**

Literature: R.L. Stevenson – Travel, H.G. Wells – The Magic Shop, Jonathan Swift – Excerpt from Gulliver's Travels Book – I; **Writing Skills**: Travelogue.

Unit-IV: Success Stories **9 Hrs**

Literature: Emily Dickinson – Success is Counted Sweetest; 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. *Gitanjal*i. 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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHA101	**CO1**					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Communicative English-I	Type	L	T	P	C	Hrs/Week
B21AHE101		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the student

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.

Course Contents:

UNIT – I: Functional English **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

Remedial Grammar: Collocations; Prepositions**; Writing Skills:** Precis 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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHE101	**CO1**					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Mathematics-I	Type	L	T	P	C	Hrs/Week
B21MT0101		HC	3	0	0	3	4

Course Objectives:

This course aims to provide for the student to

1. Familiarize the concepts of matrix and its applications in various fields.
2. Understand the concepts of successive differentiation and n^{th} order derivative.
3. Learn about reduction formula with limit and without limit and differentiation under integral sign - Leibnitz rule.
4. Understand the concept of partial differentiation

Course Outcomes:

1. Apply the matrix theory to solve the system of linear equations.
2. Compute derivatives of any order and apply Leibniz' theorem to find n^{th} derivative of product of two functions.
3. Gain the Knowledge of reduction formulae and differentiation under integral sign by Leibnitz rule to solve integral equations.
4. Master the fundamental concepts of partial differentiation and apply Euler's theorem for homogeneous functions.

Course Contents:

Unit-I: Differential Calculus **12 Hrs**

Recap of differentiation, Successive differentiation, nth derivatives of standard functions $\left(e^{ax},(ax+b)^n,\frac{1}{(ax+b)},\log(ax+b),\sin(ax+b),\cos(ax+b),e^{ax}\sin(bx+c),e^{ax}\cos(bx+c)\right)$ Leibnitz theorem (without proof)-problems. Indeterminate forms $\left(\frac{0}{0},\frac{\infty}{\infty},\ 0X\infty,\ \infty-\infty,\ 0^0,1^\infty\right)$, L' Hospital rule and problems. Taylor's and McLaurin's theorem for a function of one variable and problems (without proof).

Unit-II: Partial differentiation **12 Hrs**

Partial derivatives – definition and simple problems, Euler's theorem (with proof) , Eulers extension theorem (without proof) problems, total derivatives, differentiation of implicit functions, partial differentiation of composite functions- problems. Jacobians – Definition, properties and problems.

Unit-III: Integral Calculus **12 Hrs**

Reduction formulae for $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \tan^n x\,dx$ and $\int sin^m x\, cos^n x\ dx$, evaluation of theses integrals with standard limits and problems. $(Illutration\ of\ reduction\ formulae\ for\ \int cot^n x\,dx,\ \int sec^n x\,dx,\ \int cosec^n x\,dx,)$ **.** Leibnitz's rule- differentiation under integral sign and problems. Applications of Integral Calculus: Computation of length of arc and plane area for standard curves in Cartesian and polar.

Unit-IV: Linear Algebra **12 Hrs**

Elementary operations - Rank of a Matrix, – Inverse of a matrix using row operations - Echelon Forms - Normal Forms - System of Homogeneous and non-homogeneous equations- Gauss elimination method and Gauss-Jordon method. Eigenvalues - Eigenvectors - Cayley Hamilton Theorem (without proof) and diagonalization.

Text Books:

1. Shanthi Narayan and P.K. Mittal, Differential Calculus, Reprint. New Delhi: S.Chand & Company Ltd., 2011.
2. Shanthi Narayan, Integral Calculus, Reprint. New Delhi: S. Chand and Company Ltd., 2004.
3. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.
4. A R Vashista, Matrices, Krishna PrakashanaMandir, 2003.
5. Krishnamoorty V K and Mainra V P and Arora J L, An Introduction to Linear Algebra, Reprint. New Delhi, India: Affiliated East West Press Pvt. Ltd., 2003.
6. G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011.

7. M D Raisinghania, Ordinary and Partial Differential Equations, S Chand and Co. Pvt. Ltd., 2014.

Reference Books:

1. Serge Lang – First Course in Calculus
2. S. Narayanan & T. K. Manicavachogam Pillay, Calculus: S. Viswanathan Pvt. Ltd., 1996, vol. I & II.
3. S. Narayanan and T.K. Manicavachogam Pillay, Calculus (I & II). Chennai, India: S. Viswanathan Pvt. Ltd., 1996.
4. Joseph Edwards, An elementary treatise on the differential calculus: with applications and numerous examples, Reprint. Charleston, USA: BiblioBazaar, 2010.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0101	**CO1**	3	2	2						3	2
	CO2	2	2	2						3	2
	CO3	3	2	2						3	3
	CO4	3	2	2						3	2

Course code	Basic statistics and introduction to python programming	L	T	P	C
B21ST0101		**2**	**1**	**0**	**3**

Prerequisites:

Knowledge of basics mathematics, probability basics, graphs.

Course Objectives:

1. To impart the basic knowledge of collection, tabulation and presentation of data.
2. To explore the basics of Python software.
3. To learn to describe and analyze the univariate and bivariate data.
4. To understand the concepts of probability.

Course Outcomes:

The students should have developed a clear understanding of basic concepts of the topics and able to:

1. Tabulate the data and analyze them graphically.
2. Perform elementary statistical analysis using Python software.
3. Describe and analyze the univariate data.
4. Describe and analyze the bivariate data and to use various probability techniques in real life data.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2

B21ST0101	**CO1**	2	3	2	2	1	2	1	1	3	2
	CO2	2	3	2	3	1	2	1	1	2	3
	CO3	3	3	2	3	1	2	1	1	2	2
	CO4	2	2	2	3	2	2	1	1	2	2

Course Contents:

Unit-1: Introduction to statistics and condensation and presentation of data [12 Hrs]

Statistics: Meaning, importance, scope and limitations of Statistics. Concepts of statistical population and sample. Variable and attribute. Data: quantitative and qualitative, cross-sectional and time-series, discrete and continuous, primary and secondary data. Scales of measurement: nominal, ordinal, interval and ratio. Classification and tabulation-Definition, types, objectives, construction of statistical table. Frequency distribution: Basic concepts, definition and types. Graphical representation of data: Histogram, frequency polygon, frequency curve and ogives.

Unit-2:Introduction to python programming [12 Hrs]

Introduction, environmental setup, python fundamentals-character set, tokens-keywords, identifiers, literals or values, punctuators; basic syntax of python program, comments, variables and assignment, simple input and output. Basic operators-arithmetic, relational, identity, logical and bitwise operators; expressions, data types-numbers, strings, list, tuple, set and dictionary. Conditional statements-if, if..else, if..else if..else, nested if statements. Loops statements- for loop, while loop, nested loop; loop control statements-break, continue and pass. Functions-Define function , Calling function,pass by reference as value , function arguments , anonymous functions , return statements, Scope of variables - local & global. Modules and packages-Import statements, Locating modules - current directory , Pythonpath, Dir() function , global and location functions and reload () functions, Packages in Python. File manipulation-Files in Python- Reading keyboard input , input function, Opening and closing files . Syntax and list of modes, Files object attribute- open , close . Reading and writing files , file Position, Renaming and deleting files.Data analysis libraries-numPy, SciPy, Pandas, Matplotlib, seaborn,statsmodels. .

Unit-3: **Univariate data analysis: [12 Hrs]**

Measures of central tendency: Arithmetic mean, median, mode, geometric mean, harmonic mean-definition, properties, merits and demerits. Relationship between A.M, G.M, and H.M. Quantiles: quartiles, deciles, percentiles. Measures of dispersion: absolute and relative measures; range, quartile deviation, mean deviation, standard deviation and coefficient of variation-definition, properties, merits and demerits. Moments: raw and central moments and their relation. Skewness and kurtosis: definition, types and measures. Boxplot.

Unit-4: **Bivariate data analysis and basic probability [12 Hrs]**

Bivariate data analysis**:** Bivariate data, Scatter diagram, Correlation-simple, partial and multiple correlation, co-variance, Karl Pearson's correlation coefficient and its properties, co-efficient of determination. Spearman's rank correlation coefficient. Simple linear

regression, regression co-efficients and their properties, regression lines, concept of errors, principle of least squares and fitting of polynomials and exponential curves.

Basic probability: Random experiment, trial, sample point, sample space, events and algebra of events. Definitions of probability – classical, statistical, and axiomatic with their merits and demerits. Simple problems. Addition theorem of probability, conditional probability, independence of events, multiplication theorem - Bayes theorem and its applications.

Text books:

1. Goon, A.M., Gupta, M.K., and Das Gupta, B. (2017). *Fundamentals of Statistics, Vol. I*, World Press, Calcutta
2. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers*, Wiley India, New Delhi.
3. S.C Gupta and V.K Kapoor, Fundamentals of mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons, 2007.
4. Miller, Irwin and Miller, Marylees, John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia, 2006.
5. Freund, J.E. and Walpole, R.E. (1987). Mathematical Statistics, 4/e, Prentice Hall Inc., New Jersey, USA.
6. Eric Matthes.(2019) *Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming,* no starch press, San Francisco, U.S.A.
7. Wes McKinney.(2017) *Python for Data Analysis, 2e: Data Wrangling with Pandas, Numpy, and Ipython* , O'Reilly, California, U.S.A.

Reference Books:

1. Mood, A.M., Graybill, F.A., and Boes, D.C. (1974): *Introduction to the Theory of Statistics*, McGraw Hill, New York.
2. A.M Mood, F.A Graybill and D.C Boes, Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd
3. Snedecor, G.W. and Cochran, W.G. (1967). *Statistical Methods*, Iowa State University Press, USA.
4. Spiegel, M.R. (1967).*Theory and Problems of Statistics*, Schaum's Publishing Series, London.
5. Peter Bruce and Andrew Bruce.(2017) *Practical Statistics for Data Scientists***,** O'Reilly, California, U.S.A.John Wiley & Sons, Inc. 2001.
6. Charles Kittel & others, Berkeley Physics -Vol. 2, 2nd edition McGraw-Hill Education (India) 2011.

Course Code	Programming In C	Type	L	T	P	C	Hrs/Week
B21CP0101		HC	3	0	0	3	4

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0101	**CO1**	**3**	**3**	**3**	**3**					**3**	**3**
	CO2	**3**	**3**	**3**	**3**					**3**	**3**
	CO3	**3**	**3**	**3**	**2**					**3**	**3**
	CO4	**3**	**3**	**3**	**2**					**2**	**2**

Course Objectives:

The students should be made to:

- To develop enough familiarity with the specific environment.
- To develop an understanding of fundamental programming logic and programming techniques.
- To develop programming language of different numerical methods which are used to solve scientific and engineering problems.
- To emphasize on developing the students ability to analyze and solve problems by using high level programming language.

Course Outcomes:

At the end of the course, the student should be able to:

- To understand the Syntax and Structure of the C Programming.
- Design C Programs for Problems.
- Write and Execute C Programs for simple applications.

Course Content:

UNIT-1

Introduction to C **12Hrs**

Fundamentals in C, Programming Languages, Types of software's, Compilers, Operating Systems, Program execution phases, Character set , Number systems, Format specifiers, Identifiers, Keywords ,Variables, Data Types, Declaration of Variable , Assigning Values to Variables , Initialization, Constants, Comments, Basic Structure of a 'C' program , Header files, Pre Processor, Programming Examples, Arithmetic, Logical & Relational operator, Increment & Decrement operators, Conditional operator, Assignment operator, Unary, Binary, Bitwise, Ternary Operators, Expressions, Type conversions, Operator precedence, Basic Console I/O functions- Formatted Console I/O, Unformatted Console I/O.

UNIT-2

Control statements, Arrays and Pointers **12Hrs**

Conditional Branching if statement, if-else statement, Nested if statement, switch statement, Un-Conditional Branching, Looping: while loop, do-while loop, for loop, Break and continue statements. Introduction to Arrays, one dimensional arrays, Array Initialization, Array indexing, Reading and displaying elements, Two dimensional arrays, Programming Examples. Pointers: Declaration of Pointer Variables, Assigning Address to Pointer Variables, pointer to pointer, Programming Examples.

UNIT-3

Functions and Structures **12Hrs**

Functions: Advantages of using functions, Function Prototype, Defining a function, Calling a function, Return statement, Types of functions, Recursion, Nested functions, main ( ) function, Library Function, Local and global variables, Call by value and call by references, programming Examples. Structures: Definition, Declaration, Initialization of a Structure, Structure Variables, typedef statement, Programming Examples.

UNIT-4

Unions, Strings and Files **12Hrs**

Unions: Definition, Declaration, Initialization, Accessing union members. Strings: Definition, Declaring and Initializing String variables, Reading and Writing Strings, String manipulation functions, Array of Strings. The %s format specifier –The gets () and puts () functions. Files – declaration of file, File modes, opening and closing a file, reading, and writing a file. Programming examples & exercises.

TEXT BOOKS:

1. Anita Goel and Ajay Mittal," Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt Ltd, Pearson Education in South Asia, 2011.

2. YESHVANT KANETKAR "LetUs C" BPB Publications,2011.

3. E Balaguruswamy, "Computing Fundamentals & C Programming", McGraw Hill Education India.

REFERENCE BOOKS:

1. BYRON GOTTFRIED, Fourth Edition, "PROGRAMMING WITH C", SCHAUM'S OUTLINES.

2. Kernighan B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education,2006.

Course Code	Elementary Number Theory	Type	L	T	P	C	Hrs/Week
B21MTS111		SC	3	0	0	3	3

Course objectives:

This course aims to provide for the student

1. Concepts of divisibility, congruence, greatest common divisor and prime factorization.
2. The concept of congruence and use various results related to congruences.
3. Certain number theoretic functions and their properties.

Course Outcomes:

1. Define, interpret and apply the concepts and principles of number theory to perform numerical and symbolic computations.
2. Apply different types of proof writing techniques in number theory to related situations.
3. Develop an in-depth understanding of the principles of number theory.
4. Communicate the number theory concepts, techniques and principles effectively in both written and oral form.

Course Contents:

Unit-I:

Divisibility, Greatest common divisor, The Fundamental theorem of Arithmetic, Euclid's algorithm, prime numbers and Prime number theorem.

Unit-II:

Definition and basic properties of congruence, Residue and complete residue systems.

Unit-III:

Linear congruence's, The Euler-Fermats Theorem, Chinese remainder theorem and applications.

Unit-IV:

Arithmetic functions- Mobius function $\mu(n)$, Euler quotient function $\varphi(n)$, relation connecting μ and φ, Product formula for $\varphi(n)$ and properties of φ.

Suggested Text Books and References:

1. D. M. Burton – Elementary Number Theory, Tata McGraw-Hill, New Delhi, 6th Ed.,
2. Niven, H. S. Zuckerman and H. L. Montgomery – An Introduction to the Theory of Numbers, New York, John Wiley and Sons, Inc., 2004, 5th Ed.,
3. G. A. Jones and J. M. Jones – Elementary Number Theory, Springer,1998
4. T. M. Apostal – Mathematical Analysis, Addison Wesley, Narosa, New Delhi, 2nd Ed.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS111	**CO1**	3	3	2	1	1				3	2
	CO2	3	3	2	2	1				3	2
	CO3	3	3	2	2	1				3	2
	CO4	3	3	2	2	1				3	2

Course Code	Discrete Mathematics and Graph Theory	Type	L	T	P	C	Hrs/Week
B21MTS112		SC	3	0	0	3	3

Course objectives:

This course aims to provide for the student

1. To study the set theory, logic, Recurrence relations and functions and to know the application of Boolean Algebra to switching theory
2. To understand and apply the fundamental concepts in graph theory
3. To apply graph theory based tools in solving practical problems

Course Outcomes:

1. Apply operations on discrete structures such as sets, relations, functions and Recurrence relations.
2. Apply Boolean Algebra to switching theory and their minimization techniques and Phase structure grammars and languages, Finite state Machine, Recognition in regular languages.
3. Apply principles and concepts of graph theory in practical situations
4. Apply the theory and applications of graphs, fundamental theorems and their proofs and computer applications such as networks of communication, data organizations, computational devices, the flow of computation.

Course Contents:

Unit-I: Set Theory & Logic

Set theory fundamental operations; propositions; negation; disjunction and conjunction; implication and equivalence; truth tables; laws of Logic; predicates.

Unit-II: Logic & Relations

Quantifiers; rules of Inference; methods of proofs.

Relations; representation of relations by graphs; properties of relations; equivalence relations and partitions. Hasse diagrams.

Unit-III: Graph Theory -1

Konigsberg's Bridge problem, Utilities problem, Seating Problems, graphs, Representation of graphs, directed graphs, incidence, adjacency, degree, Indegree, out degree, regular graphs, complete graphs, Null graphs, Bipartite graphs, Isomorphism, directed graphs, sub graphs, Walk, Trail, Path, Cycle, Connected and Disconnected graphs, Components, Euler graphs, Operation on graphs Complement of Graph, Partition, Decomposition.

Unit-IV: Graph Theory -2 **9**

Hrs

Hamiltonian paths, Circuits, Planar graphs, Kuratowskiís graphs, Different representation of planar graphs, Geometric dual, Trees and some properties of trees, Rootedand binary tree, Spanning tree and fundamental circuits. Matrix representation, Incidence matrix, Cutset matrix, Circuit matrix, Adjacency matrix.

Suggested Text Books and References:

1. Elements of Discrete Mathematics 3rdedition by C.L. Liu, Tata Macgraw Hill Publishers (2008).
2. Discrete Mathematical Structures with Applications to Computer Science by J.P. Trembley and R. Manohar, TataMagrawHill Publishers
3. Kenneth H. Rosen, Discrete Mathematics and its Application, Fifth edition, Tata McGraw-Hill Publishing company PVT. Ltd., New Delhi, 2003.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS112	**CO1**	3	3	2	2	3				3	3
	CO2	3	2	3	2	2				2	3
	CO3	3	3	2	3	3				3	2
	CO4	3	3	3	2	2				3	3

Course Code	Fuzzy Mathematics	Type	L	T	P	C	Hrs/Week
B21MTS113		SC	3	0	0	3	3

Course objectives:

This course aims to provide for the student to

1. Study the fuzzy sets, basic operation on fuzzy sets and inverse fuzzy operations.
2. Study fuzzy subsets and its properties.
3. Read and analyze the concept of fuzzy rings.

Course Outcomes:

1. Analyse the concept of fuzzy set and fuzzy logic using fuzzy operations.
2. Apply the concept of fuzzy sum, fuzzy product and Cartesian product on real world problems.
3. Analyse the concept of algebra of fuzzy relations and logic connectives.
4. Analyse the concept of fuzzy invariant subgroups and fuzzy subrings.

Course Contents:

Unit-I:

Introduction- Fuzzy Subsets-Lattices and Boolean Algebras- L fuzzy sets-operations on fuzzy – level sets – properties of fuzzy subsets.

Unit-II:

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-cartesian product of fuzzy subsets.

Unit-III:

Introduction- Algebra of fuzzy relations-logic-connectives.

Unit-IV:

Some more connectives-Introduction-fuzzy subgroup-homomorphic image and Preimage of subgroupoid. Fuzzy invariant subgroups-fuzzy subrings.

Suggested Text Books and References:

1. S. Nanda and N. R. Das Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi, 2010.
2. M.Ganesh, Introduction to Fuzzy Sets & Fuzzy Logic, Prentice Hall of India Pvt. Ltd., 2006.
3. J.N. Mordeson and P.S. Nair, Fuzzy Mathematics.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7		PO8	PSO1	PSO2
B21MTS113	**CO1**	3	3	2	2						2	3
	CO2	3	2	2	3						3	2
	CO3	3	2	3	2						3	2
	CO4	3	3	3	2						3	3

Course Code	Constitution of India and Professional Ethics	Type	L	T	P	C	Hrs/Week
B21LSM101		FC	**0**	0	0	0	2

Course objectives:

This course aims to provide for the student

1. To impart knowledge on Constitution of India.
2. To facilitate the understanding of Fundamental Rights, Duties and other Rights which is been given by our law.
3. To facilitate the understanding of Constitution perspective and make them face the world as a bonafide citizen.
4. To attain knowledge about ethics and also know about professional ethics.
5. Explore ethical standards followed by different companies.

