SACRED HEART COLLEGE (AUTONOMOUS), THEVARA

KOCHI, KERALA 682013

Syllabus of Courses

Under the discipline

STATISTICS

(For Undergraduate(Honours) Degree Programmes)

Introduced from 2024-25 admission onwards

Prepared by

Board of Studies in Statistics

Sacred Heart College (Autonomous), Thevara, Kochi.

BOARD OF STUDIES IN STATISTICS
Sacred Heart College (Autonomous)
Thevara, Kochi, Kerala

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1. INTRODUCTION

The National Education Policy (NEP) 2020 envisages the revision of the Choice Based Credit System (CBCS) for instilling innovation and flexibility. It emphasizes on promoting interdisciplinary studies, introducing new subjects, and providing flexibility in courses and fresh opportunities for students. It also envisages setting up of facilitative norms for issues, such as credit transfer, equivalence etc., and a criterion-based grading system that assesses student achievement based on the learning goals for each programme.

The NEP document suggests several transformative initiatives in higher education. These include:

- Introduction of holistic and multidisciplinary undergraduate education that would help develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, ethical and moral - in an integrated manner; soft skills, such as complex problem solving, critical thinking, creative thinking, communication skills; and rigorous specialization in a chosen field(s) of learning.
- Adoption of flexible curricular structures in order to enable creative combinations of disciplinary areas for study in multidisciplinary contexts in addition to rigorous specialization in a subject
- Undergraduate degree programmes of either 3 or 4-year duration.
- The students are getting a chance to determine his/her own semester-wise academic load and will be allowed to learn at his/her pace, to the extent possible.
- Increase in the number of choices of courses available to students and the students are getting an opportunity to choose the courses of their interest from all disciplines.
- Multidisciplinary and holistic education with emphasizes on research, skill development and higher order thinking,
- Promotion of innovation and employability of the student.
- Flexibility for the students to move from one institution to another as per their choice.
- Flexibility to switch to alternative modes of learning (offline, ODL, and online learning, and hybrid modes of learning).

Outcome Based Education (OBE)

Undergraduate courses in Statistics follow the Outcome-based Education (OBE) framework. OBE is a system where all the parts and aspects of education are focused on the outcomes of the course. The students take up courses with a certain goal of developing skills or gaining knowledge and they have to complete the goal by the end of the course. Outcome-based education affirms teachers as facilitators, rather than lecturers. In this model, teachers guide the students and encourage them to develop their knowledge and skills. The undergraduate courses at the Department of Statistics, Sacred Heart College (Autonomous), Thevara provide a learning approach in which students develop analytical ability, critical thinking and research acumen over different situations.

Programme Outcomes:

The Undergraduate Programme Outcomes (POs) are as follows:

PO 1: Critical thinking and Analytical reasoning

- Critical thinking guides the assessment and judgment of information, while analytical reasoning involves specific methods for analysis and conclusion drawing. It includes the ability to assess evidence, identify assumptions, formulate coherent arguments, understand complex relationships, and evaluate practices and theories critically. Additionally, critical sensibility involves self-awareness and reflection on personal and societal experiences.

PO 2: Scientific reasoning and Problem solving

- Capacity to interpret and draw conclusions from data, critically evaluate ideas and evidence with an open-minded perspective; ability to apply learned competencies to solve unfamiliar problems and apply knowledge to real-life situations, avoiding mere replication of curriculum content.

PO 3: Effective communication and leadership skill

- Proficiency in expressing thoughts verbally and non-verbally, utilizing appropriate communication media. Confidently sharing ideas, active listening, analytical reading and writing and presenting complex information clearly to diverse groups. Effective teamwork and leadership skills, including setting direction, inspiring vision, building and motivating teams, and guiding them efficiently towards common goals.

PO 4: Social consciousness and responsible citizenship

- Social consciousness involves an empathetic and informed perspective, extending beyond personal concerns to embrace a responsibility for the collective good in nation-building. It includes reflecting on the impact of research on conventional practices and a clear understanding of societal needs for inclusive and sustainable development. Responsible citizens contribute positively through civic engagement, environmental stewardship, and a commitment to social justice, abiding by laws and working for the advancement of society.

PO 5: Equity, Inclusiveness and Sustainability

- Promoting equity, inclusiveness, sustainability, and diversity appreciation. Developing ethical and moral reasoning with values of unity, secularism, and national integration for dignified citizenship. Understanding and appreciating diversity, managing differences, and using an inclusive approach. Emphasizing creating environments where diverse individuals feel valued, addressing present needs without compromising future generations' ability to meet their own needs, considering environmental, economic, and social factors.

PO 6: Moral and Ethical Reasoning

- Possessing the capacity to embody moral and ethical values in personal conduct, articulating positions and arguments on ethical matters from diverse perspectives, and consistently applying ethical practices in all endeavours. Proficient in recognizing and addressing ethical issues pertinent to one's work, steadfastly steering clear of any unethical behaviour.

PO 7: Networking and Collaboration

- Cultivating networking skills in education entails establishing meaningful professional connections and relationships among educators, administrators, and stakeholders. It also involves fostering cooperative efforts among individuals, institutions, and research organizations within the educational realm. These practices are indispensable for nurturing a supportive, innovative, and dynamic learning environment.

PO 8: Lifelong Learning

- Cultivating the ability to continually acquire knowledge and skills, including the art of "learning how to learn," becomes paramount for lifelong learning. This self-paced and self-directed approach serves personal development, aligns with economic, social, and cultural objectives, and facilitates adaptation to evolving workplace demands through skill development and reskilling. It equips individuals with competencies and insights, allowing them to adeptly respond to society's changing landscape and enhance their overall quality of life. Lifelong learning extends beyond formal education, embracing diverse informal and non-traditional learning experiences.

2. REGULATIONS FOR UNDERGRADUATE (HONOURS) DEGREE PROGRAMMES

PREAMBLE

Sacred Heart College (Autonomous), Thevara, Kochi is a grant-in-aid private college affiliated to Mahatma Gandhi University, Kottayam, Kerala. The College was established in 1944 as a higher educational institute for men on the basis of the minority rights. It started admitting girls in 1975 and currently serves all sections of the society without any discrimination of caste or creed.

The College was granted Autonomous Status by the University Grants Commission (UGC) in 2014.

Vision and Mission of the Institution

The vision of the College aims at the formation of holistic individuals who would champion the cause of justice, love, truth and peace. To this effect, Sacred Heart College envisions the **"Fashioning of an enlightened society founded on a relentless pursuit of excellence, a secular outlook on life, a thirst for moral values as well as an unflinching faith in God."** It seeks the creation of a world, guided by divine wisdom, governed by moral principles, inclusive by secular outlook and united by the principle of equity.

The Mission of the Institution is to provide an environment that

- facilitates the holistic development of the individual
- enables the students to play a vital role in the nation-building process and contribute to the progress of humanity
- disseminates knowledge even beyond academia
- instils in the students a feel for the frontier disciplines, and
- cultivates a concern for the environment

by setting lofty standards in the ever-evolving teacher-learner interface.

Framing of the Regulations

As part of the implementation of the National Education Policy 2020 (NEP 2020), the University Grants Commission (UGC) has issued the Curriculum and Credit Framework for Undergraduate Programmes 2023 (CCFUP) which would provide a flexible choice-based credit system, multidisciplinary approach, multiple entry and exit options, and establish three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and (c) 4-year UG Degree (Honours with Research).

The Kerala Higher Education Reforms Commission has recommended a comprehensive reform in the undergraduate curriculum for the 2023-24 academic year, adopting 4-year undergraduate programmes to bring Kerala's undergraduate education at par with well acclaimed universities across the globe.

The Kerala State Curriculum Committee for Higher Education has been constituted, and have proposed a model Kerala State Higher Education Curriculum Framework (KSHECF) for Undergraduate Education.

Further, an Academic Committee and various sub committees were constituted for the implementation of the Regulations. The Academic Committee submitted the draft regulations on 15-03-2024, namely**: THE SACRED HEART COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {SHC-UGP (Honours)}** under the New Curriculum and Credit Framework, 2024.

REGULATIONS

Short Title and Commencement

i. These Regulations may be called THE SACRED HEART COLLEGE (AUTONOMOUS) UNDERGRADUATE PROGRAMMES (HONOURS) REGULATIONS, 2024 {SHC-UGP (Honours)} under the New Curriculum and Credit Framework 2024.
ii. These Regulations will come into effect from the academic year 2024-2025 and will have prospective effect.

Scope and Application

i. These Regulations shall apply to all Undergraduate programmes under various Faculties conducted by THE SACRED HEART COLLEGE (AUTONOMOUS) for the admissions commencing in the academic year 2024-2025.
ii. Every programme conducted under the SHC-UGP shall be monitored by an SHC-UGP Academic Committee comprising members nominated by the Principal.