Course Outcomes:

1. Explain the Indian constitutional provisions and fololow them.
2. Demonstrate the fundamental rights and human rights.
3. Explain the duties and more importantly practice them 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 Contents:

Unit-I: Constitution of India **6 Hrs**

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

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

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-cartesian product of fuzzy subsets.

Unit-III: Judiciary **6 Hrs**

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

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

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

Suggested Text Books and References:

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

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21LSM101	**CO1**	3	3	2	2					2	3

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

Course Code	**Mathematics Practical-I**	**Type**	**L**	**T**	**P**	**C**	**Hrs/Week**
B21MT0102		HC	0	0	1.5	1.5	3

Course Objectives:

This course aims to provide for the student to

1. Practical introduction to understand the concepts of matrix and its applications in various fields.
2. Acquire skill in solving problems on partial derivatives using *Python*.
3. Gain proficiency in using *Python* to solve the problems of differential calculus.

Course Outcomes:

1. Demonstrate the use of *Python* to understand concepts in matrix theory.
2. Be familiar with the built-in functions to find derivatives of any order in differential calculus.
3. Acquire problem solving skills on partial derivatives.
4. Exhibit the use of *Python* to understand and interpret the concepts of reduction formula.

Course Contents:

List of Programmes

1. Introduction to Python: Basic syntax, variable types, basic operators, numbers, strings, lists, tuples, functions and input/output statements.
2. Some simple programs to understand the relational, conditional and logical operators.
   i) Compare two numbers (less than, greater than) using if statement
   ii) Sum of natural numbers using while loop
   iii) Finding the factors of a number using for loop.
   iv) To check the given number is prime or not (use if... else statement).
   v) Find the factorial of a number (use if...if...else). vi) Simple programs to illustrate logical operators (and, or, not)
3. Python commands to reduce given matrix to echelon form and normal form with examples.
4. Python program/command to establish the consistency or otherwise and solving system of linear equations.
5. Python command to find the nth derivatives.
6. Python program to find nth derivative with and without Leibnitz rule.
7. Obtaining partial derivative of some standard functions
8. Verification of Euler's theorem, its extension and Jacobean.
9. Python program for reduction formula with or without limits.
10. Plotting 2D and 3D graphs.

Suggested Text Books and References:

1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0102	**CO1**	3	2	2		1				3	3
	CO2	3	2	2		1				3	3
	CO3	2	2	2		1				3	2
	CO4	3	2	2		1				2	3

Course code	Basic statistics and introduction to python programming lab	L	T	P	C
B21ST0102		**0**	**0**	**1.5**	**1.5**

Prerequisites:

Knowledge of basics mathematics, probability basics, graphs.

Course Objectives:

1. To familiarize students with computational techniques and software used in the statistical arena
2. To have the basic knowledge of collection, tabulation and presentation of data.
3. To learn to do the univariate and bivariate data analysis.
4. To learn the probability theory and its applications.

Course Outcomes:

The students should have developed a practical knowledge of the topics and able to:

1. Tabulate the real life data and analyze them graphically.
2. Perform elementary statistical analysis of the real life data using Python software.
3. Describe and analyze the univariate real life data.
4. Describe and analyze the real life bivariate data and to use various probability techniques in real life data.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0102	**CO1**	2	3	2	2	1	2	1	1	3	2
	CO2	2	3	2	3	1	2	1	1	2	3
	CO3	3	3	2	3	1	2	1	1	2	2
	CO4	2	2	2	3	2	2	1	1	2	2

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. Construction of frequency distribution and graphical representation of data.
2. Measures of central tendency I (Mathematical averages).
3. Measures of central tendency II (Positional averages & Partition values).
4. Measures of dispersion I (Range, QD, MD,SD and CV).
5. Moments, skewness, and kurtosis for a frequency distribution.
6. Fitting of first, second, exponential and geometric curves.
7. Correlation and regression for ungrouped data and Spearman's rank correlation coefficient.
8. Correlation and regression for grouped data.
9. Computation of probabilities using combinatorial methods.
10. Application of addition rule, conditional probability, Baye's formula.

Text books:

1. Goon, A.M., Gupta, M.K., and Das Gupta, B. (2017). *Fundamentals of Statistics, Vol. I,* World Press, Calcutta
2. S.C Gupta and V.K Kapoor, Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons, 2007.
3. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers,* Wiley India, New Delhi.
4. W.J DeCoursey, Statistics and Probability for Engineering Applications, Elsevier Science (USA), 2009.
5. Miller, Irwin and Miller, Marylees, John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia, 2006.
6. Medhi, J. (1992).Statistical Methods*: An introductory Text,* New Age International, New Delhi.
7. Freund, J.E. and Walpole, R.E. (1987). Mathematical Statistics, 4/e,Prentice Hall Inc., New Jersey, USA.
8. Croxton, F.E, Cowden, D.J., and Klein, S. (1973). *Applied General Statistics*, 3/e, Prentice Hall Inc., New Jersey, USA.

Reference Books:

1. A.M Mood, F.A Graybill and D.C Boes, Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd
2. Snedecor, G.W. and Cochran, W.G. (1967). *Statistical Methods*, Iowa StateUniversity Press, USA.
3. Spiegel, M.R. (1967).*Theory and Problems of Statistics*, Schaum's PublishingSeries, London.

Course Code	C PROGRAMMING LAB	Type	L	T	P	C	Hrs/Week
B21CP0102		HC	0	0	1.5	1.5	3

Pre-requisites of C programming Lab:

1. Basic Computer Knowledge
2. Know syntax rules and coding style. ...

COURSE OUTCOME:

1. To recognize and understand the syntax and construction of C programming code.
2. To gain experience of procedural language programming.
3. To know the steps involved in compiling, linking and debugging C code.
4. To understand using header files
5. To learn the methods of iteration or looping and branching.
6. To make use of different data-structures like arrays, pointers, structures and files.

PART – A

1. Write a C Program to find area and circumference of circle.
2. Write a C program to display the size of every data type using "sizeof" operator.
3. Write a C Program to Make a Simple Calculator Using switch…case.
4. Write a C program to add two numbers using Call by value.
5. Write a C program to find the Fibonacci series using recursion.
6. Write a C program to find number of occurrences of vowels, Consonants, word, space and the special characters in the given statement.
7. Write a C program to read and print the student information using structure.
8. Write a C Program to open, read and close the File.

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).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0102	CO1	2			3		2	2	2	2	2
	CO2	3	2		3		2	1	3	3	3
	CO3	3	3	3	3			2	2	3	2
	CO4	3	3	2	2		2	2	3	3	2

SECOND SEMESTER

Course Code	Language – II: Kannada-II	Type	L	T	P	C	Hrs/Week
B21AHK201		CC	2	0	0	2	3

Course Objectives:

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

1. ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಇತಿಹಾಸ ಮತ್ತು ಸಂಸ್ಕೃತಿಗಳನ್ನು ಕನ್ನಡ, ಕರ್ನಾಟಕಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪರಿಚಯಿಸಲಾಗುತ್ತದೆ.

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

Course Outcomes:

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

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

Course Contents:

Unit-I: ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ **9 Hrs**

1. ಚಂದ್ರಮತಿ ವಿಲಾಪ – ರಾಘವಾಂಕ
2. ಹಗೆಗಳನು ಹಿಂಡಿದನು ಮನದೊಳಗೆ – ಕುಮಾರವ್ಯಾಸ
3. ಗೋರಕ್ಷ ಪ್ರಸಂಗ – ಚಾಮರಸ

Unit-II: ಮಧ್ಯಕಾಲೀನ ಕಾವ್ಯ **9 Hrs**

1. ತ್ರಿಪದಿಗಳು – ಸರ್ವಜ್ಞ
2. ಗಿಳಿಯು ಪಂಜರದೊಳಿಲ್ಲ – ಪುರಂದರ ದಾಸರು
3. ಕರೆದು ಕೊಟ್ಟನು ಶಾಪವನು – ಕನಕದಾಸರು

Unit-III: ಲೇಖನಗಳು **9 Hrs**

1. ರಾಮ–ಕೃಷ್ಣ–ಶಿವ – ಲೋಹಿಯಾರ
2. ಮಾನವೀಯತೆ ಅಂತಾರಲ್ಲಾ – ದೇವನೂರು ಮಹಾದೇವ
3. ಭೂತಾಯಿ ಮುನಿದಾಳು – ಮುರಾರಿ ಬಲ್ಲಾಳ

Unit-IV: ಪ್ರವಾಸ ಕಥನ **9 Hrs**

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. 2013

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHK201	**CO1**	2			3	2	3				
	CO2	3	2		3	2	3				
	CO3	3	3	3	3		3				
	CO4	3	3	2	2			3	2		

Course Code	Language-II: Hindi-II	Type	L	T	P	C	Hrs/Week
B21AHH201		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the students to

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 पद्धतियाँ एवं विचारधाराओं का व्याख्यान करने में सक्षम बन सकता है।
4. साहित्य के माध्यम से प्रभावी एवं कुशल संचार का विकास कर सकता है।

Course Contents:

इकाई – 1: कविता: प्राचीन एवं आधुनिक **9 hrs.**

कबीर के दोहे

कविता –जलियाँवाला बाग में बसंत- सुभद्राकुमारी चौहान

कविता – सुभाष की मृत्यु पर - धर्मवीर भारती

इकाई – 2: कविता: प्राचीन एवं आधुनिक **9 hrs.**

तुलसीदस के पद

कविता – पाषाणी – नागार्जुन

कविता –चलना हमारा काम है।- शिवमंगल सिंह सुमन

इकाई – 3: कविता: प्राचीन एवं आधुनिक **9 hrs.**

मीराबाई के पद

कविता – मेरे सपने बहुत नहीं हैं- गिरिराज कुमार माथुर

कविता – अभी न होगा मेरा अंत – निराला

इकाई – 4: अनुवाद, निबंध 9 **hrs.**

अनुवाद : शब्द एवं अनुच्छेद (हिन्दी से अंग्रेज़ी)

सूचना: प्रत्येक इकाई 25 अंक के लिए निर्धारित है |

Text book

1. हिन्दी पाठ्य पुस्तक – रेवा विश्वविद्यालय |

References

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHH201	CO1	2	3	3	3	2	3	2			
	CO2	3	2		3	2	2	3			
	CO3	3	3	3	3	3	3	3			
	CO4	3	3	2	2	3	2	3			

Course Code	Language-II: Additional English-II	Type	L	T	P	C	Hrs/Week
B21AHA201		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the students

1. To assess ecological and environmental concerns through literature.
2. To identify the inequal structures of power in society.
3. To compare and relate 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. Criticize the subordinate position of women in society.
4. Justify the depiction of society in popular culture.

Course Contents:

Unit – I: Ecology & Environment **9 Hrs**

Literature: Toru Dutt - Casuarina Tree**;** Gordon J.L. Ramen – Daffodils No More; C.V. Raman – Water – The Elixir of Life; **Language:** Degrees of Comparison

Unit – II: Voices from the Margin **9 Hrs**

Literature: Tadeusz Rozewicz – Pigtail**;** Jyoti Lanjewar – Mother**;** Harriet Jacobs – Excerpt from *Incidents in the Life of a Slave Girl***; Language:** Prefix and Suffix

Unit – III: Women & Society **9 Hrs**

Literature: Kamala Das – An Introduction**;** Rabindranath Tagore – The Exercise Book**;** Jamaica Kincaid – Girl**; Writing Skills:** Dialogue Writing

Unit – IV: Popular Culture **9 Hrs**

Literature: Rudyard Kipling – The Absent-minded Beggar; Sir Arthur Conan Doyle – The Adventure of Lion's Mane; 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. Ram*an. 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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHA201	**CO1**					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Communicative English-II	Type	L	T	P	C	Hrs/Week
B21AHE201		CC	2	0	0	2	3

Course Objectives:

This course aims to provide for the students

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.

Course Contents:

UNIT –I: Language Acquisition **9 Hrs**

Remedial Grammar: Questions & Negatives; Questions Tags**; Writing Skills:** Email Writing**; Activities:** Group Discussions**; Literature:** Alphonse Daudet - The Last Lesson.

UNIT – II: Persuasive Skills **9 Hrs**

Remedial Grammar: Past Simple & Past Perfect; **Writing Skills:** Report Writing**; Activities:** Book & Movie Reviews; **Literature:** Lord Alfred Tennyson – Ulysses.

UNIT – III: Cognitive Skills **9 Hrs**

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 **9 Hrs**

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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHE201	CO1					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Mathematics-II	Type	L	T	P	C	Hrs/Week
B21MT0201		HC	3	0	0	3	4

Course Objectives:

This course aims to provide for the students to

1. Make the students to learn fundamental concepts of groups.
2. Make the students to develop the knowledge of differential calculus in polar coordinates.
3. Solve differential equations.

Course Outcomes:

1. Explain the classification of finitely generated abelian groups and subgroups.
2. Understand the concept of normal groups and quotient groups.
3. Interpret and apply polar coordinates to solve the problems.
4. Identify and solve the linear differential equations.

Course Contents:

Unit-I: Group Theory-I **12 Hrs**

Definition and examples of groups – Some general properties of Groups, subgroups, Group of permutations – Cyclic permutations – Even and odd permutations. Order of an element of a group – Subgroups – Cyclic groups problems and theorems. Cosets, Index of a group, Lagrange's theorem, consequences.

Unit-II: Group theory-II **12 Hrs**

Normal Subgroups, Quotient groups – Homomorphism. – Kernel of homomorphism – Isomorphism - Automorphism – Fundamental theorem of homomorphism.

Unit-III: Differential Calculus **12 Hrs**

Polar coordinates – angle between the radius vector and the tangent at a point on a curve– angle of intersection between two curves – Pedal equations– Derivative of arc length in Cartesian, Parametric and Polar form (without proof). Curvature of plane curves - formula for radius of curvature in Cartesian, parametric, polar and pedal forms, (Centre of curvature - evolutes. Singular points – Asymptotes –Envelopes- Illustrative examples only).

Unit-IV: **12 Hrs**

Differential equations of first order and first degree- Exact differential equations, reducible to exact, (close to M and N)

Linear Differential equations: Definitions, complete solution, rules for finding complementary functions, inverse operator, rules for finding particular integral. Method of variation of parameter. Cauchy's and Legendre linear equation.

Text Books:

1. Vashista, A First Course in Modern Algebra, 11th ed.: Krishna PrakasanMandir, 1980.
2. Shanthi Narayan and P.K. Mittal, Differential Calculus, Reprint. New Delhi: SChand and Co. Pvt. Ltd., 2014.

3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S Chand and Co. Pvt. Ltd., 2014.

Reference Books:

1. I.N. Herstien – Topics in Algebra.
2. Joseph Gallian – Contemporary Abstract Algebra, Narosa Publishing House, New Delhi, Fourth Edition.
3. J.B. Fraleigh – A first course in Abstract Algebra.
4. M.D. Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt.Ltd., 2013.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0201	**CO1**	3	2	2						3	2
	CO2	2	2	2						3	3
	CO3	3	2	2						3	3
	CO4	3	2	2						3	2

Couse code	Random variable, probability distributions and limit theorems	L	T	P	C
B21ST0201		**3**	**0**	**0**	**3**

Prerequisites:

Knowledge of basics statistics-I, basics mathematics, differentiation, and integration.

Course Objectives:

1. To introduce the concepts of random variable and probability distribution
2. To know the difference between discrete and continuous random variables
3. To know how to compute expectation, variance and m.g.f. for random variables
4. To know how to compute probabilities for discrete and continuous distributions
5. To understand the importance of normal distribution, Chebyschev's inequality and central limit theorem.

Course Outcomes:

The students should be able to:

1. Understand the concepts of random variable along with their characteristics.
2. Comprehend the most common discrete probability distributions and their real life applications
3. Understand the most common continuous probability distributions and their real life applications
4. Acquire the knowledge of bivariate random variables and limit theorems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0201	CO1	2	3	2	3	1	2	1	1	3	2
	CO2	3	3	2	3	1	2	1	1	3	3
	CO3	2	3	2	2	1	2	1	1	3	3
	CO4	3	2	2	1	1	1			3	2

Course Contents:

Unit-1: **Univariate Random variable [12 Hrs]**

Random variable: concept and definition, discrete and continuous random variables, p.m.f, p.d.f –definition, properties and illustrations, distribution function-definition, properties and illustrations, expectation-definition, mean, variance,s.d,Properties and illustrations, Cauchy-Schwartz inequality, moments, m.g.f.-definition, properties and applications. Transformation of random variables-definition and illustrations.

Unit-2: Discrete probability distributions [12 Hrs]

Degenerate distribution, discrete uniform, Bernoulli, Binomial, Poisson, geometric, negative binomial, and hyper geometric distributions – definition, properties, mean, variance, moments, and m.g.f. Illustration of real life situations and approximation/limiting cases of these distributions.

Unit-3: Continuous probability distributions [12 Hrs]

Continuous uniform(rectangular), exponential, normal, gamma, beta, and Cauchy distributions – definition, properties, mean, variance, moments and m.g.f. Illustration of real life situations of these distributions, normal approximation of binomial and Poisson distributions.

Unit-4:Bivariate random variables and limit theorems [12 Hrs]

Bivariate random variables: definition of discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f and c.d.f with their definition and properties, independence of random variables, theorems on sum and product of expectations of random variables, conditional expectation, conditional variance, covariance-definition and properties, correlation coefficient. Mean and variance of linear combination of random variables, m.g.f of sum of independent random variables.

Limit theorems: Markov's inequality-statement, Chebyshev's inequality – proof and its applications. Convergence of binomial, Poisson, gamma distributions to normal distribution using m.g.f. Statement of central limit theorem and its applications.

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers and Scientists*, 9/e, Pearson, New Delhi.
2. Mukhopadhyay, P.(2015): *Mathematical Statistics*, Books and Allied Pvt Ltd., Kolkata.
3. V.K Rohatgi and A.K Saleh Md. E. An Introduction to Probability and Statistics, 2nd Edn. (Reprint). John Wiley and Sons, 2009.
4. Goon A.M., Gupta, M.K., Das Gupta, B. (1991).*Fundamentals of Statistics*,Vol.I, World Press, Calcutta
5. Gupta S.C. and Kapoor V.K.(2007) *Fundamentals of Mathematical Statistics, 11th Edn*., (Reprint), Sultan Chand and Sons.
6. Miller, Irwin and Miller, Marylees, John E. Freund' (2006) *Mathematical Statistics with Applications*, (7th Edn.), Pearson Education, Asia.
7. Spiegel, M.R. (2001).*Probability and Statistics*, 4/e, Schaum's Outline Series, McGraw Hill, London.
8. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics*, 5/e, Prentice Hall, New Jersey, USA.
9. Medhi, J. (1992).*Statistical Methods: An introductory text*, New Age International, New Delhi.

Reference Books:

1. Bhattacharya, G. K. and Johnson, R.A. (1986): Statistical Concepts and Methods, John Wiley, New York.
2. Dudewicz, E.J. and Mishra, S.N.(1980). *Modern Mathematical Statistics*, John Wiley, New York.
3. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers*, Wiley.India, New Delhi.
4. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). *An Introduction to Probability Theory and Mathematical Statistics*, 3/e, John Wiley, New York.
5. Ross, S.M (2003).*Introduction to Probability Models*, 10/e, Academic Press, UK.

Course Code	Programming in Python	Type	L	T	P	C	Hrs/Week
B2CP0201		HC	3	0	0	3	4

Course Objectives:

1. To know the basics of algorithmic problem solving to do input/output with files in Python
2. To use Python data structures –- lists, tuples, dictionaries.
3. To develop Python programs with conditionals and loops.
4. To read and write simple Python programs using files.

Course Outcomes:

After completion of the course the student shall be able to:

1. Develop algorithmic solutions to simple computational problems, simple Python programs for solving problems.
2. Read, write & execute simple Python programs.
3. Read and write data from/to files in Python Programs.
4. Represent compound data using Python lists, tuples, and dictionaries.
5. Decompose a Python program into functions.

6. Learn the object-oriented concepts.

Course Content:

UNIT- I **12 Hrs**

Introduction to Python, Installing Python, Expression and values, Variable, Keywords, Basic operators. Conditional Statements, Looping, Control statements, Arrays

UNIT II **12 Hrs**

Strings and Functions: A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, String Methods, in Operator, String Operations. Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Directories Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT III **12 Hrs**

List: Values and Accessing Elements, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, Built-in List functions and methods. Dictionaries: Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods. Tuples: Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions. Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions Regular

UNIT IV **12 Hrs**

Files: Text Files, The File Object Attributes, Classes and Objects: Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding.

Text Books:

1. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education, 2016
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2015
3. Downey, A. et al., "How to think like a Computer Scientist: Learning with Python", John Wiley, 2015

Reference Books:

1. Mark Lutz, "Learning Python", 5th edition, Orelly Publication, 2013,
2. John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013,
3. Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013,

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2

B2CP0202	**CO1**	3	3	2	3			2	1	2	2
	CO2	3	3	3	2			1	2	2	3
	CO3	3	2	2	2			2	1	2	3
	CO4	3	2	1	2			2	3	3	3

Course code	**Applied Statistics**	**L**	**T**	**P**	**C**
B21STS211		**3**	**0**	**0**	**3**

Prerequisites:

Knowledge of basic mathematics and basic statistics, knowledge of linear algebra, basics of probability and probability distributions

Course Objectives:

1. To study the demographic data with its sources and measures.
2. To learn the fundamentals of index numbers and their types along with their construction.
3. To understand time series data, components of time series and their measurements.
4. To know about official statistical system in India and functions of different agencies.

Course Outcomes:

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

1. Demonstrate demographic analysis of real life data.
2. Understand the fundamentals of index numbers and able to construct index numbers for real life data.
3. Perform basic analysis of time series data
4. Understand the present official statistical system in India and the functions of C.S.O. and N.S.S.O..

Mapping of Course Outcomes with programme Outcomes

Course Code	**POs/ COs**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
B21STS211	**CO1**	**2**	**3**	**3**	**2**	**0**	**0**	**2**	**1**	**3**	**0**
	CO2	**3**	**3**	**2**	**3**	**0**	**0**	**2**	**3**	**3**	**2**
	CO3	**2**	**3**	**2**	**3**	**0**	**0**	**1**	**3**	**0**	**3**
	CO4	**2**	**3**	**3**	**2**	**0**	**0**	**2**	**3**	**0**	**1**

Course Contents:

Unit 1: Vital Statistics
[12 hrs]

Demographic Methods: Introduction, measurement of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates-problems Life (mortality) tables: definition of its main functions and uses. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR-problems.

Unit 2: Index numbers
[12 hrs]

Introduction, Price, Quantity and Value indices. Price Index numbers: Construction, Uses, Limitations, Tests for index numbers, various formulae and their comparisons, Chain-Index Numbers. Some Important Indices: Consumer Price Index, Wholesale Price Index and Index of Industrial Production – formulae and uses-problems.

Unit3: Time series analysis
[12 hrs]

Components of time series. Decomposition of time series- additive and multiplicative model with their merits and demerits, illustrations of time series. Measurements of trend by moving averages and by least squares. Construction of seasonal indices by simple averages and ratio to moving averages-problems.

Unit4: Official Statistics and national income [12 hrs]

An outline of present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), Registered General Office and National Statistical Commission. Government of India's Principal publications containing data on the topics such as Agriculture, price, population, industry, finance and employment, Consumer price Index, Wholesale price index number and index of industrial production.

National Income: Basic idea and a brief description of income, expenditure and production approaches.

Text Books:

1. Goon A.M., Gupta, M.K., Das Gupta, B. (1991). *Fundamentals of Statistics*, Vol. II, World Press, Calcutta.
2. Gupta S.C., V.K. Kapoor.(2014) *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi, India.
3. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers,* Wiley India, New Delhi.
4. Saluja, M. R. (1972). Indian Official Statistical Systems, Statistical Publishing Society, Calcutta

References:

1. CSO (1980). *National Accounts Statistics* - Sources and Health, Govt. of India, New Delhi.
2. UNESCO: Principles for Vital Statistics Systems. Series M -12.
3. Sen, A. (1997). Poverty and Inequality, Stanford University Press, USA.
4. Mukhopadhyay, P. (2015). *Applied Statistics,* Books and Allied Pvt Ltd., Kolkata.

Course code	Statistical Quality Control	L	T	P	C
B21STS212		3	0	0	3

Prerequisites:

Knowledge of summarizing and descriptive statistics, plotting graph.

Course Objectives:

1. To learn the basic concepts of Statistical Quality Control and it's need.
2. To familiarize with techniques and approach of SQC being used in industry to manufacture goods and services of high quality at low cost.

Course Outcomes:

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

1. Understand the basic concepts of Statistical Quality Control and it's need
2. Explore various Control charts for variables.
3. Apply different control charts for attributes to real life data
4. Describe acceptance sampling technique.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21STS212	CO1	2	3	3	2	0	0	1	0	3	0
	CO2	3	3	2	3	0	0	1	2	3	1
	CO3	2	3	2	3	0	0	1	2	3	2
	CO4	2	3	2	3	0	0	1	2	0	3

Course Contents:

Unit 1 **[12 hrs]**

***Basics of SQC*:** Introduction to statistical quality control (SQC), aims and objectives. Chance and assignable causes of variation. Process control and product control. Control charts and basis for their construction. Action and warning limits. Various tools of SPC. Rational subgroups.

Unit 2

[12 hrs]

Control charts for variables: Derivation of control limits, basis, construction and interpretation of mean, range and standard deviation charts. Criteria for detecting lack of control.

Unit 3

[12 hrs]

Control charts for attributes: np-chart, p-chart, stabilized p-chart, c-chart and u-chart. Criteria for detecting lack of control. Comparison between control charts for variables and control charts for attributes. Analysis of patterns on control chart, Estimation of process capability.

Unit 4

[12 hrs]

Product control: Lot acceptance sampling- Sampling inspection, 100 percent inspection and rectifying inspection. AQL, LTPD, Producer's risk and consumer's risk. Acceptance sampling plans – single and double sampling plans by attributes- Derivation of OC, AOQ, ASN, and ATI, functions.

Text Books:

1. Goon A.M., Gupta, M.K., Das Gupta, B. (1991).*Fundamentals of Statistics*,Vol.I, World Press, Calcutta.
2. Gupta S.C., V.K. Kapoor.(2014) *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi, India.
3. Grant, E.L. and Leavenworth, R. S. (1996). *Statistical Quality Control*. 7th edition, McGrawHill, New York.
4. Mahajan, M. (2001).*Statistical Quality Control*, Dhanpat Rai & Co. (P) Ltd. New Delhi.
5. Montgomery, D.C. (2013). *Introduction to Statistical Quality Control*, (Wiley Int. Edn.)

References:

1. John, S.O. and Followell, R. F. (1990). Statistical Process Control. (East West Press, India.
2. Mukhopadhyay, P (1996). Applied Statistics. Calcutta Publishing House.
3. Mukhopadhyay, P. (2015): *Mathematical Statistics*, Books and Allied (P) Ltd., Kolkata.

Course Code	Environmental Studies	Type	L	T	P	C	Hrs/Week
B21ASM201		HC	0	0	0	0	2

Course Objectives:

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

Course Outcomes:

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

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

Course Contents:

Unit-I **6 Hrs**

Multidisciplinary Nature of Environmental Studies: Introduction to environment, objectives and guiding principles of environmental education, components of environment, structure of atmosphere, sustainable environment/development. Impact of technology on the environment in terms of modern agricultural practices and industrialization. Environmental Impact Assessment.

Environmental protection – Role of government-assignments of MOEF, functions of central and state boards, Institutions in environment and people in environment. Initiative and role of non-government organizations in India and world.

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

Unit-II **6 Hrs**

Environmental pollution, Degradation & Waste management:

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

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

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

Solid Waste Management – Municipal solid waste, Biomedical waste, Industrial solid waste and electronic waste (E-Waste).

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

Unit-III **6 Hrs**

Energy & Natural resources:

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

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

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

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

Unit-IV **6 Hrs**

Ecology and ecosystem:

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

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

Reference Books

1. R.J. Ranjit Daniels and J. Krishnaswamy, Environmental Studies, by (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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ASM201	**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	Mathematics Practical-II	Type	L	T	P	C	Hrs/Week
B21MT0202		HC	0	0	1.5	1.5	3

Course Objectives:

1. Obtain skill in creating simple programs using *Python*.
2. Gain proficiency in using *Python* to solve problems on Group Theory.

Course Outcomes:

1. Acquire proficiency in using *Python* to find identity and inverse element of a group and in construction of Caley –Table.
2. Demonstrate the use of *Python* to understand and interpret the various types of functions from the algebraic and graphical points of view.
3. Sketch graphs of standard curves using *Maxima* to interpret tracing of curves.
4. Be familiar with the built-in functions to solve linear differential equations.

Course Contents:

1. Verifying whether given operator is binary or not.
2. To find identity and inverse element of a group.
3. Verification of normality of a given subgroup.
4. Illustrating homomorphism and isomorphism of groups.
5. Examples for finding right and left coset and the index of a group.
6. Examples to verify Lagrange's theorem.
7. Plotting of standard Cartesian curves.
8. Plotting of standard Cartesian curves.
9. Plotting of standard polar curves.
10. Plotting of standard parametric curves.
11. Solution of second and higher order ordinary differential equations with constant coefficients.
12. Solution of second order ordinary differential equations with variable coefficients
    i) Method of variation of parameters
    ii) When the equation is exact

Suggested Text Books and References:

1.SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).

2.The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0202	**CO1**	3	2	2				1	1	3	3
	CO2	3	2	2	1			1	1	3	3
	CO3	2	2	2	1			1	1	3	3
	CO4	3	2	2				1	1	3	3

Course code	Random variable, probability distributionsand limit theorems lab	L	T	P	C
B21ST0202		**0**	**0**	**1.5**	**1.5**

Prerequisites:

Knowledge of basics statistics-I, basics mathematics, differentiation, and integration.

Course Objectives:

1. To introduce the concepts of random variable and probability distribution
2. To know the difference between discrete and continuous random variables
3. To know how to compute expectation, variance and m.g.f. for random variables
4. To know how to compute probabilities for discrete and continuous distributions

5. To understand the importance of normal distribution, Chebyschevs inequality and central limit theorem.

Course Outcomes:

The student will be able to

1. Describe the univariate random variables
2. Apply various discrete probability distributions to real life problems
3. Demonstrate the ability to use the skills to apply continuous probability distributions to real life problems
4. Investigate the applications of limit theorems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0202	CO1	2	3	2	3	1	2	1	1	3	2
	CO2	3	3	2	3	1	2	1	1	3	3
	CO3	2	3	2	2	1	2	1	1	3	3
	CO4	3	2	2	1	1	1			3	2

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. Problems based on univariate probability distribution.
2. Application problems of binomial distribution and its fitting.
3. Application problems of Poisson distribution and its fitting.
4. Application problems of discrete uniform distribution and negative binomial distributions.
5. Application problems of geometric and hyper geometric distributions.
6. Application problems of normal distribution.
7. Problems based on fitting normal distribution.
8. Application problems of rectangular and exponential distributions.
9. Problems based on bivariate probability distribution.
10. Application problems of Chebyshev's inequality and central limit theorem.

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers and scientists,* 9/e, Pearson, New Delhi.
2. Goon A.M., Gupta, M.K., Das Gupta, B. (1991).*Fundamentals of Statistics,*Vol.I, World Press, Calcutta
3. Mukhopadhyay, P.(2015): *Mathematical Statistics,* Books and Allied Pvt Ltd., Kolkata.
4. V.K Rohatgi and A.K Saleh Md. E. An Introduction to Probability and Statistics, 2nd Edn. (Reprint). John Wiley and Sons, 2009.
5. Miller, Irwin and Miller, Marylees, John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia, 2006.
6. Gupta S.C. and Kapoor V.K.(2007) *Fundamentals of Mathematical Statistics, 11th Edn.*, (Reprint), Sultan Chand and Sons, New Delhi.
7. Spiegel, M.R. (2001).*Probability and Statistics*, 4/e, Schaum's Outline Series, McGraw

Hill, London.
8. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics,* 5/e, Prentice Hall, New Jersey, USA.
9. Medhi, J. (1992).*Statistical Methods: An introductory text,* New Age International, New Delhi.

Reference Books:

1. Bhattacharya, G. K. and Johnson, R.A. (1986): Statistical Concepts and Methods, John Wiley, New York.
2. Dudewicz, E.J. and Mishra, S.N.(1980). *Modern Mathematical Statistics,* John Wiley, New York.
3. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers,* Wiley
4. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). *An Introduction to Probability Theory and Mathematical Statistics,* 3/e, John Wiley, New York.
5. Ross, S.M (2003).*Introduction to Probability Models,* 10/e, Academic Press, UK.

Course Code	Programming in Python - LAB	Type	L	T	P	C	Hrs/Week
B21CP0202		HC	0	0	1.5	1.5	3

Course Objectives:

1. Basic programming knowledge.
2. Minimum knowledge of installing softwares.

Course Outcomes:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using python lists, Dictionaries.
5. To Write programs on files to read data from files.

Course Contents:

PART A

1. Write a python program to demonstrate basic data type in python.
2. Write a python program to find factorial of a number.
3. Write a python program to check whether the number is prime or not.
4. Write a python program to find the largest number in each array.
5. Write a Python program to swap first and last element of the list.
6. Write a Python program to check if a string is palindrome or not.
7. Write a python program to sort list of dictionaries by values– Using itemgetter.
8. Write a Python program to read file word by word.

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).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0202	**CO1**	2	2	3	2	1		2	2	1	3
	CO2	3	3	3	3	1		2	3	2	2
	CO3	3	2	2	3			2	2	3	2
	CO4	2	3	2	2	1		2	3	2	2

THIRD-SEMESTER

Course Code	Language – II: Kannada-III	Type	L	T	P	C	Hrs/Week
B21AHK301		CC	2	0	0	2	3

Course Objectives:

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

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

Course Outcomes:

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

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

2.ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.

3.ಸಾಮಾಜಿಕ ಅರಿವು ಮೂಡಿಸುತ್ತದೆ

4.ಉತ್ತಮ ಸಂವಹನ ಕಲೆಯನ್ನು ಬೆಳೆಸುವ ಉದ್ದೇಶವನ್ನು ಈಡೇರಿಸುತ್ತದೆ.

Course Contents:

Unit I **ನವೋದಯ ಕವಿತೆಗಳು** **9 Hrs**

1. ಮುದಿಯ ರಾಮಗೌಡ ಬಿ. ಎಂ. ಶ್ರೀ
2. ಬೆಳಗು ದ.ರಾ. ಬೇಂದ್ರೆ
3. ಕಲ್ಕಿ ಕುವೆಂಪು
4. ಕನ್ನಡ್ ಪದಗೊಳ್ ಜಿ. ಪಿ. ರಾಜರತ್ನಂ

Unit II **ನವೋದಯ ಹಾಗು ನವ್ಯ ಕವಿತೆಗಳು** **9 Hrs**

1. ಅವಧೂತ ಸು.ರಂ.ಎಕ್ಕುಂಡಿ
2. ಮನೆಯಿಂದ ಮನೆಗೆ ಕೆ.ಎಸ್.ನ
3. ನನ್ನ ಹಣತೆ ಜಿ.ಎಸ್.ಎಸ್.
4. ನಂಬಿಕೆ ಚನ್ನವೀರ ಕಣವಿ

Unit III **ಸಣ್ಣ ಕಥೆಗಳು** **9 Hrs**

1. ಮುದ್ದಣ ಮನೋರಮೆ ಸಲ್ಲಾಪ ಮುದ್ದಣ
2. ದಾಳಿ ನಡೆದಾವ ಅಣ್ಣಾ ಮರೇಶ ನುಗಡೋಣಿ
3. ಕೊನೆಯ ಗಿರಾಕಿ ನಿರಂಜನ
4. ಮಾನೀಟರ್ ತೇಜಸ್ವಿ

Unit IV **ನಾಟಕ** **9 Hrs**

ಮೀಡಿಯಾ ಅನುವಾದ.: ಕೆ. ಮರುಳ ಸಿದ್ಧಪ್ಪ

Suggested Text Books and References:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHK301	**CO1**					2	3				
	CO2					2	3				
	CO3						3				
	CO4							3	2		

Course Code	Language – II: Hindi-III	Type	L	T	P	C	Hrs/Week
B21AHH301		CC	2	0	0	2	3

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।

Course Contents:

इकाई – 1: नाटक **:** एक और द्रोणाचार्य – डॉ. शंकर शेष **9 hrs.**
लेखक परिचय
प्रथम दृश्य
द्वितीय दृश्य

इकाई – 2: नाटक **:** एक और द्रोणाचार्य **9 hrs.**
तृतीय दृश्य
चतुर्थ दृश्य

इका ई – 3: नाटक **:** एक और द्रोणाचार्य **9 hrs.**
पंचम दृश्य
छठा दृश्य

इकाई – 4: **9 hrs.**

अनुवाद : अंग्रेजी - हिन्दी-समाचार पत्र संबंध

सूचना: प्रत्येक इकाई 25 अंक के लिए निर्धारित है |

Text book/s: पाठ्य पुस्तक

1. एक और द्रोणाचार्य – डॉ. शंकर शेष

References: सन्दर्भ ग्रन्थ

1. एक और द्रोणाचार्य – डॉ. शंकर शेष
2. मीडिया लेखन एवं जनसंचार – डॉ.संजीव कुमार
3. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
4. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
5. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
6. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
7. कार्यालय अनुवाद निदेशिका
8. मीडिया विमर्श – रामशरण जोशी
9. संस्कृति, जनसंचार और बाजार – नन्द भरद्वाज

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHH301	**CO1**					2	3	2			
	CO2					2	2	3			
	CO3					3	3	3			
	CO4					3	2	3			

Course Code	Language-II: Additional English-III	Type	L	T	P	C	Hrs/Week
B21AHA301		CC	2	0	0	2	3

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.

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. Disprove the assumption of a privileged childhood.

Course Contents:

UNIT-I: Gender & Identity **9 hrs**

Anne Sexton – Consorting with Angels; Eugene Field – The Doll's Wooing; Vijay Dan Detha – Double Life; Charlotte Perkins Gilman – The Yellow Wallpaper.

UNIT-II: Love & Romance **9 hrs**

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 **9 hrs**

Lord Alfred Tennyson – The Charge of the Light Brigade; Taufiq Rafat – The Medal; Guy de Maupassant – Two Friends; Sadaat Hasan Manto – Toba Tek Singh.

UNIT-IV: Children's Literature **9 hrs**

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 &Saleem Kidwai (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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21SGA303	**CO1**					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Mathematics-III	Type	L	T	P	C	Hrs/Week
B21MT0301		HC	3	0	0	3	4

Course Objectives:

1. Apply and understand limit of a sequence.

2. Demonstrate the convergence or divergence of sequences and standard series.
3. Prove the tests for convergence: Comparison Test, Ratio Test, Cauchy's Root test, Raabe's Test, Alternating Series Test etc.
4. familiarize with vector calculus.
5. Formation and solving of a partial differential equation.

Course Outcomes:

1. Quote and understand the definition of a limit of a sequence or a function in its various forms
2. Demonstrate the convergence or divergence of the geometric and harmonic series and other standard series.
3. Interpret physically vector differentiation applied to both scalar and vector functions. Apply suitable method to solve partial differential equations and to solve non-linear partial differential equations.

Course Content:

Unit-I: G **12 Hrs**

Sequences and Series-I: Sequence of real numbers – Bounded and unbounded sequences – Limit of a sequence – Sum, product and quotient of limits – Standard theorems on limits – Convergent, divergent and oscillatory sequences – Standard properties – Monotonic sequences and their properties – Cauchy's general principle of convergence.

Unit-II: **12 Hrs**

Sequences and Series-II: Infinite series of real numbers – Convergence and Divergence - Properties of convergence – Series of positive terms – Geometric series – p – series – Comparison tests – D' Alembert's ratio test – Raabe's test – Cauchy's root test – alternating series Leibnitz's test.

Unit-III: **12 Hrs**

Vector Calculus: Scalar field – gradient of a scalar field, geometrical meaning – directional derivative – Maximum directional derivative – Angle between two surfaces - vector field – divergence and curl of a vector field – solenoidal and irrotational fields – scalar and vector potentials – Laplacian of a scalar field – vector identities. Standard properties, Harmonic functions, Problems.