Definitions

Unless used in a context otherwise specified,

i. College means THE SACRED HEART COLLEGE (Autonomous), a grant-in-aid private college affiliated to Mahatma Gandhi University, Kottayam, Kerala.
ii. 'University' means the MAHATMA GANDHI University which is the affiliating University of Sacred Heart College (Autonomous).
iii. FYUGP means Four Year Undergraduate Programme.
iv. Academic Year: Two consecutive (one odd and one even) semesters followed by a vacation in one academic year.
v. Academic Coordinator/Nodal Officer: Academic Coordinator/Nodal Officer is a faculty nominated by the college council to co-ordinate the effective conduct of the FYUGP including Continuous Comprehensive Assessment (CCA) undertaken by various departments within the college. She/ he/ they shall be the convenor for the College level Academic Committee.
vi. Academic Week: A unit of five working days in which the distribution of work is organized, with at least five contact hours of one-hour duration on each day.
vii. Academic Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. It is defined both in terms of student efforts and teacher's efforts. A course which includes one hour of lecture or tutorial or minimum 2 hours of lab work/ practicum work/ field work per week is given one credit hour. Accordingly, one credit is equivalent to one hour of lecture or tutorial or two hours of lab work/ practicum work/ field work/ practicum and learner engagement in

terms of course related activities (such as seminars preparation, submitting assignments, group discussion, recognized club-related activities etc.) per week. Generally, a one credit course in a semester should be designed for 15 hours Lecture/ tutorials or 30 hours of practicum/ field work/ practicum and 30 hours learner engagement.

viii. Academic Bank of Credits (ABC): An academic service mechanism as a digital/ virtual entity established and managed by Government of India to facilitate the learner to become its academic account holder and facilitating seamless learner mobility, between or within degree-granting Higher Education Institutions (HEIs) through a formal system of credit recognition, credit accumulation, credit transfers and credit redemption to promote distributed and flexible process of teaching and learning. This will facilitate the learner to choose their own learning path to attain a Degree/ Diploma/ Certificate, working on the principle of multiple entry and exit, keeping to the doctrine of anytime, anywhere, and any level of learning.

ix. Credit Accumulation: The facility created by ABC in the Academic Credit Bank Account (ABA) opened by the learner across the country in order to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs.

x. Credit Recognition: The credits earned through eligible/ partnering HEIs and transferred directly to the ABC by the HEIs concerned.

xi. Credit Redemption: The process of commuting the accrued credits in the ABC of the learner for the purpose of fulfilling the credits requirements for the award of various degrees. Total credits necessary to fulfil the criteria to get a degree shall be debited and deleted from the account concerned upon collecting a degree by the learner.

xii. Credit Transfer: The mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed credits to individual's registered with ABA in adherence to the UGC credit norms for the course(s) registered by the learner in any HEIs within India.

xiii. Credit Cap: Maximum number of credits that a student can take per semester, which is restricted to 30.

xiv. Continuous Comprehensive Assessment (CCA): The mechanism of evaluating the learner by the course faculty at the institutional level.

xv. End Semester Evaluation (ESE): The mechanism of evaluating the learner at the end of each semester.

xvi. Audit Course: a course that the learner can register without earning credits, and is not mandatory for completing the SHC-UGP. The student has the option not to take part in the CCA and ESE of the Audit Course. If the student has 75% attendance in an Audit Course, he/she/they is eligible for a pass in that course, without any credit (zero-credit).

xvii. Courses: refer to the papers which are taught and evaluated within a programme, which include lectures, tutorials, laboratory work, studio activity, field work, project work, vocational training, viva, seminars, term papers, presentations, assignments, self-study, group discussion, internship, etc., or a combination of some of these elements.

xviii. Choice Based Credit System (CBCS) means the system wherein students have the option to select courses from the prescribed list of courses.

xix. College-level Academic Committee: Is a committee constituted for the FYUGP at the college level comprising the Principal as the Chairperson, the Academic Co-ordinator/ Nodal Officer as its convenor.

xx. Academic Co-ordinator/ Nodal Officer: A senior faculty member nominated by the college council.

xxi. Course Faculty: A faculty member nominated by the Head of the Department shall be in charge of offering a particular course in a particular semester of FYUGP.

xxii. Department means any teaching department in a college offering a course of study approved by the College as per the regulations of the college and it includes a Department, Centre, or School of Teaching and Research conducted directly by the College.

xxiii. Board of Studies (BoS) means the academic body duly constituted to frame the syllabus of each department.

xxiv. Senior Faculty Advisor (SFA) is a faculty nominated by a Department Council to co-ordinate all the necessary work related to FYUGP undertaken in that department, including the continuous comprehensive assessment.

xxv. Department Council means the body of all teachers of a department in a college.

xxvi. Faculty Adviser (FA) means a teacher from the parent department nominated by the Department Council to advise students in academic matters.

xxvii. Graduate Attributes means the qualities and characteristics to be obtained by the graduates of a programme of study at the College, which include the learning outcomes related to the disciplinary areas in the chosen field of learning and generic learning outcomes. The College will specify graduate attributes for its programmes.

xxviii. Programme means the entire duration of the educational process including the evaluation leading to the award of a degree.

xxix. Programme Pathway: Combination of courses that can be chosen by a student that give options to pursue interesting and unconventional combinations of courses drawn from different disciplinary areas, like the sciences and the social sciences/ humanities. The pathways could be in terms of major- minor options with different complementary/ allied disciplines.

xxx. Regulatory Body means University Grants Commission (UGC), All India Council for Technical Education (AICTE), National Assessment and Accreditation Council (NAAC) and National Board of Accreditation (NBA) etc.

xxxi. Signature Courses: Signature courses are the specialized Discipline Specific Elective courses or skill-based courses designed and offered by the regular/ ad hoc/ visiting/ emeritus/ adjunct faculty member of a particular college with the prior recommendation of the BoS and the approval of Academic Council of the College.

xxxii. Letter Grade or simply ‘Grade’ in a course is a letter symbol (O, A+, A, B+, B, C, P, F, and Ab). Grade shall mean the prescribed alphabetical grade awarded to a student based on their performance in various examinations. The Letter grade that corresponds to a range of CGPA.

xxxiii. Grade Point: Each letter grade is assigned a ‘Grade point’ (G) which is an integer indicating the numerical equivalent of the broad level of performance of a student in each course. Grade Point means point given to a letter grade on 10-point scale.

xxxiv. Semester Grade Point Average (SGPA) is the value obtained by dividing the sum of credit points obtained by a student in the various courses taken in a semester by the total number of credits in that semester. SGPA shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.

xxxv. Credit Point (P) of a course is the value obtained by multiplying the grade point (G) by the credit (C) of the course: P = G x C

xxxvi. Cumulative Grade Point Average (CGPA) is the value obtained by dividing the sum of credit points in all the semesters earned by the student for the entire programme by the total number of credits in the entire programme and shall be rounded off to two decimal places.

xxxvii. Grade Card means the printed record of students' performance, awarded to them.

xxxviii. Words and expressions used and not defined in this regulation, but defined in the Mahatma Gandhi University Act and Statutes, being the Act and Statues of Sacred Heart College (Autonomous)'s affiliating University shall have the meaning assigned to them in the Act and Statutes.

Features and Objectives of SHC-UGP

The features and objectives of the SHC-UGP shall be:

i. The features, meaning, and purpose of FYUGP shall be as stipulated by the UGC and as adapted by the Kerala State Higher Education Curriculum Framework (KSHECF) for undergraduate education.

ii. The practice of lateral entry of students to various semesters exists, but an exit with a Degree shall be awarded only upon successful completion of 133 credits as per the conditions stipulated in this regulation.

iii. FYUGP shall have three Broad Pathways, (a) 3-year UG Degree, (b) 4-year UG Degree (Honours), and (c) 4-year UG Degree (Honours with Research).

iv. Students who choose to exit after 3 years shall be awarded UG Degree in their respective Discipline/ Disciplines after the successful completion of the required minimum Courses with 133 credits.

v. A 4-year UG Degree (Honours) in the Discipline/ Disciplines shall be awarded to those who complete the FYUGP with a specific number of Courses with 177 credits including 8 credits from a graduate project/ dissertation in their major discipline.

vi. Students who acquire minimum 75% in their graduation (upto 6th semester) are eligible for Honours with Research Programme. However if necessary, College may conduct screening test for the honours with research programme in accordance with College Regulations from time to time.

vii. 4-year UG Degree (Honours with Research): Students who aspire to pursue research as a career may opt for 4-year UG Degree Honours with Research stream under FYUGP with a specific number of Courses with 177 credits including 12 credits from a research project in their major discipline.

viii. The recognized research departments or departments with at least two faculty members having PhD shall offer the Honours with Research programme. Minimum 2 students (mentees) should be allotted to a faculty member (Mentor).

ix. Students who have chosen the honours with research stream shall do their entire fourth year under the mentorship of a mentor.

x. The mentor shall prescribe suitable advanced level/capstone level courses for a minimum of 20 credits to be taken within the institutions along with the courses on research methodology, research ethics, and research topic-specific courses for a minimum of 12

credits which may be obtained either within the institution or from other recognized institutions, including online and blended modes.

xi. Students who have opted for the honours with research should successfully complete a research project under the guidance of the mentor and should submit a research report for evaluation. They need to defend successfully the research project to obtain 12 credits under a faculty member of the College. The research shall be in the Major/ allied discipline.

xii. The research outcomes of their project work may be published in peer-reviewed journals or presented at conferences or seminars or patented.

xiii. The proposed FYUGP curriculum comprises Three Broad Parts: a) Foundation Components, b) Discipline Specific Pathway components (Major/ Minor), and c) Discipline Specific Capstone Components.

xiv. The Foundation component of the FYUGP shall consist of a Set of General Foundation Courses and a Set of Discipline Specific Foundation Courses.

xv. General Foundation Courses shall be grouped into 4 major baskets as Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC), Value Addition Courses (VAC), and Multi-Disciplinary Courses (MDC).

xvi. Ability Enhancement Courses shall be designed specifically to achieve competency in English, other languages as per the student's choice with special emphasis on language and communication skills.

xvii. English or other language courses shall be designed to enable the students to acquire and demonstrate the core linguistic skills, including critical reading, academic and expository writing skills as well as the cultural and intellectual heritage of the language chosen. Separate courses will be designed for Science, Humanities and Commerce streams.

xviii. Multi-Disciplinary Courses (MDC) shall be so designed as to enable the students to broaden their intellectual experience by understanding the conceptual foundations of Science, Social Sciences, Humanities, and Liberal Arts. Students shall not be eligible to take the MDC in the same discipline that they have studied during their +2. Third semester MDC can be Kerala specific content.

xix. Skill Enhancement Courses (SEC) shall be designed to enhance 21st century workplace skills such as creativity, critical thinking, communication, and collaboration.

xx. Discipline Specific Courses shall include Discipline Specific Pathway Courses, both Major and Minor streams, enabling students to gain basic knowledge in the chosen discipline.

xxi. Discipline Specific Foundation Courses shall focus on foundational theories, concepts, perspectives, principles, methods, and critical thinking essential for taking up advanced/ Capstone Courses. Practicum courses shall be included in discipline specific foundation courses.

xxii. The curriculum of the SEC should be designed in a manner that at the end of year- 1, year-2, year-3, and year-4 students are able to meet the level descriptors for levels 5, 6, 7, and 8 of the UGC Guidelines on National Skills Qualifications Framework (NSQF). The detailed descriptors of the NSQF levels is provided as **Appendix I** below.

xxiii. Value Addition Courses (VAC) shall be so designed as to empower the students with personality development, perspective building, and self-awareness.

xxiv. Discipline Specific Pathway Components (Major/ Minor) shall provide the students with an opportunity to pursue in-depth study of a particular subject or discipline and develop competency in that chosen area, which includes Discipline Specific Core (DSC) courses and Discipline Specific Elective (DSE) courses as Major and Minor courses.

xxv. Major components consist of three types: Discipline Specific Core or the Discipline Specific Elective Courses, and the research /laboratory/ fieldwork.

xxvi. Minor Courses can be selected from any discipline that may supplement or complement the Major Courses.

xxvii. Students who complete a sufficient number of Courses in a discipline or an interdisciplinary area of study other than their chosen Major shall qualify for a Minor in that discipline or in a chosen interdisciplinary area of study.

xxviii. Major Components shall be the main focus of study. By selecting a Major, the student shall be provided with an opportunity to pursue an in-depth study of a particular discipline.

xxix. Each Board of Studies (BoS) shall identify specific Courses or baskets of Courses towards Minor Course credits. Students shall have the option to choose Courses from disciplinary/ interdisciplinary minors and skill-based courses related to a chosen programme.

xxx. Students can opt for a change of Major at the end of the second semester to any Minor discipline studied among the foundation level courses. Students also can opt for a change of Major at the end of the second semester to any MDC.

xxxi. Students should opt their 5th and 6th semester VAC and SEC from their Major disciplines only.

xxxii. Course cum Credits Certificate: After the successful completion of a semester as proof for re-entry to another institution this certificate is essential. This will help the learner for preserving the credits in the Academic Bank of Credits.

xxxiii. The Advanced Level/ Capstone Level Courses shall be designed in such a manner as to enable students to demonstrate their cumulative knowledge in their main field of study, which shall include advanced thematic specialization or internships or community engagement or services, vocational or professional training, or other kinds of work experience.

xxxiv. Advanced/ Capstone level Major Specialization shall include Courses focused on a specific area of study attached to a specific Major, which could be an Elective Course. They shall include research methodology as well.

xxxv. The student has the option to register for and attend a course without taking part in the CCA and ESE of that course. Such a course is called the Audit Course. If the student has 75% attendance in an Audit Course, he/she/they is/are eligible for a pass in that course, without any credit (zero-credit). The Audit Course will be recorded in the final grade card of the student.

xxxvi. All students shall undergo Summer Internship or Apprenticeship in a Firm, Industry or Organization; or Training in labs with faculty and researchers or other Higher Education Institutions (HEIs) or Research Institutions. The College will adhere to the guidelines on internship published by the University.

xxxvii. Students will be provided the opportunities for internships with local industries, business organizations, agriculture, health and allied sectors, Local Government institutions (such

as panchayats, municipalities), State Planning Board, State Councils/ Boards, Research Institutions, Research Labs, Library, elected representatives to the parliament/ state assembly/ panchayat, media organizations, artists, crafts persons etc. These opportunities will enable the students to actively engage with the practicum aspects of their learning and to improve their employability.

xxxviii. The College will provide opportunities for field-based learning/minor projects enabling them to understand the different socio-economic and development-related issues in rural and urban settings. The College will provide the students with opportunities for Community engagement and services, exposing them to socio-economic issues to facilitate theoretical learning in real-life contexts.

xxxix. Additional Credits will be awarded for those who actively participating in Social Activities, which may include participation in National Service Scheme (NSS), Sports and Games, Arts, participation in College union related activities (for respective elected/ nominated members), National Cadet Corps (NCC), adult education/ literacy initiatives, mentoring school students, and engaging in similar social service organizations that deemed appropriate to the College.

xl. Grace marks shall be awarded to a student for meritorious achievements in co-curricular activities (in Sports/ Arts/ NSS/ NCC etc.). Such a benefit is applicable in the same academic year spreading over two semesters, in which the said meritorious achievements are earned. The Academic Council will decide from time to time the eligibility and other rules of awarding the grace marks.

xli. Options will be made available for students to earn credit by completing quality- assured remote learning modes, including Online programmes offered on the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) or other Online Educational Platforms approved by the competent body/university from time to time.

xlii. Students shall be entitled to gain credits from courses offered by other recognized institutions directly as well as through distance learning.

xliii. For the effective operation of the FYUGP, a system of flexible academic transaction timings shall be implemented for the students and teachers.

Eligibility for Admission and Reservation of Seats

i. The eligibility for admissions and reservation of seats for various FYUG Degree Programmes shall be in accordance with the norms/ rules made by the Government/ University from time to time.

ii. No student shall be eligible for admission to FYUG Degree Programmes in any of the disciplines unless he/she/they has successfully completed the examination conducted by a Board/University at the +2 level of schooling or its equivalent.

iii. Students shall be admitted and enrolled in the respective programmes solely based on the availability of the academic and physical facilities within the institution. The College shall provide all students with a brochure detailing the Courses offered by the various departments under the various Programmes and the number of seats sanctioned by the University for each Programme.

iv. During the time of admission each student may be provided with a unique higher education student ID which may be linked with the Aadhar number of the student so that this ID can be transferred if required to other higher education institutions as well.

v. The students at the end of second semester may be permitted to change their major programme of study to any course/ institution/ university across the state. Based on the availability of seats and other facilities, the students may be permitted to opt any discipline which he/she/they had studied during the first two semesters as Discipline Specific Foundation courses/ Multidisciplinary Foundation courses. If ranking is required it will be in the order of the highest-grade points secured in the discipline to which the switching of Major is sought.

vi. Students shall be allowed to change their major programmes, if required, to a maximum of 10% of the sanctioned strength of that particular programmes depending upon the academic and infrastructural facilities available in the Institution.

vii. Depending upon the availability of academic and infrastructural facilities, the College may also admit a certain number of students who are registered for particular programmes in each semester by transfer method, if required, from other Institutions subject to conditions as may be issued by the University.

viii. A student who has already successfully completed a First-Degree Programme and is desirous of and academically capable of pursuing another First-Degree Programme may also be admitted with the prior approval of the University as per the conditions regarding programme requirements specified by the University.

ix. A Student can also be admitted for an additional major/ second major/ additional minor and on completion of the required credits he/she/they can be awarded a second major/ additional major/ minor. He/she/they may be exempted from minor pathway and general foundation course requirement.

x. The College can also enroll students in certain courses as per their choice depending upon the availability of infrastructure and other academic facilities from other recognized HEIs who are already registered for a particular programme there either through regular/ online/ distance mode irrespective of the nature of programme (Govt./ Aided/ Self-finance/ Autonomous). On successful completion of the course the credits may be transferred through the Academic Bank of Credit.