Unit-IV: **12 Hrs**

Partial differential Equations: Formation of a partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations – Charpit's method.

Text Books:

1) S.C.Malik and Savita Arora, Mathematical Analysis, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992.
2) Shanthi Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: SChand and Co. Pvt. Ltd., 2014.
3) G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011
4) M D Raisinghania, Ordinary and Partial Differential Equations, S Chand and Co. Pvt. Ltd., 2014.
5) B.S Grewal – Higher engineering mathematics.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0301	CO1	3	3	3	3			1	3	3	3
	CO2	3	2	1	2			1	2	3	3
	CO3	3	2	2	2			1	2	3	3
	CO4	3	3	3	3			1	3	3	3

Course code	Sampling distributions, estimation theory and simulation	L	T	P	C
B21ST0301		2	1	0	3

Prerequisites:

Knowledge of basic statistics and probability distributions.

Course Objectives:

1. To understand the basic concepts of sampling distributions and their applications in statistical inference.
2. To acquire knowledge about location, scale, location-scale and single parameter families of distributions
3. To possess skills concerning estimation techniques such as point estimation and interval estimation.
4. To demonstrate the use of simulation techniques in statistics.

Course Outcomes:

The student will be able to

1. Understand the basic concepts of sampling distributions and their applications in statistical inference along with their characteristics.
2. Acquire knowledge about location, scale, location-scale, single parameter families of distributions and characteristics of a good estimator such as unbiasedness, consistency and efficiency.
3. Possess skills concerning sufficiency of an estimator and point estimation methods.
4. Recognize the importance of interval estimation and simulation techniques.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0301	CO1	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**
	CO2	**2**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**3**	**3**
	CO3	**2**	**3**	**3**	**2**	**1**	**2**	**1**	**1**	**3**	**2**
	CO4	3	3	3	3			1	3	3	3

Course Contents:

Unit-1: **Sampling distributions** **[12 Hrs]**

Concept and definition of population, sample, random sample, parameter and statistic, sampling distribution of a statistic, standard error of statistic, sampling distribution of sample mean and variance, standard errors of sample mean, sample variance and sample proportion. Chi-square, t, and F distributions –definition through p.d.f, mean variance, m.g.f, properties and applications. Relation among t, F and chi-square distributions.

Unit-2: Point estimation-I **[12 Hrs]**

Families of distributions - location and scale families. Single parameter exponential family. Point estimation. Concepts of estimator and estimate. Criteria for estimators: Unbiasedness, consistency, invariance property of consistent estimators. Efficiency and relative efficiency. Mean square error as a criterion for comparing estimators.

Unit-3: Point estimation-II **[12 Hrs]**

S ufficient statistic. Statement of Neyman - Factorization theorem. Fisher information function. Statement of Cramer - Rao inequality and its applications. Minimum variance unbiased estimator and minimum bound estimator**.**

Methods of point estimation**:** Maximum likelihood and method of moment estimation. Properties of maximum likelihood and moment estimators and examples

Unit-4: **Interval estimation and Simulation** **[12 Hrs]**

Interval estimation: Confidence interval, confidence coefficient, shortest confidence interval. Method of constructing confidence intervals using pivotal quantity. Construction of confidence intervals for mean, difference of two means, variance and ratio of variances, proportion, difference of two proportions, and correlation coefficient.

Simulation: Introduction to simulation. Monte Carlo method. Generation of random observations from uniform, exponential, normal, Cauchy, binomial and Poisson distributions. Simple illustrations.

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers and Scientists*, 9/e, Pearson, New Delhi.
2. Mukhopadhyay, P.(2015): *Mathematical Statistics,* Books and Allied (P) Ltd., Kolkata.
3. S.C Gupta and V.K Kapoor, Fundamentals of mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons, 2007.
4. Goon A.M., Gupta, M.K., Das Gupta, B. (2013).*Fundamentals of Statistics*,Vol.I, World Press, Calcutta.
5. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers*, WileyIndia, New Delhi.

6. Spiegel, M.R. (2001).*Probability and Statistics*, 4/e, Schaum's Outline Series, McGraw Hill, London.
7. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics,* 5/e, Prentice Hall, New Jersey, USA.
8. Medhi, J. (1992).Statistical Methods: An introductory text, New Age International, New Delhi.

Reference Books:

1. Ross, S.M (2003). *Introduction to Probability Models*, 10/e, Academic Press, UK.
2. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). *An Introduction to Probability and Statistics*, 2/e, John Wiley, New York.
3. Bhattacharya, G. K. and Johnson, R.A. (1986): *Statistical Concepts and Methods*, John Wiley, New York.
4. Casella, G. and Berger, R.L. (2007). *Statistical Inference*, Duxbury Press, Belmont, California, USA. (2nd Edition).
5. Dudewicz, E.J. and Mishra, S.N.(1980). *Modern Mathematical Statistics*, John Wiley, New York.

Course Code	Relational Data Base Management Systems	Type	L	T	P	C	Hrs/Week
B21CP0301		HC	3	0	0	3	4

Course Objectives:

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:

Upon successful completion of this course, students will be able to:

1. Describe the fundamental elements of relational database management systems
2. Explain the basic concepts of relational data model, entity-relationship model, relational Database design, relational algebra, and SQL.
3. Design ER-models to represent simple database application scenarios
4. Convert the ER-model to relational tables, populate relational database and formulate SQL Queries on data.
5. Improve the database design by normalization.

Course Contents:

UNIT – I: **12 Hrs**

BASIC CONCEPTS: Database Management System - Characteristics of the Database Approach - Different people behind DBMS- Advantages of DBMS over file based system - Three level architecture of DBMS or logical DBMS architecture - Physical DBMS Architecture

- Database Administrator (DBA) Functions & Role - Types of Database. The database system Environment, Classification of DBMS.

UNIT - II: **12 Hrs**

RELATIONAL, ER MODELS AND NORMALIZATION: Data Models - Relational Model – Domains - Tuple and Relation - Super keys - Candidate keys - Primary keys and foreign key for the Relations - Relational Constraints - Domain Constraint - Key Constraint - Integrity Constraint - Entity Relationship (ER) Model – Entities – Attributes – Relationships - Defining Relationship for College Database - E-R Diagram - Conversion of E-R Diagram to Relational Database. Functional Dependencies and Normalization for Relational Database: Informal Design Guidelines for Relational schemas, Functional Dependencies, First Normal Form, Second Normal form, Third Normal form, Boyce-Codd Normal Form**.**

UNIT - III: **12 Hrs**

RELATIONAL ALGEBRA OPERATIONS: Union, Intersection, Difference, Cartesian product, Selection, Projection, Join, Division, Additional Relational Operations.

STRUCTURES QUERY LANGUAGE (SQL): Meaning – SQL commands - Data Definition Language - Data Manipulation Language - Data Control Language - Transaction Control Language - Queries using Order by – Where –Group by-Nested Queries.

Aggregate functions in SQL.

UNIT – IV: **12 Hrs**

DISTRIBUTED AND CLIENT SERVER DATABASES: Need for Distributed Database Systems - Structure of Distributed Database - Advantages and Disadvantages of DDBMS - Advantages of Data Distribution - Disadvantages of Data Distribution - Data Replication - Data Fragmentation. Client Server Databases: Emergence of Client Server Architecture - Need for Client Server Computing - Structure of Client Server Systems & its advantages.

PL/SQL Introduction, Language fundamentals, conditional and sequential control, Iterative Processing and loops.

Text 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.

Reference Books

1) Database Management System: R.Ramakrishnan & J.Gehrke, McGraw Hill.

2) Modern Database Management: J.A.Hoffer,V.Rames &H.Topi, Pearson.

3) Database System Concepts: Silberschatz, Korth & Sudarshan, McGraw Hill.

4). Krishna P. Radha, Das Gupta Pranab Kumar, "Database Management System Oracle SQL and PL/SQL" Prentice-Hall of India Pvt. Ltd, 2013.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2

B21CP0301	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		3	3
	CO4	3	3	3	2	0	0	0	3	2	3

Course Code	Data Communication and Networks	Type	L	T	P	C	Hrs/Week
B21CPS311		SC	3	0	0	3	3

Course Objectives:

1. Outline the theory behind the basic design of networks and approaches to design networks.
2. Get the idea of representation of digital information and digital transmission and could able to understand and design reliable transmission.
3. Able to determine type of transmission and technology required for transmission.
4. Outline the theory behind the various protocol used in transmission and could design new protocols.

Course Outcomes:

1. Explain the basics of networking, Network Models.
2. Identify the data & signals, the channel rate and conversion techniques, the error detection and correction techniques.
3. Demonstrate handling of multiple channels and transmission.
4. Determine how to transmit data over the channels reliably.

Course Contents:

UNIT – I

INTRODUCTION: 12 Hrs

Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet. Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.

UNIT – II 12 Hrs

Physical layer: Analog and digital, Analog signals, Digital signals, Analog versus digital, Data rate limit, Transmission impairments, Line coding, Block coding, Sampling, Transmission mode, Modulation of digital data, Telephone modems, Modulation of analog signal, FDM, WDM, TDM, Guided media, Unguided media, Circuit switching, Telephone networks, DSL technology, Cable modem, SONET.

UNIT – III 12 Hrs

Data link layer: Types of errors, Detection, Error correction, Flow and error control, Stop and wait ARQ, go back n ARQ, Selective repeat ARQ, HDLC, Point to point protocol, PPP stack, Random access, Controlled access, Channelization, Traditional Ethernet, Fast Ethernet, Gigabit

Ethernet, IEEE802.11, Bluetooth, Connecting devices, Backbone network, Virtual LAN, Cellular telephony, Satellite networks.

UNIT – IV **12 Hrs**

Network layer: Internetworks, Addressing, Routing, ARP, IP, ICMP, IPV6.
Transport layer: User datagram protocol (UDP), Transmission control protocol (TCP).
Application layer: Name space, Domain name space, Distribution of name space, DNS in the internet, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Streaming stored audio/video, Streaming live audio/video, Real time interactive audio/video, Voice over IP.

Text Books:

1. Ferouzan, Behrouz A., Data Communications and Networking, TATA McGraw Hill (2002) 2nd ed.
2. Stallings William, Data and Computer Communication, Pearson Education (2000) 7th ed.

Reference Books:

1. Black, Ulylers D., Data Communication and Distributed Networks, PHI (1999) 3rded.
2. Tanenbaum, Andrew S., Computer Networks, PHI (2000) 2nd ed.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CPS311	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	Multimedia Computing	Type	L	T	P	C	Hrs/Week
B21CPS312		SC	3	0	0	3	3

Course Objectives:

1. To provide knowledge on different concept of multimedia
2. To understand the different data formats
3. To know the applications of multimedia in different fields

Course Outcomes:

1. Understand the concept of Multimedia Technology.
2. Learn the concepts of various digital media.

3. Know the fundamentals of data compression.
4. Understand the distributed multimedia system.

Course Contents:

UNIT-I

Introduction, Media, and Audio Technology **9 Hrs**

Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture, Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three-Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT-II

Graphics and Images, Video Technology, Computer-Based Animation **9 Hrs**

Capturing Graphics and Images Computer Assisted Graphics and Image Processing, Reconstructing Images, Graphics and Image Output Options. Basics, Television Systems, Digitalization of Video Signals, Digital Television; Basic Concepts, Specification of Animations, Methods of Controlling Animation, Display of Animation, Transmission of Animation, Virtual Reality Modelling Language.

UNIT III

Multimedia Data Compression **9 Hrs**

Types of compression Binary image compression colour, gray scale and still video image compression video image compression audio compression fractal compression. Data and file formats: RTF TIFF RIFF, MIDI, JPEG, AVI video file formats, MPEG standards.

UNIT IV **9 Hrs**

Multimedia Applications

Media Preparation and composition, Media integration and communication, Media Entertainment, Telemedicine, E-Learning, Digital Video editing and production system, Video Conferencing.

Text Books:

1. Ralf steinmetz, Klara Narstedt : Multimedia Fundamentals Volume 1: Media Coding and Content Processing, 2nd Edition, Pearson Education, 2003.
2. Brabhat K Andleigh, Kiran Thakrar : Multimedia System Design PHI 2003.

Reference Books:

1. K R Roa, Zoran S, Bojkovik and dragorad A: Multimedia communication systems: Techniques, standards, and networks. Pearson Edition 2002.

2. Nalin K sharid : Multimedia Information networking PHI, 2002

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CPS312	**CO1**	**2**	**1**	**1**						**1**	**1**
	CO2	**2**	**1**	**1**	**1**	**1**				**1**	**1**
	CO3	**2**	**1**	**1**	**1**	**1**				**1**	**1**
	CO4	**2**	**1**	**1**	**1**	**1**			**1**	**1**	**1**

Course Code	NCC	Type	L	T	P	C	Hrs/Week
		OE	3	0	0	3	3

Course Objectives:

To develop character, discipline, comradeship, secular outlook and to create a pool of trained, organized and motivated youth with various leadership qualities.

Course Outcomes:

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

1. Develop qualities of character, discipline, leadership, secular outlook, spirit of national integrity and the ideals of selfless service among the youth to make them useful citizen.
2. Create a human resource of organized, trained, and motivated youth by imparting different drills and shall exhibit field experience.
3. Demonstrate the qualities of a, ethical leader and communicate effective as a team member.
4. Participate as a citizen of the country during disasters for the protection of the weaker sections and carry out social service.

Course Contents:

UNIT-I: National Integration and Awareness 9 Hrs

Introduction on Organization, Indian History & Culture, Religion & customs of India, Unity, Integrity & Diversity, National integration and its importance, Social movement, Famous leaders in India and Its Neighbors.

UNIT-II: Protocols in drill 9 Hrs

General and words of commands, Attention stand, saluting at the halt, getting on parade, falling out and dismissing, Marching length of place and time of marching in quick time and halt, slow march and halt, Turning at the march and wheeling, Guard of honor, Formation of Squad and Squad drill, Basic organization of Armed Forces, Badges and Ranks, Organization of the Navy, NHQ, commands and fleets, Organization of IAF, ranks and cadres.

UNIT-III: Personality Development **9 Hrs**

Motivation, Discipline and Unity of a good citizen, Leadership Traits, Personality and Characters development, Values and Code of Ethics, Perception, Communication, Importance of Group and teamwork, importance of time and its management, tools for time management.

UNIT-IV: Disaster management & Community Development **9 Hrs**

Types of Emergencies/ National disasters, Protection, Essential Services & their materials, setting up relief camp during disaster management, Weaker section of society and their needs, social service & their needs, Family planning, Cancer, causes and prevention, NGOs and its contribution in society

Text Books:

1. Cadet's Hand book.
2. NCC OTA Precise.
3. Radhakrishnan Pillai, Chanakya's 7 Secrets of Leadership, JAICO Publishing House, New Delhi, 2014.
4. Prakash Iyer, The Habit of winning - Stories to Inspire, Motivate and Unleash the Winner Within, CloudTrail India, New Delhi, 2nd Edition, 2020.
5. Bipin Chandra, India's Struggle for Independence: 1857-1947, Penguin Random House, India, 2016.
6. A.K. Shrivastava, Disaster management, Scientific Publishers, 2021.
7. Mukesh Kumar, Famous Indian leaders: Biography, e-book, 2016.
8. Kuttan Mahadevan, The great leaders of India, Emerald Publishers, India, 2016.

Course Code	Classical Optimization	Type	L	T	P	C	Hrs/Week
B21ASO301		OE	3	0	0	3	3

Course Objectives:

1. Make the students to know about the optimization techniques.
2. Make the students to know about unconstrained minimization techniques.
3. Make the students to know about unconstrained minimization techniques to solve non-linear programming problems.
4. Make the students to know about constrained minimization techniques.

Course Outcomes:

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

1. Able to implement optimization techniques.
2. Able to implement unconstrained minimization techniques.

3. Able to solve non-linear programming problems by unconstrained minimization techniques.
4. Able to solve non-linear programming problems by constrained minimization techniques.

Course Contents:

UNIT-I: **9 Hrs**

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: **9 Hrs**

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

UNIT-III: **9 Hrs**

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: **9 Hrs**

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.

Text Books:

(i) "Operations Research" by J.K. Sharma
(ii) "Operations Research" by S.D. Sharma

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.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ASO301	**CO1**	3	3	3	3					3	3
	CO2	3	3	3	3					3	2
	CO3	3	2	2	2					3	3

	CO4	3	3	2	2					3	2

Course Code	Physics in Everyday Life	Type	L	T	P	C	Hrs/Week
B21ASO303		OE	3	0	0	3	3

Course Objectives:

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

Course Contents:

UNIT-I: Gadgets in Daily Life **9 hrs**

Principle of levers, Frictional force, Electric bulb, fan, and motor, Washing Machine, Kitchen Electronics; Microwave, Dishwasher, Induction Stoves, Basics of Smartphones, Smart Refrigerators, Smart alarms, Smart floor, Smart locks, batteries, working principle of Microphone and Loudspeaker, Radio and Radio waves, AM and FM, Basics of Digital Cameras.

UNIT-II: Applications of Electromagnetic Waves **9 hrs**

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

UNIT-III: Atmosphere **9 hrs**

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 **9 hrs**

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

Recommended Books:

1. Louis A. Bloomfield, How Things Work: The Physics of Everyday Life, 6th Edition, Wiley 2016.
2. DK, How to Be Good at Science, Technology, and Engineering, DK Publishing, 2018.
3. DK, How Things Work Encyclopedia, DK Publishing, 2009.
4. DK, How Technology Works: The Facts Visually Explained, DK Publishing, 2019.
5. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
6. Jordan Frith, “Smartphones as Locative Media ", Wiley 2014.
7. M. I. Skolnik, Introduction to Radar Systems, Tata McGraw Hill 2006.
8. R. R. Rogers, A Short Course in Cloud Physics, 3rd Edition, 1889, Reprint 1996.
9. Dennis C Brewer, " Home Automation", Que Publishing 2013.
10. T. Pratt, C. Bostian and J. Allnutt, Satellite Communications, John Wiley and Sons, Second Edition., 2003.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ASO303	**CO1**	3	3	3	3					3	3
	CO2	3	3	3	3					3	2
	CO3	3	2	2	2					3	3
	CO4	3	3	2	2					3	2

Course Code	Water Technology	Type	L	T	P	C	Hrs/Week
B21ASO304		OE	3	0	0	3	3

Course Objectives:

1. Determine the basic concepts of water pollution, various water analysis methods like COD, BOD, TOC, hardness and properties of water.
2. Analyze the estimation of dissolved oxygen, alkalinity, acidity and chlorides in water, Water treatment for domestic purpose.
3. Enhance knowledge one Ion-exchange processes, and lime soda process.
4. Conclude the biological relevance of pH and pKa of functional groups in biopolymers, proteins and nucleic acids.

Course Outcomes:

1. Differentiate between the Organic pollutants and Inorganic pollutants
2. Acquired the knowledge about acid-base reactions and alkalinity/acidity to solve problems associated with water/wastewater treatment and natural water quality.
3. Explain the hardness of water and their internal and external treatment.
4. Analyze properties of water and buffers, pH value of various bio-entities

Course Contents:

UNIT-I **9Hrs**

Introduction, Sources, Water pollutants classification: Organic pollutants –Pesticides, insecticides, detergents. Inorganic pollutants, Sediments, Radioactive materials and Thermal pollutants. Drinking water supplies, Trace elements in water. COD, BOD, TOC-definitions. Monitoring techniques and methods: Determination of pH, conductance, dissolved oxygen by Winkler's method, nitrate/nitrite by diazo coupling, chloride by Mohrs and Volhard's method, and fluoride by Alizarin Visual method, Water contamination with cyanide, sulfide, sulphate, phosphate and total hardness. Analysis of Arsenic by Atomic absorption spectroscopy (AAS), cadmium and mercury by dithizone method, chromium by diphenyl carbazide method, lead by polarographic method. Water pollution control and management. [9 hrs]

UNIT-II **9Hrs**

Determination of Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching powder, ionization)

Industrial Use of water: For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion. [9 hrs]

UNIT-III **9Hrs**

Treatment of Boiler Feed water: Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes, Lime soda process.