Academic Monitoring and Student Support

The academic monitoring and student support shall be in the following manner, namely

i. The College shall appoint a Senior Faculty member as Academic Co-ordinator/ Nodal officer for the smooth conduct of FYUGP.

ii. Advisory System: There shall be one Senior Faculty Advisor (SFA) for each department and one Faculty Advisor (FA) for 20 to 30 students of the class to provide advice in all relevant matters. The Head of the Department, in consultation with the SFA, shall assign FA for each student.

iii. The documents regarding all academic activities of students in a class shall be kept under the custody of the FA/ SFA.

iv. All requests/ applications from a student or parent to higher offices are to be forwarded/ recommended by FA/ SFA.

v. Students shall first approach their FA/ SFA for all kinds of advice, clarifications, and permissions on academic matters.
vi. It is the official responsibility of the institution to provide the required guidance, clarifications, and advice to the students and parents strictly based on the prevailing academic regulations.
vii. The SFA shall arrange separate or combined meetings with FA, faculty members, parents, and students as and when required and discuss the academic progress of students.
viii. The FA/ SFA shall also offer guidance and help to solve the issues on academic and non-academic matters, including personal issues of the students.
ix. Regular advisory meetings shall be convened immediately after the commencement of the semester and immediately after announcing the marks of the Continuous Comprehensive Assessment (CCA).
x. The CCA related results shall be displayed on the department notice board/ other official digital platforms of the college at least for two working days.
    a. Any concern raised by the students regarding CCA shall be looked into in the combined meetings of advisors, HOD, course faculty, and the students concerned.
    b. If the concerns are not resolved at the advisor's level, the same can be referred to the properly constituted college-level grievance redressal committees as per the existing UGC/ University/ Government norms.
    c. The Principal/ HOD shall ensure the proper redressal of the concerns raised by the students regarding CCA.
    d. If the students raise further concerns about the issue, the principal shall refer the issue to the appropriate authorities with proper documents and minutes of all the committees.
xi. The FA/ SFA shall be the custodian of the minutes and action taken reports of the advisory meetings. The SFA shall get the minutes and action taken reports of advisory meetings approved by the Head of Department and the Principal.
xii. The Principal shall inform/forward all regulations, guidelines, communications, announcements, etc. regarding student academic and other matters to the HODs/ SFA for information and timely action.
xiii. It shall be the official responsibility of the Principal to extend the required administrative and financial support to the HODs, SFAs and FAs to arrange necessary orientation programmes for students regarding student counselling, the prevailing norms, regulations, guidelines and procedures on all academic and other related matters.
xiv. An integrated educational planning and administration software will be made available by the College to manage the academic information of all students including student admissions and registration, managing students' personal and academic information, course registrations, attendance management, all process related to assessments including regular & online examinations, grading, publishing of results, supplementary examinations, LMS, stakeholders' feedback, etc.
xv. Faculty, staff, students, and parents shall be allowed to access this software system over a highly secure authenticated mechanism from within the campus.

Course Registration

i. Each department shall publish well in advance the relevant details of courses offered, such as the name, academic level, expected outcomes, time slot, and course faculty members.

ii. Students shall be allowed to visit and interact with respective faculty members during the first week of each semester, to gather more information about the courses and the availability of seats.
iii. Based on consultations and advice from the faculty adviser, each student shall complete course registration within one week from the commencement of each semester.
iv. The number of credits that a student can take in a semester is governed by the provisions in these Regulations, subject to a minimum of 16 and a maximum of 30 Credits.
v. A student can opt out of a Course or Courses registered, subject to the minimum Credit/ Course requirement, if he/she/they feels that he/she/they has registered for more Courses than he/she/they can handle, within 30 days from the commencement of the semester.
vi. The college shall publish a list of the students registered for each course including audit course, if any, along with the chosen Programmes, repeat/ reappearance courses, if any.
vii. The higher education institutions shall admit candidates not only for programmes, but also for courses.

Re-admission and Scheme Migration

i. Students who opt out before the completion of the third year shall be provided with a 'Course cum Credits Certificate' after the successful completion of a semester as proof for re-entry to another institution.
ii. Students who have successfully completed a particular programme pathway may be permitted to take an additional minor or second major.
iii. Those students who are opting for a second major are eligible for getting certain credit transfer/ credit exemption from their previous minor programs of study, subject to the prior recommendation of the BoS that, those credits are relevant for the present major programme of study.

Duration of Programme, Credits, Requirements and Options

i. Students will be offered the opportunity to take breaks during the programme and resume after the break, but the total duration for completing the FYUG programme shall not exceed 7 years.
ii. Students who wish to complete the undergraduate programmes faster may do so by completing different courses equivalent to the required number of credits and fulfilling all other requirements in N-1 semesters, where N is the number of semesters in the FYUGP.
iii. Provided further that the students may complete the undergraduate programme in slower pace, they may pursue the three years or six semester programme in 4 to 5 years (8 to 10 semesters), and four years, or eight semester programme in 5 to 6 years (10 to 12 semesters) without obtaining readmission.
iv. For students who crossed 6 semesters at a slower space, the requirement of 16 credits per semester from the institutions where they enrolled may be relaxed.

Credit Structure

The proposed number of credits per course and the credit distribution of them for the FYUG Programmes are given below:

i. An academic year shall consist of 200 working days; one semester consists of 90 working days; and an academic year consists of two semesters.
ii. Ten working days in a semester shall be used for extracurricular activities. One semester consists of 18 weeks with 5 working days per week. In each semester, 15 days (3 weeks) should be kept aside for End Semester Evaluation (ESE) and CCA.
iii. The maximum number of available weeks for curriculum transactions should be fixed at 15 in each semester. A minimum of 5 teaching or tutorial hours could be made available for a day in a 5-day week.

iv. A course that includes one hour of lecture/ tutorial or two hours of lab work/ practicum work/ field work/ practicum per week is given one credit hour.
v. One credit in a semester should be designed for 15 hours of lectures/ tutorials or 30 hours of lab work/ practicum work/ field work/ practicum and 30 hours of learner engagement in terms of course-related activities such as seminar preparation, submitting assignments, etc.
vi. A one-credit seminar or internship or studio activities or field work/ projects or community engagement and service will have two-hour engagements per week (30 hours of engagement per semester).
vii. A course can have a combination of lecture credits, tutorial credits, and practicum credits.
viii. Minimum credit for one Course should be 2 (Two), and the maximum credit should be 4 (Four).
ix. All Discipline Specific Major/ Minor Courses shall be of 4 (Four) credits.
x. For all Discipline Specific Major/ Minor Courses, there may be practicum/ practicum of two or four hours per week.
xi. All Courses under the Multi-Disciplinary, Ability Enhancement, Value Addition and Skill Enhancement categories are of 3 credits.
xii. Summer Internship, Apprenticeship, Community outreach activities, etc. may require sixty hours (or as appropriate) of engagement for acquiring one credit.
xiii. A student shall be able to opt for a certain number of extra credits over and above the requirements for the award of a degree.
xiv. Maximum number of credits that a student can earn per semester shall be restricted to 30. Hence, a student shall have the option of acquiring credits to a maximum of 180 credits for a 6-semester UG programmes and 240 credits for a 4-year (8-semester) programmes.
xv. Each faculty member shall offer a maximum of 16 credits per semester. However, those who are offering both practicum and theory courses shall offer a maximum of 12-16 credits per semester.
xvi. For a four-credit theory course, 60 hours of lecture/ tutorial class shall be assured as a mandatory requirement for the completion of that course.