Demineralization of brackish water: Reverse Osmosis and Electro dialysis Determination of turbidity of wastewater,

Total solids, volatile solids and fixed solids of wastewater, nitrogen, Phosporous from waste water. [9 hrs]

UNIT-IV **9Hrs**

Properties of water: Ionic product of water and its measurements. Importance of water in biological system with special reference to the maintenance of the native structure of biological molecules. Types of bonding in biological molecules. Biological relevance of pH and pKa of functional groups in biopolymers, proteins and nucleic acids. Buffers, pH value of various bio-entities, buffer action, buffer capacity and their importance in biological systems. Isoelectric points for amino acids. Titration of proteins and preparation of buffer.

Karl-Fischer titrations: Stoichiometry of the reaction, preparation of the reagent, titration method, standardization of the reagent using water-in-methanol, determination of water in samples, interference and their elimination, application to quantitative analysis of some organic compounds-alcohols, carboxylic acids, acid anhydrides and carbonyl compounds. [9 hrs]

References:

1. Jain and Jain, D. Rai, A Text Book of Engineering Chemistry, Himalaya Publications, New Delhi, 2012.
2. K.B. Chandra Sekhar, U.N. Das and S. Mishra, Engineering Chemistry, SCITECH Publications India Pvt Limited, 2012.
3. A. Srivastava and N.N. Janhavi, Concepts of Engineering Chemistry, Himalaya

Publications, 2014.
4. C.P. Murthy, C.V. Agarwal and A. Naidu, Text Book of Engineering Chemistry, Dhanapathirai Publications, 2012.
5. C.V. Agarwal and C. P. Andranaidu, Chemistry of Engineering Materials, Dhanapathirai Publications, 2013.
6. Shashichawla, Text Book of Engineering Chemistry, Dhanapathirai Publications. 2012.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ASO304	**CO1**	2	1	1	1	1			2	1	1
	CO2	2	1	1	1	1			2	1	1
	CO3	2	1	1	1	1			2	1	1
	CO4	2	1	1	1	1			2	1	1

Course Code	Sports/Yoga/Music/Dance/Theatre	Type	L	T	P	C	Hrs/Week
B21SGM314		RULO	2	0	0	0	2

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

A. YOGA FOR HEALTH (B21SGM314A**)**

Course Objectives:

Following are the Course Objectives.

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

Course Outcomes:

On completion of the course learners will be able to:

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

Course Content:

Unit-I:
Yoga: Introduction; **Surya Namaskara: -** 12 counts

Unit-II:
Asanas: Sitting- Vajrasana, Dandasana, Padmasana, Matsyasana, Paschimottasana, Shirasasana.
Asanas: Standing- Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana.

Unit-III:
Asanas: Prone Position- Bhujangasana, Dhanurasana.
Asanas: Supine Position- Sarvangasana, Halasana.
Mudras- Dhyana mudra, Namaste mudra, Nasika mudra

Unit-IV:
Pranayams: - Anuloma – Viloma, Basthrika, Bhramari.
Dhyana & its types: Competition format, Rules and their interpretations

B. VOLLEYBALL (B21SGM314B**)**

Course Objectives:

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

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

Course Outcomes:

On completion of the course learners will be able to:

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

Course Content:

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

C. BASKETBALL (B21SGM314C**)**

Course Objectives:

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

Course Outcomes:

On completion of the course learners will be able to:

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

Course Content:

Unit-I

- Basketball: Introduction
- Grip; Player stance- Triple threat stance and Ball handling exercises
- Passing (Two hand/one hand)- Chest pass, Bounce Pass, over head pass, Underhand pass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running.
- Receiving-Two Hand receiving, one hand receiving, receiving in stationary position, receiving while jumping, receiving while running.

Unit-II

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

Unit-III

- Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.
- Individual Defensive- Guarding the man with the ball and without the ball.

- Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

Unit-IV

- Court marking, Rules and their interpretations

D. FOOTBALL (B21SGM314D**)**

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

E. ATHLETICS (TRACK AND FIELD) (B21SGM314E**)**

Course Objectives:

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

Course Outcomes:

On completion of the course learners will be able to:

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

Course Content:

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Reference Books

1. Arthur E. Ellison (ed) (1994). Athletic Training and Sports Medicine.
2. Ballisteros, J.M. (1998). Hurdles Basic Coaching Manual, IAAF.
3. Bosen K.O. (1993). Teaching Athletics Skills and Technique.

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

F. DRAMATICS (B21SGM314F**)**

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

Course Objectives:

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

Course Outcomes:

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

- Freely express improvisation in non-verbal communication.
- Shall hone good acting skills and be able to emote better.
- Be able to put up a theatre act and play a key role.
- 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.

A. INDIAN CLASSICAL DANCE FORMS

(Bharatanatyam, Kuchipudi, Mohiniyattam) (**B20PC2077**)

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

Note: Non-classical dancers can also join.

Course Objectives:

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

Course Outcomes:

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

Course Content:

Unit – 1

An introduction to Indian classical dance forms
Bharatanatyam, Kuchipudi, Mohiniyattam

Unit - 2

Learning of Fundamentals
Exercises and Adavus- I (Bharathanatyam, Kuchipudi, Mohiniyattam)

Unit - 3

Adavus –II (Bharathanatyam, Kuchipudi, Mohiniyattam)

Unit - 4

Learn a basic composition in the chosen dance form.

Reference Books

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

B. PERCUSSION INSTRUMENT (TABLA AND MRIDANGAM) (B20PC2078)

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

Course Objectives:

- To understand the Rhythmology.
- To understand the importance of Laya, Taala.
- 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:

- To be able to set instrument to Sruthi.
- To be able to play the fundamentals on instrument.
- 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 five 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	Mathematics Practical-III	Type	L	T	P	C	Hrs/Week
B21MT0302		HC	0	0	1.5	1.5	3

Course Objectives:

1. Acquire skill in solving problems on differential calculus using *Python*.
2. Acquire proficiency in using *Python* to solve the concept of sequence and series of real numbers.
3. Obtain skill in creating programs on vector calculus using *Python*.
4. Obtain skill in creating programs on solving partial differential equations.

Course Outcomes:

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

1. Demonstrate the use of *Python* to understand and interpret the core concepts in sequences and series.
2. Demonstrate the use of *Python* to apply ratio test, root test and Raabe's test to test the convergence of a series.
3. Exhibit proficiency in using *Python* to vector derivatives
4. Obtain the proficiency in using python to solve partial differential equations.

Course Contents:

1. Illustration of convergent, divergent and oscillatory sequence.
2. Illustration of convergent, divergent and oscillatory series.
3. Using Cauchy's criterion to determine the convergence of a sequence.
4. To find the sum of the series.
5. To demonstrate the physical interpretation of gradient, divergence curl and laplacian.
6. Using cyclic notations to derive some more vector identities
7. Solutions to the problems on solenoidal and irrotational vecotrs.
8. Solutions to the problems on different types of Partial differential equations.
9. Solving second order linear partial differential equations in two variables with constant coefficient.
10. Solving some more second order linear partial differential equations in two variables with constant coefficient.

Text Books:

1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0302	**CO1**	3	2	2	1	1	1		1	3	2
	CO2	3	2	2	1	1			1	3	3
	CO3	3	2	2	1	1			1	3	2
	CO4	3	2	2	1			1	1	2	2

Coursecode	Sampling distributions, estimation theory and simulation lab	L	T	P	C
B21ST0302		**0**	**0**	**1.5**	**1.5**

Prerequisites:

Knowledge of basics statistics and probability distributions.

Course Objectives:

1. To understand the basic concepts of sampling distributions and their applications in statistical inference.
2. To acquire knowledge about location, scale, location-scale and single parameter families of distributions
3. To possess skills concerning estimation techniques such as point estimation and interval estimation.
4. To demonstrate the use of simulation techniques in statistics.

Course Outcomes:

The student will be able to

1. Obtain the estimators of parameters and their standard errors using random sample
2. Perform comparison of estimators using mean square error.
3. Estimate the parameters of various probability distributions using maximum likelihood estimation and moment estimation methods.
4. Demonstrate the ability to use the skills to apply interval estimation and simulation techniques to real life problems

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0302	CO1	3	3	2	1	1	1		1	3	3
	CO2	3	2	2	2	1			1	3	3
	CO3	3	3	2	1	1			1	3	2
	CO4	3	2	2	1			1	1	2	2

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. Drawing random samples using random number tables.
2. Point estimation of parameters and obtaining estimates of standard errors.
3. Comparison of estimators by plotting mean square error.
4. Maximum likelihood estimation for discrete probability distributions
5. Maximum likelihood estimation for continuous probability distributions
6. Moment estimation problems
7. Constructing confidence intervals based on large samples.
8. Constructing confidence intervals based on small samples.
9. Generating random samples from discrete distributions.
10. Generating random samples from continuous distributions.

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers and Scientists,*

9/e, Pearson, New Delhi.
2. S.C Gupta and V.K Kapoor, *Fundamentals of mathematical Statistics*, 11th Edn., (Reprint), Sultan Chand and Sons, 2007
3. Mukhopadhyay, P.(2015): *Mathematical Statistics*, Books and Allied (P) Ltd., Kolkata.
4. Spiegel, M.R. (2001).*Probability and Statistics*, 4/e, Schaum's Outline Series, McGraw Hill, London.
5. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics,* 5/e, Prentice Hall, New Jersey, USA.
6. Medhi, J. (1992).*Statistical Methods: An introductory text,* New Age International, New Delhi.
7. Goon A.M., Gupta, M.K., Das Gupta, B. (2013).*Fundamentals of Statistics*,Vol.I, World Press, Calcutta.

Reference Books:

1. Ross, S.M (2003). *Introduction to Probability Models*, 10/e, Academic Press, UK.
2. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). *An Introduction to Probability and Statistics*, 2/e, John Wiley, New York.
3. Bhattacharya, G. K. and Johnson, R.A. (1986): *Statistical Concepts and Methods*, John Wiley, New York.
4. Casella, G. and Berger, R.L. (2007). *Statistical Inference*, Duxbury Press, Belmont, California, USA. (2^{nd} Edition).
5. Dudewicz, E.J. and Mishra, S.N.(1980). *Modern Mathematical Statistics,* John Wiley, New York.

Course Code	RDBMS LAB	Type	L	T	P	C	Hrs/Week
B21CP0302		HC	0	0	1.5	1.5	3

Course Objectives:

The major objective of this lab is to provide a strong formal foundation in database Concepts, technology and practice to the participants to groom them into well-informed database application developers.

1. To present SQL and procedural interfaces to SQL comprehensively.
2. To introduce systematic database design approaches covering conceptual.
3. Design, logical design, and an overview of physical design.
4. To give a good formal foundation on the relational model of data.

Course Outcomes:

1. Understand, appreciate, and effectively explain the underlying concepts of database technologies.
2. Design and implement a database schema for a given problem-domain.
3. Normalize a database.
4. Populate and query a database using SQL DML/DDL commands.
5. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.
6. Programming PL/SQL including stored procedures, stored functions, cursors, Packages.

Course Contents:

PART – A

1. Draw E-R diagram and convert entities and relationships to relation table for a given scenario.
   a. Two assignments shall be carried out i.e. consider two different scenarios (eg. Bank, college)

2.Date and Time Functions

3. 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.

4. 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

5. 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.

6. Consider the following DATABASE OF STUDENTS ENROLLMENT in courses and books adopted for each course. (ER-Diagram).
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.

7. 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%

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).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0302	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

FOURTH – SEMESTER

Course Code	Language-II: Kannada-IV	Type	L	T	P	C	Hrs/Week
B21AHK401		CC	2	0	0	2	3

Course Objectives:

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

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

Course Outcomes:

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

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

Course Contents:

Unit I **ನವ್ಯ–ಸ್ತ್ರೀವಾದಿ ಕವಿತೆಗಳು** **9 Hrs**

1. ಕಟ್ಟುವೆವು ನಾವು ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗರು

2. ಬುದ್ಧವಂತರಿಗೆ ಕನಸು ಬಿದ್ದರೆ ಎ.ಕೆ.ರಾಮಾನುಜನ್
3. ಕುರಿಗಳು ಸಾರ್ ಕುರಿಗಳು ನಿಸಾರ್ ಅಹಮದ್
4. ಅಕ್ಕ ಹೇಳಿದು ಸ. ಉಷಾ

Unit II **ದಲಿತ–ಬಂಡಾಯ** **9 Hrs**

1. ನನ್ನ ಕವನಗಳಲ್ಲಿ ಹುಡುಕದಿರು ನನ್ನ ಚಂಪಾ
2. ಜನಪದ ಕಥೆಗಳ ರಾಕ್ಷಸ ಚಂದ್ರಶೇಖರ ಕಂಬಾರ
3. ದಲಿತರು ಬರುವರು ದಾರಿಬಿಡಿ ಸಿದ್ಧಲಿಂಗಯ
4. ಕಟ್ಟಡದ ಕೆಲಸಗಾರರು ಎಚ್ ಎಸ್ ಶಿವಪ್ರಕಾಶ

Unit III **ಲೇಖನಗಳು** **9 Hrs**

1. ಹಸಿರು ಹೊಸಕುವ ಗಣಿಗಳು ಯಲ್ಲಪ್ಪ ರೆಡ್ಡಿ
2. ವಚನಕಾರರ ವಿಚಾರ ಕ್ರಾಂತಿ ಜಿ.ಎಸ್.ಎಸ್
3. ಜಾಗತೀಕರಣದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಗಾಂಧೀಜಿಯ ಪ್ರಸ್ತುತತೆ ಸಿ. ನಾಗಣ್ಣ
4. ಚಾರ್ವಾಕರು : ಒಂದು ಟಿಪ್ಪಣಿ ಪಿ ಎನ್ ರಂಗನ್

Unit IV **ಕಾದಂಬರಿ** **9 Hrs**

1. ಸಂಸ್ಕಾರ ಯು.ಆರ್. ಅನಂತಮೂರ್ತಿ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHK401	CO1					2	3				
	CO2					2	3				

	CO3						3				
	CO4							3	2		

Course Code	**Language – II: Hindi-IV**	**Type**	**L**	**T**	**P**	**C**	**Hrs/Week**
B21AHH401		CC	2	0	0	2	3

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।

Course Contents:

इकाई – 1: खंड काव्य – नहुष – मैथिलीशरण गुप्त **9 hrs.**
कवि परिचय
शची सर्ग
नहुष सर्ग

इकाई – 2: खंड काव्य – नहुष – मैथिलीशरण गुप्त **9 hrs.**
उर्वशी सर्ग
स्वर्गभोग सर्ग

इका ई – 3: खंड काव्य – नहुष – मैथिलीशरण गुप्त **9 hrs.**
सन्देश सर्ग
मंत्रणा सर्ग
पतन सर्ग

इकाई – 4: सिनिमा रिव्यू **9 hrs.**
सूपर 30, मिशन मंगल, थप्पड़, आर्टिकल 15
सूचना: प्रत्येक इकाई 25 अंक के लिए निर्धारित है।

Text book/s: पाठ्य पुस्तक:

1. **खंड-काव्य – नहुष – मैथिलीशरण गुप्त**

References: सन्दर्भ ग्रन्थ

1. रस – छंद – अलंकर - कृष्णदेव शर्मा & सुरेश अग्रवाल
2. हिन्दी साहित्य का इतिहास - डॉ. नागेन्द्र
3. आधुनिक हिन्दी साहित्य का इतिहास - डॉ. बच्चन सिंह
4. हिन्दी साहित्य का नवीन इतिहास - डॉ. लाल साहब सिंह
5. शुद्ध हिन्दी कैसे बोले कैसे लिखे- पृथ्वीनाथ पाण्डे
6. मीडिया विमर्श – रामशरण जोशी

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHH401	**CO1**					2	3	2			
	CO2					2	2	3			
	CO3					3	3	3			
	CO4					3	2	3			

Course Code	Language-II: Additional English-IV	Type	L	T	P	C	Hrs/Week
B21AHA401		CC	2	0	0	2	3

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.

Course Contents:

UNIT – I **9 Hrs**

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 **9 Hrs**

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 **9 Hrs**

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

UNIT – IV: Education **9 Hrs**

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. Karve, Irawati. *Yuganta: The End of an Epoch*. Orient Blackswan, 2007.
4. Ezekiel, Nissim. *Collected Poems* (With A New Introduction By John Thieme). OUP, 2005.
5. Hughes, Langston. *The Collected Poems of Langston Hughes*. Vintage, 1995.
6. Chopin, Kate. *The Awakening and Selected Stories of Kate Chopin*. Simon & Schuster, 2004.
7. Ibsen, Henrik. *A Doll's House*. Maple Press, 2011.
8. Poe, Edgar Allan. *The Complete Poetry of Edgar Allan Poe*. Penguin USA, 2008.
9. Stoker, Bram. *Dracula*. Fingerprint Publishing, 2013.
10. Ray, Satyajit. *The Complete Adventures of Feluda* (Vol. 2). Penguin Books Ltd., 2015.
11. Lama, Dalai. *Freedom In Exile: The Autobiography of the Dalai Lama of Tibet*. Little, Brown Book Group, 1998.
12. Murthy, Sudha. *Wise and Otherwise: A Salute to Life*. Penguin India, 2006.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21AHA401	**CO1**					3	3	3	2		
	CO2					3	3	3	3		
	CO3					3	3	3	2		
	CO4					3	3	3	2		

Course Code	Mathematics –IV	Type	L	T	P	C	Hrs/Week
B21MT0401		HC	3	0	0	3	4

Course Objectives:

1. Get familiar with the theories on rings, integral domains and fields.
2. Introduce the basic concepts of abstract algebra.
3. To understand the concepts of solid geometry and its applications in various fields.
4. Demonstrate an understanding of and be able to use Green's Theorem for the plane, Stokes Theorem, and Gauss' divergence Theorem to simplify and solve appropriate integrals.

Course Outcomes:

1. Explain the fundamental concepts of abstract algebra such as rings, fields and their role in modern mathematics and applied contexts.
2. Apply the concepts of solid geometry and to solve problems of various fields.
3. Compute double integrals and be familiar with change of order of integration.
4. Apply Green's Theorem, Divergence Theorem and Stoke's Theorem.

Course Contents:

Unit-I: - Ring theory **12 Hrs**

Rings – Subrings, Examples – Integral Domains – Division rings – The ring of quaternions- Fields--Subfields with examples- Homomorphism of Rings – Definition and elementary properties, Maximal and Prime ideals.

Unit-II: Analytical geometry in 3-D **12 Hrs**

(Recapitulation of three-dimensional geometry - Different forms of equations of straight line and plane). Angle between two planes - Line of intersection of two planes - Plane coaxial with given planes - Planes bisecting the angle between two planes - Angle between a line and a plane - Coplanarity of two lines - shortest distance between two lines. Equation of the sphere in general and standard forms - equation of a sphere with given ends of a diameter. Tangent plane to a sphere, orthogonallity of spheres. Standard equations of right circular cone and right circular cylinder.

Unit-III: Multiple integrals **12 Hrs**

Definition of a line integral and basic properties – Examples on evaluation of line integrals –Double integrals- Change of order of integration –change of variables (polar coordinates, area enclosed by plane curves, evaluation of triple integrals and volume of solids.

Unit-IV: Vector Integration **12 Hrs**

Integration of vectors- line integral (circulation, work done)-Surface integral (flux), Green's theorem (with proof) - Direct consequences of the theorem. The Divergence theorem (without proof) and problems (verification and evaluation). The Stokes' theorem (without proof) and problems (verification and evaluation) - Direct consequences of the theorem.

Text Books:

1. Shanthi Narayan, Analytical Solid Geometry. New Delhi: S. Chand and Co. Pvt. Ltd., 2004.
2. D E Bournesand and P C Kendall, Vector Analysis, ELBS, 1996
3. M. D. Raisinghania, Vector Calculus, S Chand Co. Pvt. Ltd., 2013

Reference Books:

1. I N Herstien – Topics in Algebra
2. John B Fraleigh, A First course in Abstract Algebra, 3rd ed.: Narosa Publishing House., 1990.
3. R. Balakrishan and N. Ramabadran, A Textbook of Modern Algebra, 1st ed. New Delhi, India: Vikas publishing house pvt. Ltd., 1991.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 8th ed.: New Delhi, India: Wiley India Pvt. Ltd., 2010.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21SG0404	CO1	3	3	2	3	2				3	3
	CO2	3	3	2	3	2				3	3
	CO3	3	3	2	3	2				3	2
	CO4	3	2	1	2	2				3	3

Course code	Testing of hypothesis, tests of significance and non-parametric tests	L	T	P	C
B21ST0401		**2**	**1**	**0**	**3**

Prerequisites:

Knowledge of basics statistics, probability distributions, sampling distributions and estimation.