Course Structure of the SHC-UGP Programme

The SHC-UGP consists of the following categories of courses and the minimum credit requirements for pathway option-one shall be as follows;

Sl. No.	**Categorization of Courses for all Programme**	**Minimum Number of Credit Required**	
1.	Major	68	88
2.	Minor	24	24+12*
3.	Multi-Disciplinary Courses (MDC)	9	9
4.	Skill Enhancement Courses (SEC)	9	9
5.	Ability Enhancement Courses (AEC)	12	12
6.	Value Addition Courses (VAC)	9	9
7.	Summer Internship, field basedlearning etc.	2	2
8.	Research Project / Dissertation		12/8**

* The students can acquire advanced/ capstone level courses with 12 credits from their DSC/ DSE/ Minor courses depending up on their pathway choice. The Minor courses can be of level 300 or above.

** The students pursuing the 4-year honours with research have to complete a project with 12 credits and for the 4-year honours degree students have to complete a project with 8 credits and DSC/ DSE capstone/ advanced level course in the 8th semester.

i. 20% syllabus of each course will be prepared by the teacher as 'Teacher Specific Content' and will be evaluated under CCA.
ii. In case of MDC, SEC, VAC courses coming under 3rd & 4th semester, college should make necessary arrangements to give adequate preference to courses designed by language departments. MDC in the 3rd semester can be Kerala Specific Content.

Academic Levels of Pathway Courses

Semester	Difficulty level	Nature of Course
1 & 2	100-199	Foundation-level or introductory courses
3 & 4	200-299	Intermediate level courses
5 & 6	300-399	Higher level courses
7 & 8	400-499	Advanced/Capstone level courses

Signature Courses

i. With a prior recommendation of BoS and the approval of academic council, each faculty member can design and offer at least one signature course in every semester, which may be offered as DSE /SEC/ VAC.
ii. The College will publish a list of signature courses in DSE/ SEC/ VAC offered by the faculty members with a prior recommendation of BoS and the approval of academic council.
iii. The College may empanel distinguished individuals who have excelled in their field of specialization like science and technology, industry, commerce, social research, media, literature, fine arts, civil services etc. as adjunct faculty as per the UGC guidelines with the approval of the College. With a prior recommendation of BoS and the approval of academic council, the adjunct faculty can offer SEC/VAC as signature course.
iv. Ad hoc/ Guest faculty/ Visiting faculty/ Visiting Scholars can also offer DSE/ SEC/ VAC as signature courses with a prior recommendation of BoS and the approval of academic council.
v. The faculty concerned may design the particular course and it should be forwarded to the concerned BoS after the approval of the Academic Committees formed as part of this regulations.
vi. The examinations and evaluation of the signature courses designed by the faculty shall be conducted by the faculty themselves and an external expert faculty chosen by the college from a panel of experts submitted by the faculty and recommend by the BoS concerned.

Programme Pathways and Curriculum Structure

Students who have joined for any programme under these regulations shall have the option to choose the following pathways for their UG degree and Honours programme.

i. **Degree with single Major**: A student pursuing the FYUG programme in a specific discipline shall be awarded a Major degree if he secures at least 50% of the total credits

in the specific discipline required for the award of the Degree in that Discipline. Example: Physics Major/ Economics Major/ Commerce Major

ii. **Degree Major with Minor**: If a student pursuing the FYUG Programme is awarded a Major Degree in a particular discipline, he/she/they are eligible to be awarded a Minor in another discipline of his choice, if he earns a minimum of 32 credits (approximately 25% of credit required for the three-year programme) from 8 pathway courses in that discipline. Example: Physics Major with Chemistry Minor/ Chemistry Major with English Minor/ Commerce Major with Economics Minor/ English Major with Functional English Minor/ Hindi Major with Malayalam Minor etc.

iii. **Major with Multiple Disciplines** of Study: This pathway is recommended for students who wish to develop core competencies in multiple disciplines of study. In this case, the credits for the minor pathway shall be distributed among the constituent disciplines/ subjects. If a student pursuing FYUG Degree Programme is awarded a major Degree in a particular discipline, he/she/they are eligible to get mentioned his core competencies in other disciplines of his choice if he has earned 12 credits from the pathway courses of that discipline. Example: Physics Major with Minors in Chemistry and Mathematics, Economics Major with Minors in History and English, Commerce Major with Minors in Economics and Statistics.

iv. **Interdisciplinary Major**: For these programme pathways, the credits for the major and minor pathways shall be distributed among the constituent disciplines/subjects to attain core competence in the interdisciplinary programme. Example: Econometrics Major, Global Studies Major, Biostatistics Major.

v. **Multi-Disciplinary Major**: For multidisciplinary major pathways, the credits for the major and minor pathways will be distributed among the broad disciplines such as Life Sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc. Example: Life Science, Data Science, Nano Science.

vi. **Degree with Double Major**: A student who secures a minimum of 50% credits from the first major will be awarded a second major in another discipline if he could secure 40% of credit from that discipline for the 3-year/ 4-year UG degree to be awarded a double major degree. Example: Physics and Chemistry Major, Economics and History Major, Economics and History Major, Commerce and Management Major.

Pathway Option 1 - Degree Major or Major with Multiple Disciplines of Study

Course Components	No. of Courses											
	Semester 1	**Semester 2**	**Semester 3**	**Semester 4**		**Semester 5#**	**Semester 6#**	**Total**	**Remarks**	**Semester 7**	**Semester 8**	**Total**
DSC A (4 Credit /Course)	1(P)	1(P)	3 (2P)	3 (2P)		5	4	17	7 Out of 17 can be opted as DSE	3	2	22
DSC B & C (4 Credit /Course)	2(P)	2(P)	1(P) (B or C)	1(P) (C or B)				6		3		9
Multidisciplinary Courses (MDC) (3 Credit /Course)	1(P)	1(P)	1*					3	*Recommended that the course offered be related to Indian Knowledge Systems or allied areas.			3
Ability Enhancement Courses (AEC) (3 Credit /Course)	1 (English) 1 (OL)	1 (English) 1 (OL)						4				4
Skill Enhancement Courses (SEC) (3 Credit /Course)				1*		1**	1**	3	*Recommended that the course may be offered by the English Department ** From DSC A only			3
Value Addition Courses (VAC) (3 Credit /Course)			1*	1*			1**	3	*Recommended that one VAC be offered by the English Department and one by Other Languages Department ** From DSC A only			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours											**12/8 (1 DSC / DSE for Honours**	
Total Courses	**6**	**6**	**6**	**6**		**6**	**6**	**36**		**6**	**2+1**	
Total Credits	**21**	**21**	**22**	**22**	**2**	**23**	**22**		**Total Credits 133**	**24**	**20**	**Total Credits 177**
Total Hours per Week	**25**	**25**	**25**	**25**		**25**	**25**		**Exit option available**	**25**	**25**	

Internship of 2 Credits

BoS can include 2 practicum courses in 5th semester and 3 practicum courses in 6th semester in any of the 6 courses distributed in each semester.

Pathway Option 2 - Major with Minor

Course Components	No. of Courses											
	Semester 1	**Semester 2**	**Semester 3**	**Semester 4**		**Semester 5#**	**Semester 6#**	**Total**	**Remarks**	**Semester 7**	**Semester 8**	**Total**
DSC A (4 Credit /Course)	1(P)	1(P)	3 (2P)	3 (2P)		4	3	15	7 Out of 15 can be opted as DSE	3	2	20
DSC B (4 Credit /Course)	2(P)	2(P)	1(P)	1(P)		1	1	8	1 Out of 8 can be opted as DSE	3		11
Multidisciplinary Courses (MDC)/ (3 Credit /Course)	1(P)	1(P)	1*					3	*Recommended that the course offered be related to Indian Knowledge Systems or allied areas.			3
Ability Enhancement Courses (AEC) (3 Credit /Course)	1 (English) 1 (OL)	1 (English) 1 (OL)						4				4
Skill Enhancement Courses (SEC) (3 Credit /Course)				1*		1**	1**	3	*Recommended that the course may be offered by the English Department ** From DSC A only			3
Value Addition Courses (VAC) (3 Credit /Course)			1*	1*			1**	3	*Recommended that one VAC be offered by the English Department and one by Other Languages Department ** From DSC Aonly			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours											**12/8 (1 DSC/ DSE for Honours**	
Total Courses	**6**	**6**	**6**	**6**		**6**	**6**	**36**		**6**	**2+1**	
Total Credits	**21**	**21**	**22**	**22**	**2**	**23**	**22**		**Total Credits 133**	**24**	**20**	**Total Credits 177**
Total Hours per Week	**25**	**25**	**25**	**25**		**25**	**25**		**Exit option available**	**25**	**25**	

Internship of 2 Credits

BoS can include 2 practicum courses in 5th semester and 3 practicum courses in 6th semester in any of the 6 courses distributed in each semester.