Course Objectives:

1. To imbibe the strong foundation of testing of hypothesis.
2. To familiarize students with various large and small sample tests of significance
3. To introduce the concepts of non-parametric tests and their applications

Course Outcomes:

The student will be able to

1. Understand the basic concepts of testing of hypothesis and learn to use strong foundation skills of testing of hypothesis in evaluating probabilities of type1 and type 2 errors, power of the test and best critical region.
2. Describe the various tests of significance such as Z- test, t-test, chi-square test and F- test.
3. Explore the tests of significance for correlation coefficients, regression coefficient, independence of attributes and goodness of fit.
4. Understand the concepts of non-parametric tests and their applications.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0401	CO1	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**3**	**2**
	CO2	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
	CO3	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
	CO4	3	2	1	2	2				3	3

Course Contents:

Unit-1: Introduction to tests of hypotheses [12 Hrs]

Statistical hypotheses- null and alternative, simple and composite hypotheses. Type-I and Type-

II errors, test functions. Randomized and nonrandomized tests. Size of the test, level of significance, power function, power of the test, best critical region, p-value and its interpretation. Illustrative examples. Most powerful (MP) test. Statement of Neyman – Pearson lemma and its applications.

Unit-2: Tests of significance-I [12 Hrs]

Large and small sample tests of significance. Tests for single mean, equality of two means, single variance, and equality of two variances for normal populations Tests for proportions.

Unit-3: **Tests of significance II [12 Hrs]**

Tests for simple, partial, and multiple correlation coefficients and regression coefficients. Fisher's Z-transformation and its applications. Analysis of categorical data: contingency tables, tests for the independence and association of attributes. Chi-square tests for independence of attributes and goodness of fit.

Unit-4: **Nonparametric tests [12 Hrs]**

Introduction to nonparametric tests. Run test for randomness. Sign test and Wilcoxon signed rank test for one and paired samples. Run test, median test, and Mann-Whitney-Wilcoxon test for two sample problems. Test for independence based on Spearman's rank correlation coefficient.

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers andScientists,* 9/e, Pearson, New Delhi.
2. Gupta S.C. and Kapoor V.K.(2007) *Fundamentals of Mathematical Statistics*, *11th Edn*., (Reprint), Sultan Chand and Sons.
3. Mukhopadhyay, P.(2015): *Mathematical Statistics,* Books and Allied (P) Ltd., Kolkata.
4. Goon A.M., Gupta, M.K., Das Gupta, B. (2016).*Fundamentals of Statistics*,Vol.II, World Press, Calcutta.
5. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers,* Wiley India, New Delhi
6. Chandra,T. K. and Chatterjee, D. (2005). *A First Course in Probability*, Narosa Publishing House, New Delhi..
7. Lehmann, E. L. and Romano, J. P. (2005). *Testing Statistical Hypotheses,* 2/e, John Wiley, NewYork.
8. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics,* 5/e, Prentice Hall, New Jersey, USA.

Reference Books:

1. M.L Berenson, D.M Levine, and T.C Krehbiel, Basic Business Statistics- concepts and applications, 12th Edn, Pearson Education, 2011.
2. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). An Introduction to Probability Theory andMathematical Statistics, 2/e, John Wiley, New York.
3. Bhattacharya, G. K. and Johnson, R.A. (1986): Statistical Concepts and Methods, John Wiley, New York.

4. Dudewicz, E.J. and Mishra, S.N.(1980). Modern Mathematical Statistics, John Wiley, New York.

Course Code	Unix and Shell Programming	Type	L	T	P	C	Hrs/Week
B21CP0401		HC	3	0	0	3	4

Course Objectives:

1. Learn basic commands to interact with UNIX System and VI editor.
2. Understand the history, origin, features and architecture of UNIX Operating System.
3. The usage of various commands in UNIX environment.
4. Develop the ability to evaluate regular expressions and use them for pattern matching.
5. Apply essential facets of SHELL programming in order to solve the SHELL script problems.

Course Outcomes:

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

1. Describe history, origin, feature, and architecture of UNIX operating system.
2. Interact with UNIX system easily.
3. Construct and edit files, search for any patterns using regular expressions.
4. Solve complex jobs using tools and utilities available in UNIX. • Design and develop various tasks by using Shell scripting.

Course Contents:

UNIT -I

Introduction **12 Hrs**

Introduction, History, Architecture, General Purpose Utilities: cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, bc. Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators, exit, if, and case conditions, expr, sleep and wait, while, until, for, redirection, set and shift, trap.

UNIT –II **12 Hrs**

File System:

The File, Home Directory, Parent Child Relationship, Checking Current Working Directory, Making Directories, Removing Directories, Listing Directory Contents. Absolute path names, Relative path names. The UNIX file system. Basic File Attributes: Is options, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, changing ownership and group, hard link, symbolic link, umask, find.

UNIT –III **12 Hrs**

Simple Filters and Awk

Pr, head, tail, cut, paste, sort, uniq, tr commands, Filters using Regular Expression: grep, egrep, fgrep, sed instruction, Line Addressing, Inserting and Changing Text, Context addressing, writing selected lines to a file, the– f option, Substitution, Awk-Advanced Filters: Simple awk Filtering, Splitting a Line into Fields, printf, the Logical and Relational Operators, The –f option, BEGIN and END positional Parameters,

UNIT –IV **12 Hrs**

Process and System Administration:

Process basics: ps: process status, system processes (-e or –a), mechanism of process creation, process states and zombies, running jobs in background, job execution, job control. nice, at and batch, cron, time commands, Essential System Administration root, administrator's privileges, startup & shutdown, managing disk space, cpio, tar.

Text Book:

1.Sumitabha Das: "UNIX – Concepts and Applications", (Chapters 1,2,4,6-9,11-14,17,19), Tata McGraw Hill, Noida, 4th Edition, 15th Reprint, 2011, ISBN-13: 978-0-07-063546-3.

Reference Books:

1. Behrouz A. Forouzan and Richard F. Gilberg: "UNIX and Shell programming", Cengage Learning, India, 1 st Edition, 2005, ISBN: 81-35-0325-9.
2. M G Venkatesh Murthy: "UNIX and Shell programming", Pearson Education, Delhi, 1st Edition, 2005, ISBN: 81-7758-745-5.

Mapping of Course Outcomes with Programme Outcomes

Course Code	POs/ Cos	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0401	CO1	3	3	3	0	0	0	1	2	3	3
	CO2	3	3	2	2	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 Code	Complex Analysis	Type	L	T	P	C	Hrs/Week
B21MTS411		SC	3	0	0	3	3

Course Objectives:

This course concerns the complex analysis and applications of line integrals, Cauchy's in equality and Residue theorem.

Course Outcomes:

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

1. Analyze the conjugate and modulus of a complex number.
2. Apply the concepts of Cauchy-Riemann equations in Cartesian and polar forms to solve the problems.
3. Apply Cauchy integral theorem and its consequences to solve the problems.
4. Analyze the power series expansion of an analytic function.

Course Contents:

UNIT-I: Complex Analysis – 1 **12 hrs**

Recapitulation of Complex numbers, the complex plane, conjugate, and modulus of a complex number. Polar form, Euler's formula. Hyperbolic functions -simple problems.

UNIT-II: Complex Analysis – 2 **12 hrs**

Functions of complex variables: Limit, continuity, and differentiability-Simple problems. Analytic functions, Cauchy-Reimann equations in Cartesian and polar forms. Sufficient conditions for analyticity (in Cartesian form). Properties- Harmonic and orthogonal system and problems. Construction of analytic function, given real and imaginary parts.

UNIT-III: Complex analysis – 3 **12 hrs**

The complex line integral: Examples and properties (definitions of the concepts like neighborhood of a point, closed contour, etc. at appropriate places should be mentioned). Cauchy's integral theorem (with proof) and its consequences. Cauchy's integral formulae for the function and derivatives (with proof). Applications to the evaluation of simple line integrals. Cauchy's inequality, Liouville's Theorem-Fundamental theorem of algebra.

UNIT-IV: Complex analysis – 4 **12 hrs**

Power series expansion of an analytic function, Taylor's and Laurent's series (without proof). Singularity poles, residues, formula for the residue at a pole and Cauchy's Residue theorem (with proof) problems.

References

1. S. Shanthinarayan, Complex Analysis, S Chand Co. Pvt. Ltd., 2012.
2. R.V. Churchil & J W Brown, Complex Variables and Applications, 5th ed. TMH 1989.
3. L.V. Ahlfors, Complex Analysis, 3rd ed.: Mc Graw Hill, 1979.
4. A.R. Vashista, Complex Analysis, Krishna Prakashana Mandir, 2012.
5. Richard R Goldberg, Methods of Real Analysis, Indian ed. New Delhi, India: O&IBH Publishing Co. 1970.
6. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand Company Ltd., 2011.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS411	**CO1**	3	3	2	2					2	3
	CO2	3	2	2	3					3	2
	CO3	3	2	3	2					3	2
	CO4	3	3	3	2					3	3

Course Code	Operations Research	Type	L	T	P	C	Hrs/Week

B21MTS412		SC	3	0	0	3	3

Course Objectives:

1. Make the students to know about the history of operations research.
2. Make the students to learn about operations research models.
3. Make the students to formulate linear programming model.
4. Illustrate about the application areas of linear programming.

Course Outcomes:

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

1. Explain the classification of operations research models.
2. Demonstrate different methods for solving operations research models.
3. Gain knowledge on linear programming model formulation, applications and limitations.
4. Master on the applications of linear programming.

Course Contents:

UNIT-I: Operations Research Introduction **9 hrs**

History-Features of operations research approach-Operations research approach to problem solving-Models and modeling in operations research-Classification based on structure-Classification based on function-Classification based on time – Classification based on degree of certainty-Classification based on method of solution or quantification.

UNIT-II: Operations Research Models **9 hrs**

Advantages of model building-Methods for solving operations research models-Methodology of operations research-Advantages of operations research study-Opportunities and shortcomings of the operations research approach-Features of operations research solution-Applications of operations research-Operations research models in practice-Computer software for operations research.

UNIT-III: Linear Programming **9 hrs**

General structure of an LP model-Assumptions of an LP model-Advantages of using LP-Limitations of LP-Application areas of LP-General mathematical model of LPP-LPP model formulation.

UNIT-IV: Applications of Linear Programming **9 hrs**

LP model on production- LP model on Marketing- LP model on Finance- LP model on Agriculture-LP model on Transportation-LP model on personnel.

References

1. Operations Research by J.K. Sharma
2. Operations Research by S.D. Sharma
3. Operations Research by Sreenivasa Reddy M
4. Operations Research an Introduction by Hamdya.Taha
5. Linear Programming Methods and Applications by Saul I. Gass
6. A First Course in Optimization Theory by Rangarajan K Sundaram

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS412	**CO1**	3	3	2	2					2	3
	CO2	3	2	2	3					3	2
	CO3	3	2	3	2					3	2
	CO4	3	3	3	2					3	3

Course Code	Topology	Type	L	T	P	C	Hrs/Week
B21MTS413		SC	3	0	0	3	3

Course Objectives:

The aim of the course is to provide for the students an introduction to theory of metric and topological spaces with emphasis on those topics that are important to further studies. The course focuses on Homotopy, Homology theories and Topological groups and Lie groups.

Course Outcomes:

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

1. Analyse different axioms of Topology.
2. Learn Homotopy Theory.
3. Analyse fundamental groups of S1 and Sn.
4. Analyse Topological groups and Lie groups.

Course Contents:

UNIT-I: **9 hrs**

General Topology: Introduction, metric topology, separation axioms, compactness, Connectedness, product topology, introduction to manifolds, sub manifolds.

UNIT-II: **9 hrs**

Homotopy Theory. Covering spaces, homotopy maps, homotopy equivalence, Contractible spaces, deformation retraction.

UNIT-III: **9 hrs**

Fundamental Groups: Universal cover and lifting problem for covering maps, Fundamental groups of S1 and Sn. Introduction to Homology Theory.

UNIT-IV: **9 hrs**

Topological Groups: Introduction, integration on locally compact spaces, Haar Measure, Character groups, group action. Lie groups and lie algebras: Basic theory, linear groups.

References

1. C.O. Christenson and W.L. Voxman. Aspects of Topology.
2. J.R. Munkres. General Topology.
3. I.M. Singer and J.A. Thorpe. Lecture Notes in Elementary Topology and Geometry.
4. K. Chandrasekharan. A Course on Topological Groups.
5. W. Fulton and J. Harris. Representation Theory.
6. F.W. Warner. Foundations of Differentiable Manifolds and Lie Groups.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS413	**CO1**	3	3	2	2					2	3
	CO2	3	2	2	3					3	2
	CO3	3	2	3	2					3	2
	CO4	3	3	3	2					3	3

Course Code	Soft Skill Training	Type	L	T	P	C	Hrs/Week
B21PTM401		SC	2	0	0	0	2

Note: Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

Course Code	Skill Enhancement Course	Type	L	T	P	C	Hrs/Week
B21SCM401		SC	2	0	0	0	2

Note: Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

Course Code	Mathematics Practical-IV	Type	L	T	P	C	Hrs/Week
B21MT0402		HC	0	0	1.5	1.5	3

Course Objectives:

1. Theories on rings, integral domains and fields using *Python*.
2. Basic concepts of abstract algebra through *Python.*

Course Outcomes:

1. Exhibit proficiency in using *Python* to study abstract algebra.
2. Obtain knowledge in abstract algebra and calculus.
3. Demonstrate the use of *Python* to understand and interpret the core concepts in integral calculus.
4. Demonstrate the use of *Python* to understand and interpret the core concepts in vector integration.

Course Contents:

1. Examples on different types of rings.
2. Examples on integral domains and fields.
3. Examples on subrings, ideals and subrings which are not ideals.

4. Homomorphism and isomorphism of rings- illustrative examples.
5. Python program to find equation and plot sphere, cone, cylinder.
6. Evaluation of the line integral with constant limits.
7. Evaluation of the double integral with constant limits.
8. Evaluation of the triple integral with constant limits.
9. Evaluation of the line integral with variable limits.
10. Evaluation of the double integral with variable limits.
11. Evaluation of the triple integral with variable limits.
12. Green's theorem.

Text Books:

1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).
2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0402	**CO1**	3	2	2	2				1	3	2
	CO2	3	2	2	2				1	3	3
	CO3	3	2	2	2				1	3	2
	CO4	3	2	2	2				1	2	2

Course code	Testing of hypothesis, tests of significance and non-parametric tests lab	L	T	P	C
B21ST0402		**0**	**0**	**1.5**	**1.5**

Prerequisites:

Knowledge of basic statistics, probability distributions, sampling distributions and estimation.

Course Objectives:

1. To imbibe the strong foundation of testing of hypothesis.
2. To familiarize students with various large and small sample tests of significance
3. To introduce the concepts of non-parametric tests and their applications

Course Outcomes:

The student will be able to

1. Use foundation skills of testing of hypothesis to evaluate the probabilities of type 1 and type 2 errors, power of the test and to construct most powerful tests.
2. Describe the applications of Z- test, t-test, chi-square test and F- test.
3. Explore the applications of exact sample tests
4. Investigate the non-parametric tests along with their applications.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0402	CO1	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**3**	**2**
	CO2	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
	CO3	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**
	CO4	3	2	1	2	2				3	3

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. Evaluation of probabilities of Type-I and Type-II errors and power of tests.
2. MP test for parameters of binomial and Poisson distributions.
3. MP test for the mean of a normal distribution and power curve.
4. Tests for mean, equality of means when variance is (i) known, (ii) unknown under normality (small and large samples)
5. Tests for single proportion and equality of two proportions.
6. Tests for variance and equality of two variances under normality
7. Tests for correlation and regression coefficients.
8. Tests for the independence of attributes, analysis of categorical data and tests for the goodness of fit.(For uniform, binomial and Poisson distributions)
9. Nonparametric test I(Test for randomness, sign tests)
10. Nonparametric test II(Two sample tests)

Text books:

1. Walpole, R.E., Myers, R.H., and Myers, S.L. (2017). *Probability and Statistics for Engineers and Scientists*, 9/e, Pearson, New Delhi.
2. Gupta S.C. and Kapoor V.K.(2007) *Fundamentals of Mathematical Statistics, 11th Edn*., (Reprint), Sultan Chand and Sons.
3. Mukhopadhyay, P.(2015): *Mathematical Statistics*, Books and Allied (P) Ltd., Kolkata.
4. Goon A.M., Gupta, M.K., Das Gupta, B. (2016).*Fundamentals of Statistics*, Vol.II, World Press, Calcutta.
5. Montgomery, D.C. and Runger, G.C. (2013). *Applied Statistics and Probability for Engineers*, Wiley India, New Delhi
6. Chandra,T. K. and Chatterjee, D. (2005). *A First Course in Probability*, Narosa Publishing House, New Delhi..
7. Lehmann, E. L. and Romano, J. P. (2005). *Testing Statistical Hypotheses*, 2/e, John Wiley, NewYork.
8. Hogg, R. V. and Craig, A.T. (1995).*Introduction to Mathematical Statistics*, 5/e, Prentice Hall, New Jersey, USA.

Reference Books:

1. M.L Berenson, D.M Levine, and T.C Krehbiel, *Basic Business Statistics- concepts and applications*, 12th Edn, Pearson Education, 2011.
2. Rohatgi, V.K. and Saleh, A.K. Md. E. (2002). *An Introduction to Probability Theory and mathematical Statistics*, 2/e, John Wiley, New York.
3. Bhattacharya, G. K. and Johnson, R.A. (1986): *Statistical Concepts and Methods*, John Wiley,

New York.
4. Dudewicz, E.J. and Mishra, S.N.(1980). *Modern Mathematical Statistics*, John Wiley, New York.

Course Code	Unix Shell Programming Lab	Type	L	T	P	C	Hrs/Week
B21CP0402		HC	0	0	1.5	1.5	3

Course Objectives:

1. 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. 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:

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.

Course Contents:

PART – A

1. Use of Basic UNIX Shell Commands: ls, mkdir, rmdir, cd, cat, touch, file, wc, sort, cut, grep,dd, dfspace, du, ulimit
2. Write a shell script to generate and print the GCD and LCM of two integers.
3. To print all prime numbers between m and n (m<n).
4. Reverse a given number and check whether it is palindrome or not.
5. Shell script to find maximum and minimum of given set
6. To count the number of vowels in a given string.
7. To check whether a given string is a palindrome or not.
8. Write a menu driven program to calculate (i) Simple interest (ii) Compound interest
9. Write a shell script to count lines, words and characters in its input (do not use wc).
10. Shell script to display all the file permissions.

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).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0402	**CO1**	3	2	1	1	0	0	1	3	3	2
	CO2	3	2	3	2	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

FIFTH-SEMESTER

Course Code	Mathematics-V	Type	L	T	P	C	Hrs/Week
B21MT0501		HC	3	0	0	3	4

Course Objectives:

1. Understand the concepts in vector spaces and Linear Transformations.
2. Gain problems solving skills in solving vector spaces and linear transformations.
3. To provide students with an introduction to the field of numerical analysis.
4. The course aims to develop and apply problem solving skills through the introduction of numerical methods

Course Outcomes:

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

1. Understand concepts of vector space, subspace of a vector space, linear span, linear dependence, linear independence, dimension, basis and formally prove standard results related to these concepts.
2. Be familiar with Linear transformations and their corresponding matrices and understand the Rank and nullity concepts
3. Use information and communication technology to discuss problems relevant to Numerical Analysis.
4. Demonstrate the ability to study the solution of a differential equation and develop a practical interpretation of the numerical results.

Course Contents:

UNIT-I: Vector space-I **12 Hrs**

Vector Spaces – Definition – Examples – Vector subspaces – Criterion for a subset to be a subspace – Algebra of Subspaces – Linear Combination– Linear Span – Linear dependence and linear Independence of vectors – Theorems on linear dependence and linear independence – Basis of a vector space – Dimension of a vector space – Some properties – Quotient spaces–Homomorphism of vector spaces– first kind of Isomorphism of vector spaces.

UNIT-II: Vector space-II **12 Hrs**

Linear transformation – Linear maps as matrices – Change of basis and effect of associated matrices – Kernel and image of a linear transformation – Rank and nullity theorem.