Pathway Option 3 - Double Major

Course Components	No. of Courses											
	Semester 1	Semester 2	Semester 3	Semester 4	Internship of 2 Credits	Semester 5#	Semester 6#	Total	Remarks	Semester 7	Semester 8	Total
DSC A (4 Credit /Course)	1(P)	1 (P)	2(2P)	2(1P)		4	3	13	7 Out of 13 can be opted as DSE	3	2	18
DSC B (4 Credit /Course)	2(P)	2(P)	2(1P)	2(2P)		1	1	10	2 Out of 10 can be opted as DSE	3		13
Multidisciplinary Courses (MDC) (3 Credit /Course)	1(P)	1(P)	1*					3	*Recommended that the course offered be related to Indian Knowledge Systems or allied areas.			3
Ability Enhancement Courses (AEC) (3 Credit /Course)	1 (English) 1 (OL)	1 (English) 1 (OL)						4				4
Skill Enhancement Courses (SEC) (3 Credit /Course)				1*		1	1	3	*Recommended that the course may be offered by the English Department			3
Value Addition Courses (VAC) (3 Credit /Course)			1*	1*			1	3	*Recommended that one VAC be offered by the English Department and one by Other Languages Department			3
Project/ Dissertation 12 credits for Honours with Research & 8 for Honours											**12/8 (1 DSC/ DSE for Honours**	
Total Courses	**6**	**6**	**6**	**6**		**6**	**6**	**36**		**6**	**2+1**	
Total Credits	**21**	**21**	**22**	**22**	**2**	**23**	**22**		**Total Credits 133**	**24**	**20**	**Total Credits 177**
Total Hours per Week	**25**	**25**	**25**	**25**		**25**	**25**		**Exit option available**	**25**	**25**	

BoS can include 2 practicum courses in 5th semester and 3 practicum courses in 6th semester in any of the 6 courses distributed in each semester.

Note: In all the above 3 tables “(P)” means courses with practicum

Guidelines for Acquiring Credit from Other Institutions/Online/Distance Mode

i. A student shall register to a minimum of 16 credit per semester from the college/ department where he/she/they officially admitted for a particular programme. However, students enrolled for a particular programme in one institution can simultaneously enroll for additional credits from other HEIs within the University or outside University subject to a maximum of 30 credits per semester including the 16 institutional credits.
ii. The College shall publish a list of courses that are open for admission for students from other institutions well in advance before the commencement of each semester.
iii. Each BoS shall prepare and publish a list of online courses at different levels before the commencement of each semester offered in various online educational platforms recognized by the Academic Council of the college, which can be opted by the students for acquiring additional credits.
iv. BoS shall prepare and publish a list of allied/ relevant pathway courses before the commencement of each semester offered by other Board of Studies that can be considered as pathway course for major/ minor for their disciplines at different levels.
v. At the end of each semester the college will include the credit acquired by the student through online courses in their semester grade card subject to a maximum of 30 credits.

Attendance

i. A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if he has completed 75% of the prescribed classroom activities in physical, online, or blended modes, including any makeup activities as specified by the course faculty of that particular course.
ii. A student is eligible for attendance as per the existing university and government orders which includes participation in a meeting, or events organized by the college or the university, a regularly scheduled curricular or extracurricular activity prescribed by the college or the university. Due to unavoidable or other legitimate circumstances such as illness, injury, family emergency, care-related responsibilities, bad or severe weather conditions, academic or career-related interviews students are eligible for authorized absence. Apart from this, all other eligible leaves such as maternity leave, and menstrual leave shall also be treated as authorized absences.
iii. The condonation facility can be availed as per the university norms.

Workload

i. The workload of a faculty who offers only lecture courses during an academic year shall be 32 credits.
ii. The workload of a faculty offering both practicum courses and theory courses may be between 24-32 credits per academic year.
iii. An academic year shall consist of two semesters.
iv. To protect the existing language workload, college should make necessary arrangements to give adequate preference to those courses designed by language departments coming under MDC, SEC and VAC of 3rd & 4th semester. It is recommended that the MDC offered in the third semester shall be based on Indian Knowledge Systems or Nation-specific topics and may be offered by the Other Languages department or any other department as may be seen fit. Additionally, the SEC in the fourth semester may be offered by the English Department and of the VACs in the third and fourth semesters, one may be offered by the Other Languages Department and the other may be offered by the English Department. These recommendations may be modified as per the recommendations of the SHC-UGP Academic Monitoring Committee.

v. Programme wise workload calculation will be as per the FYUGP workload ordinance 2024.
vi. The teachers given the administrative responsibilities in the department and college level may give a relaxation in their work load as specified in the UGC regulations 2018.

Credit Transfer and Credit Accumulation

i. The college will establish a digital storage (DIGILOCKER) of academic credits for the credit accumulation and transfer in line with ABC.

ii. The validity of credits earned shall be for a maximum period of seven (7) years or as specified in the university/ UGC regulations.The students shall be required to earn at least 50% of the credits from the College.

iii. Students shall be required to earn the required number of credits as per any of the pathway structure specified in this regulation for the award of the degree.

Outcome Based Approach

The curriculum will be designed based on Outcome Based Education (OBE) practices. The Graduate Attributes (GA) and Programme Outcomes (PO) will be defined and specified in the syllabus of each programme.

Assessment and Evaluation

i. The assessment shall be a combination of Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).

ii. 30% weightage shall be given for CCA. The remaining 70% weight shall be for the ESE.

iii. Teacher Specific Content will be evaluated under CCA.

iv. CCA will have two subcomponents Formative Assessment (FA) and Summative Assessment (SA). Each of these components will have equal weightage and to be conducted by the course faculty/ course coordinator offering the course.

v. FA refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, module or course. FA is to encourage students to build on their strengths rather than fixate or dwell on their deficits. FA can help to clarify and calibrate learning expectations for both students. FA will help students become more aware of their learning needs, strengths, and interests so they can take greater responsibility over their own educational growth. FA will be prerogative of the course faculty/ course coordinator based on specific requirement of the student.

vi. Suggestive methods of FA are as follows: (anyone or in combinations as decided by the course faculty/ course coordinator)

a. Practicum assignment
b. Observation of practicum skills
c. Viva voce
d. Quiz
e. Interview
f. Oral presentations
g. Computerized adaptive testing
h. In-class discussions

i. Group tutorial work
j. Reflection writing assignments
k. Home assignments
l. Self and peer Assessments
m. Any other method as may be required for specific course/ student by the course faculty/ course coordinator.

vii. Summative Assessments (SA) are used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period- typically at the end of a project, unit, module, course or semester. SA may be a class tests, assignments, or project, used to determine whether students have learned what they were expected to learn. It will be based on evidence, collected using single or multiple ways of assessment. The systematically collected evidences should be kept in record by course faculty/ course coordinator and the marks should be displayed on the college notice board/ other official digital platforms of the college before the End Semester Evaluations.

viii. The method of SA will be as follows: (any one as decided by the course faculty/ course coordinator)

a. Written test
b. Open book test
c. Laboratory report
d. Problem based assignments
e. Individual project report
f. Case study report
g. Team project report
h. Literature survey
i. Standardized test
j. Any other pedagogic approach specifically designed for a particular course by the course faculty/ course coordinator.

ix. A student may repeat SA only if for any compulsive reason due to which the student could not attend the assessment.

x. The prerogative of arranging a CCA lies with the course faculty/ course coordinator with the approval of SHC-UGP Academic Committee based on justified reasons.

xi. The course faculty/ course coordinator shall be responsible for evaluating all the components of CCA. However, the college may involve any other person (External or Internal) for evaluation of any or all the components as decided by the Principal/Controller of Examinations from time to time in case any grievances are raised.

xii. Written tests shall be precisely designed using a variety of tools and processes (e.g., constructed responses, open-ended items, multiple-choice), and the students should be informed about the evaluation modalities before the commencement of the course.

xiii. The course faculty may provide options for students to improve their performance through continuous assessment mechanism.

xiv. There shall be theory and practicum examinations at the end of each semester.

xv. Regarding evaluation, one credit may be evaluated for 25 marks in a semester; thus, a 4-credit course will be evaluated for 100 marks; 3-credit courses for 75 marks and 2-credit courses for 50 marks.

xvi. All examinations will be conducted by the College and will be evaluated at the College itself.

xvii. Individual Learning Plans (ILPs) and/ or specific assessment arrangements may be put in place for differently abled students. Suitable evaluation strategies including technology

assisted examinations/ alternate examination strategies will be designed and implemented for differently abled students.