UNIT-III: Numerical Methods-I **12 Hrs**

Numerical solutions of Algebraic and transcendental equations – Bisection method – The method of false position – Newton – Raphson method. Numerical solutions of first order differential equations Picard's method– Euler's method – Euler's modified method – Runge -Kutta fourth order method.

UNIT-IV: Numerical Methods-II **12 Hrs**

Forward and backward differences – shift operator – Interpolation – Newton – Gregory forward and backward interpolation formulae –Divided difference, Newton's general interpolation formula, Lagrange's and Inverse Lagrange's interpolation formula.

Numerical differentiation: direct formulae and problems.

Numerical Integration: General quadrature formula – Trapezoidal Rule –Simpson's 1/3 rule – Simpson's 3/8 th rule, Weddle's rule.

Text Books:

1. G K Ranganath, Text book of B.Sc. Mathematics, Revised ed. New Delhi, India: S Chand and Company Ltd., 2011.
2. S SSastry, Introductory methods of Numerical Analysis, 3rd ed. New Delhi, India: Prentice Hall of India, 1999.
3. Francis Scheid, Schaum's Outline of Numerical Analysis, Revised ed.: Mc. Graw Hill., 2006.

Reference Books:

1. M K Jain, S R K Iyengar, and R K Jain, Numerical Methods for Scientific and Engineering Computation, 4th Ed. New Delhi, India: New Age International, 2003.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 8th edition. New Delhi, India: Wiley India Pvt. Ltd., 2010.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0501	**CO1**	3	3	3	2	3				3	2
	CO2	3	3	3	3	3				3	3
	CO3	3	3	2	3	2				3	2
	CO4	3	3	2	3	3				3	3

Course Code	Design and analysis of experiments	L	T	P	C
B21ST0501		**2**	**1**	**0**	**3**

Prerequisites:

Knowledge of basic statistics and inferential statistics.

Course Objectives:

1. To equip the students with the basic concepts, theory and applications of ANOVA technique.
2. To guide the students to understand the concepts, issues and principles of various designs of experiments.
3. To construct a good design and perform a statistical analysis of experimental data
4. To describe the factorial experiments and need for confounding.

Course Outcomes:

Upon completion of the course, students will be able to

1. Explore the basic theory of ANOVA technique and apply it to real-life data.
2. Understand the basic concepts and principles of experimental design.
3. Compare the efficiencies of various designs of experiment.
4. Learn about factorial experiments and need for confounding

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0501	CO1	2	3	3	3	2	2	2	1	3	3
	CO2	2	3	2	3	1	2	2	1	3	2
	CO3	2	3	2	3	1	2	1	1	3	3
	CO4	2	3	2	3	1	2	1	1	2	3

Course Contents:

Unit-1: Analysis of variance [12 hrs]

Meaning and assumptions. Definitions of fixed, random and mixed effect models. Analysis of variance of one-way and two-way classified data with and without interaction effects for fixed effect models. Least significant difference.

Unit-2: **Experimental designs [12hrs]**

Terminology in experimental designs, Principles of design of experiments. Completely randomized, randomized block, and Latin square designs (CRD, RBD, and LSD) – layout, models, least squares estimates of parameters, hypotheses, test procedures and ANOVA tables.

Unit-3: Relative efficiency and Missing plot technique [12hrs]

Comparison of efficiencies of CRD, RBD, and LSD. Estimation of single missing observation in RBD and LSD and analysis.

Unit-4: Factorial experiments [12 hrs]

Basic concepts, main effects, interactions, and orthogonal contrasts in 2^2 and 2^3 factorial experiments. Yates' method of computing factorial effects total. Analysis and testing the significance of effects in 2^2 and 2^3 factorial experiments in RBD**.** Confounding-Need for confounding, complete and partial confounding in a 2^3factorial experiment in RBD layout and its analysis.

Text books:

1. Montgomery, D.C. (2014). *Design and Analysis of Experiments*, Wiley, New York.
2. Gupta S.C., V.K. Kapoor.(2014) *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi, India.
3. Das M.N. and Giri N.C(1986) *Design and Analysis of Experiments* Wiley, New York
4. Goon A.M., Gupta, M.K., Das Gupta, B. (2016).*Fundamentals of Statistics*, Vol.II, World Press, Calcutta.
5. H. Toutenburg and Shalabh (2009) *Statistical Analysis of designed experiments*, Springer.
6. Joshi, D. D. (1987).*Linear Estimation and Design of Experiments*, New Age International (P) Limited, New Delhi.

Reference Books:

1. Mukhopadhya, P.(2015): *Mathematical Statistics,* Books and Allied (P) Ltd., Kolkata.
2. Cochran, W.G. and Cox, G. M. (1992).*Experimental Designs*, John Wiley and Sons, New York.

Course Code	Basics of Web Programming	Type	L	T	P	C	Hrs/Week
B21CP0501		HC	3	0	0	3	4

Course Objectives:

1. Design the web page using HTML, PHP
2. Explain the concept of form handling and Java script.
3. Design a data base related web site.
4. Use PHP and HTML code for file handling and data base connectivity.

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 PHP, Javascript programming.
4. Write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different ways.

Course Contents:

UNIT – I

Introduction to HTML **12 Hrs**

HTML Documents - Dividing the document into 2 parts(Headers tags Body tags), Paragraphs, Formatting's, Elements of an HTML Document - Text Elements ,Tag Elements, Special Character elements, Image tags, HTML Table tags, Lists(Numbered list, Non-Numbered lists, Definition lists), Anchor tag, Name tag , Hyperlinks - FTP/HTTP/HTTPS, Links with images and buttons, Links to send email messages, Text fonts and styles, background colors /images, Marquee Behaviour, Forms related tags (action, method, name, input, submit etc), Lab components

UNIT – II

CSS, Form Handling, and JavaScript **12 Hrs**

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms.
Form Handling: Introduction, Creating Forms in HTML,GET and POST, Accessing Form data, $_POST, $_GET, $_REQUEST, Handling the file upload, Saving the uploaded file, Restricting the file type/size, Checking for errors, File inclusion.
JavaScript: Introduction JavaScript, HTML DOM, JavaScript Data type, Loops in JavaScript, Functions in JavaScript, Embedding JavaScript in HTML, Lab components.

UNIT – III

PHP Basics **12 Hrs**

Introduction to PHP , Support for Database, PHP Installation, Working with PHP, Why PHP?, Basic Syntax of PHP, PHP statement terminator and case insensitivity, Embedding PHP in HTML, Comments, Variables, Assigning value to a variable, Constants, Managing Variables.

Operators: Arithmetic Operators, Bit-wise Operators, Comparison Operators, Logical Operators, Concatenation Operator, Incrementing/Decrementing Operator, Ternary Operator, Operator Precedence, String Manipulation: strtoupper(), strtolower(), ucfirst(), ucwords(), strcmp(), strlen(), substr(), trim().

Functions: Functions in PHP, User-Defined function, Function Definition, Function Call, Function with arguments, Function with return value, Call by value and call by references, Understanding variable scope, Global Variables, Static Variables, Include and Require, Built-in functions in PHP

UNIT – IV: Arrays **12 Hrs**

Introduction to Array, Array in PHP, Creating an Array, Accessing Elements of an Array, Modifying Elements of an Array, Finding the Size of an Array, Printing an Array in the readable way, Iterating Array Elements, Modifying Array while iteration, Iterating Array with Numeric index, Removing Element from an Array, Converting an Array to String, Converting String to an Array, Array Sorting, Multidimensional Array, Accessing elements of a Multidimensional Array, Iterating Multidimensional Array.

PHP File Handling

Introduction, File Open, File Creation, Writing to files, Reading from File, Searching a record from a file, closing a File, Using PHP with HTML Forms.

Text Books:

1. PHP Bible - Tim Converse, Published by John Wiley and Sons (2000).
2. PHP A beginners guide - Bill McCarthy, McGraw-Hill Education; Annotated edition (16 August 2001).
3. PHP and MySQL Web Development - Luke Welling, Addison-Wesley; 5th edition (10 November 2016).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0501	**CO1**	1	0	0	3	2	2	2	2	1	3
	CO2	2	1	1	3	1	1	1	1	1	3
	CO3	3	1	2	2	3	0	1	2	2	3
	CO4	2	2	2	2	1	0	3	1	2	3

Course code	Sampling Theory	L	T	P	C
B21MTS511		**2**	**1**	**0**	**3**

Prerequisites:

Knowledge of summarizing and descriptive statistics, basics of probability and probability

distributions.

Course Objectives:

1. To learn the basic concepts of sample survey and it's need.
2. To familiarize with various tools and techniques of sampling
3. To learn to design and conduct statistical surveys.
4. To obtain estimator of the population parameter on the basis of selected sample and study its properties.

Course Outcomes:

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

1. Demonstrate an understanding of the basic concepts of sampling theory.
2. Use simple random sampling technique in real life situations.
3. Apply the knowledge of Stratified random sampling in real life problems.
4. Explore the concepts and applications of systematic random sampling.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MTS511	CO1	2	3	3	2	0	0	2	1	3	0
	CO2	3	3	2	3	0	0	2	3	3	2
	CO3	2	3	2	3	0	0	1	3	0	3
	CO4	2	3	2	3	0	0	1	3	1	3

Course Contents:

Unit 1 **[12hrs]**

Introduction to sampling theory, Concepts of population and sample, need for sampling, complete enumeration Vs sample surveys, principal steps in a sample survey, Sampling and non-sampling errors, types of sampling: non-probability and probability sampling. Methods of drawing random samples-Lottery method and table of random numbers.

Unit2 **[12hrs]**

Simple random sampling: Sampling with and without replacement. Unbiased estimators of population mean and total. Derivation of sampling variances. Standard errors of the estimators. Confidence limits. Sampling for proportions. Derivation of the variances of the estimators and their estimation. Determination of sample size. Obtaining the sample size while estimating population proportions and population means. Advantages and limitations of SRS.

Unit 3 **[12hrs]**

Stratified random sampling: Need for stratification. Unbiased estimator of mean and total in stratified random sampling. Derivation of the variance, standard error of the estimators and their estimation. Allocation of sample size under proportional, optimum and Neyman allocations. Comparison of V(ran), V(prop) and V(opt) ignoring fpc. Estimation of gain in precision due to stratification.

Unit 4 **[12hrs]**

Systematic sampling: Linear systematic sampling, its advantages and limitations. Estimation of mean, total and variance of the estimators. Comparison with SRSWOR .Circular systematic sampling.

Text Books:

1. Gupta S.C., V.K. Kapoor.(2014) *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi, India.
2. Cochran,W. G. (2007). *Sampling Techniques*. 3/e, John Wiley and Sons, New York.
3. Mukhopadhyay, P (2011). Applied Statistics. Calcutta Publishing House

References:

1. Des Raj and Chandok, P. (1998). *Sampling Theory*, Narosa, New Delhi.
2. Mukhopadhyay, P. (2015): *Mathematical Statistics,* Books and Allied (P) Ltd., Kolkata.
3. Murthy, M.N. (1977). Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
4. Sampath, S. (2006). *Sampling Theory and Methods*, 2/e, Narosa, New Delhi.

Course code	Basic econometrics	L	T	P	C
B21PHS512		3	0	0	3

Prerequisites:

Knowledge of linear algebra, calculus, descriptive statistics, probability distributions and statistical inference.

Course Objectives:

1. To develop an understanding of fundamental concepts of econometric models.
2. To introduce regression analysis to students so that they are able to understand its applications in different fields in economics.
3. To know the assumptions and inferential aspects of regression models.

Course Outcomes:

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

1. Demonstrate an understanding of fundamental concepts of econometric models.
2. Specify the assumptions and perform an inferential analysis of regression models.

3. Apply econometric models to real life data.
4. Distinguish the results of violating the assumptions of classical regression model

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21PHS512	CO1	3	3	3	2	0	0	1	1	2	0
	CO2	3	2	2	3	0	0	1	3	2	2
	CO3	2	3	3	3	0	0	1	3	3	3
	CO4	3	3	2	3	0	0	1	3	3	3

Course Contents:

Unit 1 **[12hrs]**

Introduction to econometrics: Meaning, nature and scope, econometric models, various types of data used econometric models, objectives of econometrics, types of econometrics, methodology of econometrics, econometrics and statistics, econometrics and regression analysis.

Unit2 **[12hrs]**

Simple linear regression analysis: Meaning, model, Ordinary Least Square (OLS) estimators-properties, BLUE property. Inference in the least square model, concept of ANOVA and co-efficient of determination, prediction of response variable, simple problems.

Unit3 [12hrs]

Multiple linear regression analysis: Meaning, model, assumptions of model, Ordinary Least Square(OLS) estimators-properties, Gauss-Morkov theorem, Inference in the model, approach of ANOVA, R^2 and adjusted R^2 , simple problems with three variables.

Unit4 **[12hrs]**

Violations of classical assumptions: Multicollinearity: nature of Multicollinearity, Sources (illustrative examples), consequences, detection and remedies; Heteroscedasticity- nature of Heteroscedasticity, sources, consequences, detection and remedies; Autocorrelation-nature of autocorrelation(AR(1)),sources, consequences, detection and remedial measures.

Text Books:

1. Jack Johnston and John DiNardo (1997):Econometric Methods, Third edition, McGraw Hill.
2. G.S. Maddala (2002): Introduction to Econometrics, Third edition, John Wiley.
3. Damodar Gujrati (2003):Basic Econometrics, McGraw Hill.

4. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining.(2012)*Introduction to Linear Regression Analysis,* 5th ed.,Wiley,U.S.A.

References:

1. Damodar N Gujarati, Basic Econometrics, McGraw Hill, International Student Edition.
2. Damodar N Gujarati, Econometrics by Example, Palgrave Macmillan, United Kingdom.
3. Ghosh Sukesh K, Econometrics- Theory and Applications, Prentice Hall Private Ltd., New Delhi.
4. Koutsoyiannis A., Theory of Econometrics, The Macmillan Press Ltd., London.

Course Code	MOOC/SWAYAM	Type	L	T	P	C	Hrs/Week
B21SC0N01		SC	2	0	0	2	2

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 Enhancement Course	Type	L	T	P	C	Hrs/Week
B21SGM501		SC	2	0	0	1	2

Note: Soft Skill Training courses are organised by the **Placement and Training Centre**. The students have to undergo Soft Skill Courses conducted by the said Centre.

Course Code	Mathematics Practical-V	Type	L	T	P	C	Hrs/Week

B21MT0502		HC	0	0	1.5	1.5	3

Course Objectives:

1. To provide students with an introduction to the field of numerical analysis.
2. Aside from developing competency in the topics and emphases listed, the course aims to develop and apply problem solving skills through the introduction of numerical methods.

Course Outcomes:

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

1. Demonstrate the use of *Python* to understand to find whether vectors are dependent or independent.
2. Exhibit proficiency in using *Python* to basis and dimension of vector space.
3. Acquire proficiency in using *Python* to study Numerical differentiation.
4. Acquire proficiency in using *Python* to study Numerical integration.

Course Contents:

1. i) Vector space, subspace – illustrative examples. ii) Expressing a vector as a linear combination of given set of vectors.
2. Examples on linear dependence and independence of vectors.
3. Basis and Dimension – illustrative examples.
4. Verifying whether a given transformation is linear.
5. Finding matrix of a linear transformation.
6. Problems on rank and nullity.
7. Programs on Interpolations with equal intervals.
8. Programs on Interpolations with unequal intervals.
9. Programs to find derivatives with equal intervals.
10. Programs to evaluate integrals using Simpson's $1/3^{rd}$ and $3/8^{th}$ rule.

Reference Books:

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0502	**CO1**	3	3	2	2					2	3
	CO2	3	2	2	3					3	2
	CO3	3	2	3	2					3	2
	CO4	3	3	3	2					3	3

Course code	Design and analysis of experiments Lab	L	T	P	C
B21ST0502		**0**	**0**	**1.5**	**1.5**

Prerequisites:

Knowledge of basic statistics and inferential statistics.

Course Objectives:

1. To equip the students with the basic concepts, theory and applications of ANOVA technique.
2. To guide the students to understand the concepts, issues and principles of various designs of experiments.
3. To construct a good design and perform a statistical analysis of experimental data
4. To describe the factorial experiments and need for confounding.

Course Outcomes:

Upon completion of the course, students will be able to

1. Explore the basic theory of ANOVA technique and apply it to real-life data.
2. Understand the practical applicability of various designs of experiments.
3. Estimate the missing observations under RBD and LSD and perform their statistical analysis.
4. Carryout statistical analysis of factorial experiments using RBD layout

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0502	CO1	2	3	3	3	2	2	2	1	3	3
	CO2	2	3	2	3	1	2	2	1	3	2
	CO3	2	3	2	3	1	2	1	1	3	3
	CO4	2	3	2	3	1	2	1	1	2	3

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. ANOVA for one way classified data.
2. ANOVA for two way classified data.
3. Analysis of CRD.
4. Analysis of RBD.
5. Analysis of LSD.
6. Missing plot techniques in RBD and LSD
7. Analysis of 2^2 factorial experiment using RBD layout.
8. Analysis of 2^3 factorial experiment using RBD layout.
9. Analysis of 2^3 factorial experiment using RBD layout. (Complete confounding)
10. Analysis of 2^3 factorial experiment using RBD layout. (Partial confounding)

Text books:

1. Montgomery, D.C. (2014). *Design and Analysis of Experiments*, Wiley. New York.
2. Gupta S.C., V.K. Kapoor.(2014) *Fundamentals of Applied Statistics*, Sultan Chand and Sons, New Delhi, India.
3. Goon A.M., Gupta, M.K., Das Gupta, B. (2016).*Fundamentals of Statistics*, Vol.II, World Press, Calcutta.
4. Das M.N. and Giri N.C(1986) *Design and Analysis of Experiments* Wiley, New York.
5. Joshi, D. D. (1987).*Linear Estimation and Design of Experiments*, New Age International

(P) Limited, New Delhi.

Reference Books:

1. Mukhopadhya, P.(2015): *Mathematical Statistics,* Books and Allied (P) Ltd., Kolkata.
2. Cochran, W.G. and Cox, G. M. (1992).*Experimental Designs*, John Wiley and Sons, New York.

Course Code	Web Programming Lab	Type	L	T	P	C	Hrs/Week
B21CP0502		HC	0	0	1.5	1.5	3

Course Objectives:

1.

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. To develop PHP programs using the concepts.

Course Contents:

1. Develop and demonstrate a XHTML document that illustrates the use external style sheet, ordered list, table, borders, padding, color, and the tag.
2. Develop and demonstrate a XHTML file that includes Javascript script for the following:
   Input: A number n obtained using prompt
   Output: The first n Fibonacci numbers
3. Develop and demonstrate a XHTML file that includes Javascript script that uses functions for the following:
   Parameter: A stringOutput: The position in the string of the left-most vowel
4. Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
5. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
6. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
7. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
8. Write a PHP program to check whether a number is positive, negative or zero.

Part B

1. Create, test, and validate an XHTML document for yourself, including your name, address, and e-mail address. If you are a student, you must include your major and your grade level.

If you work, you must include your employer, your employer's address, and your job title. This document must use several headings and , , <hr />, <p>, and <br /> tags.

2. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.
3. 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.
4. Write a javascript code for case conversion
5. Write a program to create chess board in PHP using for loop
6. Write a PHP script to check whether a string contains a specific string?
7. Write a PHP script to calculate and display average temperature, five lowest and highest temperatures.
8. Write a code to:
   a) Set up an html page with a form using which we will upload the file.
   b) Setup a PHP script to upload the file to the server as well as move the file to it's destination.
   c) Inform the user whether the upload was successful or not.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0502	**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

SIXTH – SEMESTER

Course Code	Mathematics-VI	Type	L	T	P	C	Hrs/Week
B21MT0601		HC	3	0	0	3	4

Course Objectives:

1. Gain familiarity in fundamental theories on Fourier Series and Laplace Transforms.
2. Acquire problem solving skills on Fourier Series and Laplace Transforms.

Course Outcomes:

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

1. Evaluate improper integrals using beta and gamma functions.
2. Understand Laplace transforms of different types of functions.
3. Apply Laplace transform method to linear differential equations.
4. Express given function in terms of sines ad cosines.

Course Contents:

UNIT-I: **12 Hrs**

Integral Calculus: Improper Integrals (definition only) – Gamma and Beta functions and results following the definitions – relation between Beta and gamma functions – Applications to evaluation of integrals – Duplication formula.

UNIT-II: **12 Hrs**

Laplace Transforms: Definition and basic properties – Laplace transforms of e^{kt}, $\cos kt$ $\sin kt$, t^n, $\cosh kt$ and $\sinh kt$. Laplace transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, Laplace transform of derivatives, Laplace transforms of integrals (without proof) and problems. Laplace transform of periodic functions, unit-step function and Unit impulse functions and problems.

UNIT-III: **12 Hrs**

Inverse Laplace transforms: Inverse Laplace transforms – problems. Convolution theorem (with proofs) problems (both evaluation and verification). Applications of Laplace transforms to solve simultaneous differential equations and linear order differential equations with constant coefficients.

UNIT-IV: **12 Hrs**

Fourier series: Introduction – Periodic functions – Fourier series and Euler formulae (statement only) – Even and odd functions – Half range series – Change of interval. Complex form of Fourier series.

Text Books:

1. G K Ranganath, Text book of B.Sc., Mathematics, Revised ed. New Delhi, India: S Chand and Co., 2011.
2. Raisinghania M D., Laplace and Fourier Transforms. New Delhi, India: S. Chand and Co. Ltd., 1995.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th ed. New Delhi, India: Wiley India Pvt. Ltd., 2010.
2. Murray R, Spiegel L: Laplace Transforms (Schaum Series).
3. Raisinghania M.D., Laplace and Fourier Transforms. New Delhi, India: S. Chand and Co. Ltd., 1995.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0601	**CO1**	3	3	3	3			1	2	3	3
	CO2	3	3	3	3			1	2	3	3
	CO3	3	2	2	2			2	2	3	3
	CO4	3	2	2	2			2	2	3	3

Course code	Advanced Operations Research	L	T	P	C
B21ST0601		**3**	**0**	**0**	**3**

Prerequisites:

Knowledge of linear algebra, basics of probability and probability distributions

Course Objectives:

1. To study the fundamentals of operations research.
2. To understand the mathematical formulation of linear programming problems and their applications in real life problems.
3. To obtain solutions to LPPs.
4. To study various operational research techniques and models.

Course Outcomes:

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

1. Demonstrate the understanding of fundamentals of operations research.
2. Obtain solution to LPPs.
3. Distinguish transportation problems and assignment problems.
4. Explore the basic concepts of game theory and derive the solutions to different game problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21ST0601	CO1	3	3	3	2	0	0	1	2	3	0
	CO2	3	2	2	3	0	0	1	2	2	2
	CO3	2	3	3	3	0	0	1	3	1	3
	CO4	3	3	2	3	0	0	1	3	2	3

Course Contents:

Unit 1: Introduction to OR and L.P.P.
[12hrs]

Introduction, historical background, definition, scope, objectives, phases, models and limitations of Operations research, various types of OR problems**.** Linear programming problem (LPP): Definition, slack and surplus variables, standard and canonical forms, formulation of LPP. Definitions of solution, basic and non-basic variables, feasible solution, basic feasible solution, degenerate and non-degenerate solutions, optimal solution. Graphical method to solve an LPP.

Unit 2: Simplex method
[12hrs]

Simplex method for solving an L.P.P., Charne's Big- M method for solving L.P.P. involving artificial variables. Criteria for unbounded, multiple, and infeasible solutions. Concept of duality in LPP, dual vs primal, dual simplex method.

Unit 3: Transportation Problems and Assignment problems
[12hrs]

Transportation Problems: Introduction, mathematical formulation of transportation problem.

Finding initial basic feasible solution using North West corner rule, least cost method and Vogel's approximation method (VAM), Test for optimality-MODI method, special cases of transportation problem

Assignment problems: Introduction, mathematical formulation of assignment problem, Hungarian method to find optimal assignment, special cases of assignment problem.

Unit 4: Game theory
[12hrs]

Game theory: Introduction, Competitive Situations, Characteristics of Competitive Games. Rectangular game, Two-Person Zero-Sum game, maximin- minimax principle, games with saddle point, Principle of dominance, games without saddle point- mixed strategies. Determination of optimum solution for a 2x2 game, graphical solution of 2xn and mx2 games.

Text Books:

1. Churchman, C.W, Ackoff, R.L., and Arnoff, E.L. (1957). *Introduction to Operations Research*, John Wiley and Sons, New York.
2. Kanthi Swaroop, Manmohan and P.K. Gupta (2012). *Operations Research,* Sultan Chand, New Delhi.
3. Sharma S.D.(2012) *Operations Research: Theory, methods and applications,* Kedarnath, India.
4. Kalavathy, S.(2004). *Operations Research*, Vikas Publishing House Pvt. Ltd. New Delhi.
5. Shenoy, G.V., Srivastava, U. K., and Sharma, S.C. (2009). *Operations Research for Management, 2/e,* New Age International, New Delhi.

References:

1. Taha, H.A. (2010). *Operational Research: An Introduction,* Macmillan, New York.
2. Mustafi, C.K. (2006). *Operations Research: Methods and Practice*, 3/e, New Age International, New Delhi.
3. Mital, K.V. and Mohan, C. (2004). *Optimization Methods,* 3/e, New Age International, New Delhi.
4. Narag, A. S. (1970). *Linear Programming and Decision Making,* S. Chand, New Delhi.

Hillier, F.S. and Leiberman, G. J. (1962). *Introduction to Operations Research*, Holden Day, New Delhi.

Course Code	Data Mining and Data Warehousing	Type	L	T	P	C	Hrs/Week
B21CP0601		HC	3	0	0	3	4

Course Objectives:

1. To understand the scope and importance of Data mining in solving real-world problems.
2. To provide an understanding of the fundamental concepts of data mining and warehousing.
3. To examine the types of data to be mined and apply pre-processing methods on raw data.

4. To understand algorithm and tools of data mining used in real world problems.

Course Outcomes:

1. Analyze the concept of data warehouse and OLAP.
2. Demonstrate data pre-processing techniques.
3. Apply various Data Mining Techniques.
4. Analyze data mining applications in various field.

Course Contents:

UNIT-I **12 Hrs**

Data Warehouse and OLAP

Introduction to Data warehouse Data warehouse Characteristics, Data warehouse Architecture and its Components, Extraction Transformation Loading (ETL), ETL Tools. Multidimensional view and Data cube, Introduction to OLAP, OLAP Operations, Difference between (OLTP) and (OLAP), Advantages of Data mining.

UNIT II **12 Hrs**

Introduction to Data Mining

Introduction to Data Mining: Challenges, Knowledge Discovery in database, Data Mining Tools and Applications, Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT-III

Machine Learning Techniques **12 Hrs**

Machine Learning Techniques –Types of Machine learning, Supervised Learning: linear and polynomial Regression and Classification using Decision Trees & k-NN, Unsupervised learning: Association, K- Mean Clustering and Reinforcement Learning.

UNIT-IV

Applications of Data mining **12 Hours**

Introduction, Business Applications Using Data Mining- Financial Data Analysis Retail Industry, Tele Communication Industry, Healthcare applications: Biological Data Analysis, Other Scientific Applications, Intrusion Detection.

Text Books:

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.
3. PaulrajPonnian, "Data Warehousing Fundamentals", John Willey.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012
3. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0601	**CO1**	2	2	2	1		1		1		1
	CO2	3	2	1	1				2	1	1
	CO3	2	1	2	2		1		2	2	1
	CO4	2	3	1	2		1	1	2	1	1

Course Code	Software Engineering	Type	L	T	P	C	Hrs/Week
B21CPS611		SC	3	0	0	3	3

Course Objectives:

1. To provide the knowledge of software engineering discipline.
2. To apply analysis, design & testing principles to software project development.
3. To demonstrate and evaluate real time projects with respect to software engineering principles.

Course Outcomes:

1. Understand and demonstrate basic knowledge in software engineering.
2. Identify requirements, analyze and prepare models.
3. Plan, schedule and track the progress of the projects.
4. Design & develop the software projects.
5. Identify risks, manage the change to assure quality in software projects.
6. Apply testing principles on software project and understand the maintenance concepts.

Course Contents:

UNIT-1

SOFTWARE PROCESS MODELS **12 Hrs**

Introduction to software engineering, Classification of Software, Software Development Life Cycle- Waterfall Model, Iterative Waterfall Model, Spiral Model, Incremental process Model, Rapid Application Development Model(RAD), Agile Development Model, SCRUM ,Extreme Programming.

UNIT-2

SOFTWARE REQUIREMENT ANALYSIS AND SPECIFICATION **12 Hrs**

Software Requirements- Requirements Engineering Process, Classification of Software Requirements, Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modeling, Characteristics of a Good Software, Software Requirement & Specification Document(SRS).

UNIT-3

SOFTWARE PLANNING & SOFTWARE DESIGN **12 Hrs**

Software Project Management (SPM)- Project Management Process, Project size estimation techniques, System Configuration Management (SCM), COCOMO Model, Capability Maturity Model(CMM), Risk Management in SDLC, Role and Responsibility of a Software Project Manager, Software Maintenance.

Software Design- Abstraction, Architecture, Patterns, Modularity, Information Hiding, Functional Independence- Cohesion & Coupling, Object Oriented Design- Data Design, Architectural Design, User Interface Design, Component Level Design.

UNIT-4

SOFTWARE TESTING & DEBUGGING **12 Hrs**

Testing Fundamentals- Error, Fault & Failure, Black Box Testing- Equivalence Partitioning, Boundary value Analysis, White Box Testing- Control flow based Testing, Data flow based Testing, Testing Strategies- Verification & Validation, Unit Testing, Integration Testing, System Testing, Acceptance Testing, Deriving Test Cases, Alpha and Beta Testing, Regression Testing, Performance Testing, Stress Testing, Debugging.

TEXT BOOKS:

1. R.E. fairly, "software engineering concepts", McGraw Hill.1997.
2. Rajib mall fundamentals of software engineering 4th edition phi 2014

REFERENCES:

1. R.S. Pressman, "Software Engineering" – A Practitioners approach – McGraw Hill.

"Software Engineering A Concise study" – Kelkar – PHI.

2. Pankaj Jalota: "An integrated approach to software engineering" - Narosa.
3. Prof. S.Parthasathy & Prof. B.W.Khalkar ,"System Analysis & Design & Introduction to S/W Engineering".

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CPS611	**CO1**	2	1	1						1	1
	CO2	2			1	1				1	1
	CO3	2			1	1				1	1
	CO4	2			1	1				1	1

Course Code	Cryptography and Network Security	Type	L	T	P	C	Hrs/Week
B21CPS612		SC	3	0	0	3	3

Course Objectives:

1. To understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

4. To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes:

1. Classify various block ciphers and its usages.
2. Design various cryptographic algorithms that used for encryption and decryption purposes
3. Study different techniques used in key exchange protocols.
4. Discuss the applications of applied cryptography.

Course Contents:

UNIT I

Introduction to Cryptography and Block Ciphers 12 hours

Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and blockciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.

UNIT II

Confidentiality and Modular Arithmetic 12 hours

Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.

UNIT III

Public key cryptography and Authentication requirements 12 hours

Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

UNIT IV

IP Security 12 hours

Overview of IP Security (IPSec); IP Security Architecture; Modes of Operation; Security Associations (SA) – Security Parameter Index (SPI), SA Management, Security Policy; Authentication Header (AH); Encapsulating Security Payload (ESP); Internet Key Exchange.

Web Security: Web Security Requirements; Secure Socket Layer (SSL) – SSL Architecture, SSL Protocol; Transport Layer Security (TLS); Secure Electronic Transaction (SET) – Features, Components, Dual Signature.

Text Books:

1. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI. 2001

2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding Theory", Pearson. 2000

Reference Books:

1. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing –
Prentice Hall of India

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CPS612	**CO1**	3	2	2	1		2		1	2	3
	CO2	3	2	2	2		1	1		2	3
	CO3	2	3	2	1				2	2	3
	CO4	2	3	2	2			1	1	3	3

Course Code	Project	Type	L	T	P	C	Hrs/Week
B21SG0601		HC	0	0	4	4	8

Course Objectives:

To carry out the research under the guidance of R&D supervisor/Industry/R&D Institution and in the process learn the techniques of research.

Course Outcomes:

On successful completion of the project, the student shall be able to:

1. Familiarize with literature search.
2. Conduct the experiments related to research and formulate computational techniques.
3. Interpret the scientific data.
4. Write report and defend the research findings.

Course Contents:

Project:

This project will be based on preliminary research-oriented topics both in theory and experiment. The teachers who will act as supervisors for the projects will float projects and any one of them will be allocated to the student. The research projects floated should be completed in 7-8 weeks. After the completion of the project the student shall submit project report in the form of dissertation on a specified date by the school. The details of assessment of project are explained under the heading “Evaluation of Minor Project/Dissertation” in this handbook.

Course Code	Mathematics-VI Lab	Type	L	T	P	C	Hrs/Week
B21MT0602		HC	0	0	1.5	1.5	3

Course Objectives:

1. Understand the concept of Laplace transform.
2. Familiarize with Inverse Laplace transforms.

Course Outcomes:

1. Problems on Laplace transform using *Python*.
2. Problems on inverse Laplace transforms using *Python*.
3. Acquire proficiency in using *Python* to evaluate improper integrals.
4. Acquire proficiency in using *Python* to study Fourier series

Course Contents:

1. Problems on gamma and beta functions.
2. Problems on duplication formula.
3. Problems on evaluation of improper integrals in applications.
4. Finding the Laplace transform.
5. Finding the inverse Laplace transform.
6. Problems on Convolution theorem
7. Laplace transform method of solving first order ordinary differential equations with constant coefficients.
8. Laplace transform method of solving second order ordinary differential equations with constant coefficients
9. To find full range trigonometric Fourier series of some simple functions with period 2π and 2L.
10. Finding the half-range sine and cosine series of simple functions and plotting them.

Text Books:

1. SCILAB: A Practical Introduction to Programming and Problem Solving [Print Replica] Kindle Edition by Tejas Sheth (Author).

2. The Maxima Book Paulo Ney de Souza Richard J. Fateman Joel Moses Cliff Yapp 19th September 2004.

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21MT0602	**CO1**	3	3	2	2			1	2	2	3
	CO2	3	2	2	3			1	2	3	2
	CO3	3	2	3	2			2	2	3	2
	CO4	3	3	3	2			2	2	3	3

Course code	Advanced Operations Research lab	L	T	P	C
B21ST0602		**0**	**0**	**2**	**2**

Prerequisites:

Knowledge of linear algebra, basics of probability and probability distributions

Course Objectives:

1. To make students to gain practical knowledge to co-relate with the theoretical studies.
2. To prepare students to formulate real-world problems as a linear programming problem
3. To know to obtain optimal solution to a given LPP using different methods.

4. To demonstrate an understanding of transportation, assignment problems, and game problems.

Course Outcomes:

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

1. Formulate the given real problem as an LPP.
2. Obtain solutions to the given LPPs using different methods
3. Solve transportation and assignment problems
4. Demonstrate an understanding of game theory.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	P	P	P	P	P	P	P	P	PS	PS
B21ST0602	CO1	3	3	3	2	1	0	1	1	2	3
	CO2	3	2	2	3	1	0	1	3	1	2
	CO3	2	3	3	3	1	0	1	3	3	3
	CO4	3	3	2	3	1	0	1	3	3	3

Lab Experiments

(Practical's are done using MS Excel/R/Python)

1. Problems on formulation of linear programming problem (LPP)
2. Problems on graphical solution of LPP.
3. Solution of LPP - simplex algorithm
4. Solution of LPP - simplex algorithm using Big-M method
5. Solution of LPP - simplex algorithm using dual simplex method
6. Transportation problems - 1 (IBFS)
7. Transportation problems - 2 (OBFS)
8. Assignment problems
9. Game theory problems.

Text Books:

1. Churchman, C.W, Ackoff, R.L., and Arnoff, E.L. (1957). *Introduction to Operations Research*, John Wiley and Sons, New York.
2. Kanthi Swaroop, Manmohan and P.K. Gupta (2012). *Operations Research,* Sultan Chand, New Delhi.
3. Kalavathy, S.(2004). *Operations Research*, Vikas Publishing House Pvt. Ltd. New Delhi.
4. Shenoy, G.V., Srivastava, U. K., and Sharma, S.C. (2009). *Operations Research for Management, 2/e,* New Age International, New Delhi.

References:

1. Mustafi, C.K. (2006). *Operations Research: Methods and Practice*, 3/e, New Age International, New Delhi.
2. Mital, K.V. and Mohan, C. (2004). *Optimization Methods,* 3/e, New Age International, New Delhi.
3. Narag, A. S. (1970). *Linear Programming and Decision Making,* S. Chand, New Delhi.
4. Hillier, F.S. and Leiberman, G. J. (1962). *Introduction to Operations Research*, Holden Day, New
5. Taha, H.A. (2010). *Operational Research: An Introduction,* Macmillan, New York.

Course Code	Machine Learning LAB	Type	L	T	P	C	Hrs/Week
B21CP0602		HC	0	0	1.5	1.5	3

Course Objectives:

1. To demonstrate the analysis of given ore, alloy, phenol and biomolecules by titrimetric methods.
2. Exposure to prepare various standard soltutions using molarity and normality calculations.
3. Allow independently for the separation of organic compounds with the knowledge of TLC using colum chromatographic technique.
4. Analyze the spectral data to obtain the structure of the organic compound.

Course Outcomes:

1. Apply the knowledge on preparation of standard solution, estimation and separation of organic comounds using column chromatographic technique.
2. Estimate the quantitative analysis of organic and in organic compounds by titrimetric method.
3. Acquire knowledge on various titrimetric and complexometric methods in estimation of ore and organic molecules.
4. Design basic research problems in the analysis of ore, alloy and organic molecules.

Course Contents:

PART - B

1) Load the dataset from the below file and write python code to answer below exploratory analysis questions :

   a) How many observations are there in this dataset
   b) How many various features are there in the dataset
   c) How many different occupations (unique) are there in the dataset.
   d) What occupation is the most common.
   e) What is the average age of all the people in this dataset
   f) What is the average age of people in each occupation group

g) What are the occupations of the youngest and oldest people in this dataset

2) Load the dataset from the below file and write python code to answer below exploratory analysis questions :

   a) How many teams participated in this tournament
   b) List top two teams with high discipline and bottom two teams with low discipline (you can consider red and yellow cards to calculate discipline)
   c) On an average, how many yellow cards are given per team
   d) How many teams that scored more than 5 goals and which are those teams
   e) Which team is most accurate in shooting?
   f) How many teams made more fouls than their opponents?

3) Use appropriate python library to plot the below using the below dataset
   a) Plot the monthly trend of various products as line charts in a single chart.
   b) Get total number of items sold (all products together) and plot them as a line chart to show the trend
   c) Find the relationship between product 2 and product 4 using scatterplot and record your observation
   d) Plot a stacked bar chart and grouped bar chart to show monthly trend in the product sales

4) Write python code for calculating various regression errors/error metrics such as SSE, MSE, RMSE and R2 score. The function should take actual target values and predicted targets from the model as input and return these error metrics as output

5) Create a regression model for the below dataset and predict insurance charges the user has to pay. Use appropriate model selection techniques and use the solution from above (question3) to calculate various error metrics for training and testing datasets and explain the findings.

6) Construct a ID3 decision tree model manually from the given dataset (use entropy or gini value as the criterion of impurity). Explain the steps. Also find the most important feature based on information gain.

7) Build a supervised classification model to predict the iris flower variety using the below dataset. Use appropriate algorithm and model selection techniques. Calculate various error metrics for training and testing datasets and explain the findings.

8) Write a python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Use appropriate model selection techniques. Explain your findings with use of a confusion 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 6 Programs has to be prepared).

Mapping of Course Outcomes with programme Outcomes

Course Code	POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
B21CP0602	**CO1**	3	3	3	3			2	2	3	2
	CO2	3	3	2	3			2	2	3	1
	CO3	3	3	2	3			2	2	3	2
	CO4	2	2	3	3			2	2	3	3

CAREER OPPURTUNITIES

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

1. Willingness to learn
2. Self motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of

Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improves 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 Mathematics, Statistics and computer science 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 center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification-based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU's with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students' exchange programs for higher learning and for conducting certification programs.

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