Practicum Examination

i. The end semester practicum examination will be conducted and evaluated by the institution.

ii. There shall be a CCA for practicum courses conducted by the course faculty/ course coordinator.

iii. The scheme of evaluation of practicum courses will be as given below:

Components for the Evaluation of Practicum Courses	Weightage
CCA of practicum/practicum.	30%
ESE of practicum/practicum.	70%

iv. Those who have completed the CCA alone will be permitted to appear for the ESE.

v. For grievance redressal purpose, the university shall have the right to call for all the records of CCA.

vi. Duration of Examination: Questions shall be set as per the defined Outcome .The duration of the examinations shall be as follows.

Mode	Time (in Hours)
Written Examination	2
Multiple Choice	1.5
Open Book	2
Any Other Mode	2

Evaluation of Project/Dissertation

The evaluation of project work shall be CCA with 30% and ESE 70%. The scheme of evaluation of the Project is given below:

Project type	Maximum Marks	CCA	ESE
Research Project of Honours with Research (12 credits)	200	60	140
Project of Honours (8 credits)	100	30	70

Evaluation of Internship

The evaluation of internship shall be done by a committee constituted by the Department Council. The scheme of CCA and ESE is given below:

Components of Evaluation of Internship	Weightage	Marks for Internship 2 Credits/ 50 Marks
CCA	30%	15
ESE	70%	35

The department council may decide any mode for the completion of the Internship. If in case evaluation is not specified in any of the selected internship programme, institution can adopt a proper evaluation method as per the weightage specified in the table above.

Letter Grades and Grade Points

Mark system is followed for evaluating each question. For each course in the semester, letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given below,

i. The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.

ii. Based on the marks obtained, the weighted grade point will be mentioned in the student's grade cards.

Letter Grade	**Grade Point**	**Percentage of Marks (Both Internal & External Marks put together)**	**Class**
O (Outstanding)	10	95% and above	First Class with Distinction
A+ (Excellent)	9	85% and above but below 95%	
A (Very good)	8	75% and above but below 85%	
B+ (Good)	7	65% and above but below 75%	First Class
B (Above average)	6	55% and above but below 65%	
C (Average)	5	45% and above but below 55%	Second Class
P (Pass)	4	35% and above below 45% Aggregate (external and internal put together) with a minimum of 30% in external	Third Class
F (Fail)	0	Below an aggregate of 35%or below 30% in external evaluation	Fail
Ab (Absent)	0		Fail

iii. When students take audit courses, they may be given pass (P) or fail (F) grade without any credits.

Computation of SGPA and CGPA

The following method is recommended to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

iv. The SGPA is the ratio of the 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 the semester, i.e.

SGPA (Si) = Σ(Ci x Gi) / ΣCi

Where Si is the SGPA in the i^{th} semester, Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

$$\textbf{SGPA} = \frac{\text{Sum of the credit points of all courses in a semester}}{\text{Total Credits in that Semester}}$$

Illustration – Computation of SGPA

Semester	**Course**	**Credit**	**Letter Grade**	**Grade point**	**Credit Point** (Credit x Grade)
I	DSC A	4	A	8	4 x 8 = 32
I	DSC B	4	B+	7	4 x 7 = 28
I	DSC C	4	B	6	4 x 6 = 24

I	MDC	3	B	6	3 x 6 = 18
I	AEC 1	3	O	10	3 x 10 = 30
I	AEC 2	3	C	5	3 x 5 = 15
	Total	21			147
	SGPA				147/21 = 7

The CGPA is also calculated in the same manner considering all the courses undergone by a student over all the semesters of a programme, i.e.

$$\textbf{CGPA} = \frac{\text{Sum of the credit points of all courses in six or eight semesters}}{\text{Total Credits in Six (133) or Eight (177) semesters}}$$

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

Implementation and Monitoring of SHC-UGP

i. The implementation and monitoring of SHC-UGP will be carried out by duly appointed bodies/committees of the college such as the Academic Council, the various Boards of Studies and the Academic Monitoring Committee.

ii. Academic Council

Among its other functions, the Academic Council of the College shall:

i. Scrutinize and approve all the proposals submitted by the Board of Studies of each Department with regard to the SHC-UGP details such as, academic pathways, allowed syllabi enrichment/ updating, details of elective courses, Online courses, blended teaching, courses offering to the students of other HEIs, panel of examiners, summative and formative evaluation tools proposed by the course faculty concerned, new courses and syllabus proposed by the faculty members as signature courses etc.
ii. The Academic Council can differ on any proposal and it shall have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving sufficient reasons to do so.
iii. Undertake the scrutiny of all documents related to Teacher Specific Content.
iv. Recommend to the College Governing Council for starting innovative programmes using the flexibility and holistic nature of the SHC-UGP curriculum frame work.

iii. Board of Studies

Among its other functions, the Board of Studies of each Department shall:

i. Prepare teacher specific content of syllabi for various courses keeping in view the objectives of the SHC-UGP and submit the same for the approval of the Academic Council.
ii. Scrutinize the signature course content and its evaluation techniques.
iii. Suggest methodologies for innovative teaching and evaluation techniques.
iv. Suggest panel of examiners to the Office of the Controller of Examinations.
v. Coordinate research, teaching, extension and other academic activities in the department.

iv. SHC-UGP Academic Monitoring Committee

The SHC-UGP Academic Monitoring Committee shall be constituted under the Chairmanship of the Principal, with the Academic Coordinator as the Convenor,

shall be entrusted to oversee the implementation and monitoring of the SHC-UG programme.

i. The Academic Monitoring Committee will collect and whet the proposals submitted by the Board of Studies of each Department with regard to the SHC-UGP and duly forward them to the Academic Council.
ii. It will oversee and coordinate the activities undertaken for the successful implementation of SHC-UGP in the College and will function as an advisory body in such matters.

Power to Remove Difficulties

If any difficulty arises in giving effect to the provisions of these Regulations, the Principal may by order make such provisions which appears to him/her to be necessary or expedient for removing the difficulty. Every order made under this rule shall be subject to ratification by the appropriate authorities.

Modifications to the Regulations

Notwithstanding anything contained in these Regulations, any amendments or modifications issued or notified by the University Grants Commission or the State Government or the Mahatma Gandhi University from time to time, shall be incorporated into these Regulations by the appropriate regulatory bodies of the College and shall constitute an integral part thereof.

SYLLABUS INDEX

SEM	Course Code	Course Title	Course Level	Credit	Hours per Week	
					Theory	*Practicum*
DISCIPLINE SPECIFIC COURSES (DSC)						
I	24USTADSC101	Fundamentals Of Statistics and Data Visualisation	100-199	4	3	2
II	24USTADSC102	Theory Of Random Variables and Statistical Distributions	100-199	4	3	2
II	24USTADSC103	Statistics For Computational Analysis.	100-199	4	3	2
III	24USTADSC201	Data Analysis in Inferential Statistics Using R/Python	200-299	4	3	2
III	24UDSCSTA202	Statistical Tools for Decision Making	200-299	4	3	2
IV	24UDSCSTA203	Statistical Tools for Qualitative Research	200-299	4	3	2
V	24USTADSC301	Sample Survey Analysis and Design of Experiments	300-399	4	3	2
VI	24USTADSC302	Time Series Analysis and Stochastic Processes	300-399	4	3	2
VII	24UDSCSTA401	Multivariate Data Analysis	400-499	4	3	2
VIII	24USTADSC402	Analytical Tools for Multivariate Analysis and Multivariate Distributions	400-499	4	3	2
MULTIDISCIPLINARY COURSES (MDC)						
I/II	24USTAMDC101	Introduction to Elementary Statistics	100-199	3	2	2
III	24USTAMDC201	Statistical Data Analysis Using Excel/R	200-299	3	0	0
SKILL ENHANCEMENT COURSES (SEC)						
IV	24USTASEC201	Data Analysis Using SPSS/R	200-299	3	2	2

3. SYLLABUS FOR DISCIPLINE SPECIFIC COURSES IN STATISTICS

DSC - 01

Discipline	Statistics
Semester	I
Type of Course	DSC
Course Code	24USTADSC101
Course Title	Fundamentals of Statistics and Data Visualisation
Course Level	100-199
Course Summary	This course helps to acquire foundational knowledge of various types of data, Descriptive Statistics, probability theory, correlation and regression and their real world applications. Additionally, R programming built-in functions/Excel is used to address numerical challenges associated with the topics discussed
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO
1	Explain and understand the concepts of different type of data, sampling and sampling techniques.	Understand	1
2	Summarise data using various measure of central tendency, dispersion, skewness and Kurtosis.	Apply	1,2
3	Analyse relationship between variables using scatter diagrams, correlation coefficients and regression analysis	Analyse	1,2
4	Develop skills in solving real world problems through the applications of regression techniques, particularly in predicting outcomes and understanding the limitations of prediction.	Analyse	1,2
5	Explain basic Probability concepts, including random experiments sample space and elementary ideas of probability. Apply Bayes' theorem to update probabilities based on new information and evidence.	Apply	1,2
6	Apply using R or Excel to illustrate and analyse statistical concepts, enhancing practical skills.	Analyse	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.

1	**Data and Variables (17 hours)**			
	1.1	Types of data and variables: concepts of primary data and secondary data, Examples of univariate and bivariate data type	3	1
	1.2	Diagrams and Graphs	4	1
	1.3	Scales of measurements- Ordinal, Nominal, Ratio, Interval.	2	1
	1.4	Population and sample, Types of sampling. Non-probability and probability Sampling. Simple random sampling, systematic sampling, stratified sampling and cluster sampling with real life examples	4	1
	1.5	Measures of central tendency- mean, median, mode (Examples using raw data).	4	2
2	**Measures of Dispersion and Moments (12 hours)**			
	2.1	Measures of dispersion-Range, QD, MD, SD. Box Plot.	5	2
	2.2	Relative measure of Dispersion- Coefficient of variation	1	2
	2.3	Moments - Raw and central moments	3	2
	2.4	Skewness and Kurtosis with examples	3	2
3	**Correlation and Regression (8 hours)**			
	3.1	Correlation, Scatter diagram, Karl Pearson's correlation coefficient, Rank Correlation	4	3
	3.2	Regression- Two types of regression lines, Problems on prediction	4	4
4	**Elementary Probability Theory (8 hours)**			
	4.1	Random experiment-Sample space- Event, Examples	2	5
	4.2	Elementary ideas of probability – Classical and Axiomatic definitions with examples. Addition theorem of probability with proof for 2 and n events	3	5
	4.3	Conditional probability, Independence of events, Bayes' theorem with proof, Examples	3	5
5	**Practicum (30 Hours)**			
	5.1	Using MS Excel, plot diagrams and graphs. solve numerical problems in measures of central tendency using Excel/R software	8	6
	5.2	Numerical problems in measures of dispersion and obtain different measures of skewness and kurtosis.	8	6

	5.3	Draw regression lines using Excel, Numerical examples on correlation and regression	6	4
	5.4	Numerical examples of theory of probability	8	5

References:

1. Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Gupta, S.P., Statistical Methods. Sultan Chandand Sons: NewDelhi.
3. Medhi, J. Statistical Methods, 2nd Edition, New Age International Pulbishers, 2006.
4. Mukhopadhyay, P (1999) Applied Statistics, New Central Book Agency Private Limited, Kolkata.
5. Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh. (2009) Statistics Using R, 2nd edition, Narosa Publishing Ho Book Agency Private Limited, Kolkata, use.
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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 02

Discipline	Statistics
Semester	II
Type of Course	DSC
Course Code	24USTADSC102
Course Title	Theory of Random Variables and Statistical Distributions
Course Level	100-199
Course Summary	To acquire the basic knowledge of random variable theory and various distribution functions and its applications. To acquire the basic knowledge of statistical distributions and their applications.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Examine major components of random variable theory and distribution theory.	Understand	1
2	Explain bivariate random variable, joint probability distribution functions and their properties	Apply	1,2
3	Explain the concept of expectation and its properties. Explain the concept of Moment generating functions and Characteristic function	Analyze	1,2
4	Develop skills required to effective understanding of various distributions.	Analyze	1,2
5	Analyse several applications and advantages of distributions	Apply	1,2
6	R programming for Statistical Computing.	Analyze	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Random Variable theory (15 Hours)**			
	1.1	Describe univariate random variables in discrete and continuous cases.	3	1
	1.2	Demonstrate probability mass function, probability density function and their properties, Describe distribution function	3	1

		of a random variable and its properties		
	1.3	Demonstrate functions of random variable, transformation of random variable (univariate)	3	1
	1.4	Describe bivariate random variable, demonstrate joint probability mass function and joint probability density function and their properties,	3	2
	1.5	Demonstrate marginal and conditional distributions (bivariate case), Demonstrate independence of random variables (bivariate case).	3	2
2	**Mathematical Expectation (8 hours)**			
	2.1	Demonstrate mathematical expectation, its properties and simple problems.	4	3
	2.2	Describe Central Tendency and Dispersion measures in terms of expectation	2	3
	2.3	Describe generating functions – moment generating function, characteristic function, their properties	2	3
3	**Discrete Probability Distributions (12 hours)**			
	3.1	Discrete uniform distribution and Bernoulli distribution	3	4
	3.2	Explain Binomial distribution and derive its characteristics. Fitting of binomial distribution.	3	4,5
	3.3	Explain Poisson distribution and derive its characteristics, Fitting of Poisson distribution	3	4,5
	3.4	Explain Geometric distribution , its characteristics and lack of memory property	3	4,5
4	**Continuous Probability Distributions (10 hours)**			
	4.1	Explain continuous uniform distribution and its characteristics	1	4
	4.2	Explain exponential distribution, gamma distribution and their characteristics. Derive lack of memory property of exponential distribution.	4	4,5
	4.3	Explain normal distribution and derive its properties.	3	4,5
	4.4	Discuss standard normal distribution and use of standard normal tables. Fitting of normal distribution.	2	4,5
5	**Practicum (30 Hours)**			
	5.1	Numerical examples of Random Variable(Univariate, Bivariate), Marginal distributions, and problems on	8	6

		independence.		
	5.2	Numerical examples of mathematical expectation, M.G.F, and characteristic function	6	6
	5.3	Numerical examples of uniform Bernoulli Binomial, Poisson and Geometric distribution	8	4
	5.4	Numerical examples of Exponential, Gamma, Normal and Standard Normal.	8	5

References

1. Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Gupta, S.P., Statistical Methods. Sultan Chandand Sons: NewDelhi.
3. Medhi, J. Statistical Methods, 2nd Edition, New Age International Pulbishers, 2006
4. Mukhopadhyay, P (1999) Applied Statistics, New Central Book Agency Private Limited, Kolkata.
5. Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh. (2009) Statistics Using R, 2nd edition, Narosa Publishing Ho Book Agency Private Limited, Kolkata, use.
6. Tilman M. Davies. (2016) The Book of R, A First Course in R Programming and Statistics, No Starch Press

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 03

Discipline	Statistics
Semester	II
Type of Course	DSC
Course Code	24USTADSC103
Course Title	Statistics for Computational Analysis
Course Level	100-199
Course Summary	This course helps to acquire foundational knowledge of various types of data, Diagrammatic and graphical representation of data Descriptive Statistics, probability theory, correlation and regression and time series analysis.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Different type of data, sampling and sampling techniques	Understand	1
2	Diagrams and Graphs	Apply	1, 2
3	Summarise data using various measure of central tendency	Apply	1, 2
4	Summarise data using the various measure of Dispersion	Analyze	1, 2
5	Bivariate data analysis- correlation and regression analysis	Analyze	1, 2
6	Explain different approaches to probability- Statistical, Classical and Axiomatic	Apply	1
7	Determine trend in time series data using different methods.	Understand	2
8	Compute seasonal indices	Evaluate	5

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Statistics - Introduction (11 Hours)**			
	1.1	Population and sample, Census and Sampling, Advantages of sampling compared to census.	4	1
	1.2	Different sampling techniques- SRS, Stratified sampling and systematic sampling	3	1
	1.3	Diagrams and graphs- bar diagram, pie diagram, histogram, frequency curve, ogives	4	1

2	**Descriptive Statistics (12 hours)**			
	2.1	Measures of central tendency- mean, median, mode, harmonic mean and geometric mean, properties, merits and demerits and partition values- quartiles, deciles, percentiles.	4	2
	2.2	Measures of dispersion- range , quartile deviation, Standard deviation and relative measures- merits and demerits	3	2
	2.3	Introduction to Correlation and regression, Types of correlation, Scatter diagram, Pearson's coefficient of correlation , Rank correlation.	2	2
	2.4	Regression equations and their estimation. Coefficient of determination, Linear regression (Two variables case).	3	2
3	**Basic Probability Theory (12 Hours)**			
	3.1	Basic Probability concepts, including random experiments sample space and elementary ideas of probability.	4	4
	3.2	Different approaches to probability, addition theorem, multiplication theorem, independence of events	4	4
	3.3	Baye's theorem and applications	4	4
4	**Time series Analysis (10 Hours)**			
	4.1	Introduction to Time series data, Components of a time series data.	3	5
	4.2	Determination of trend using semi average, Moving average and curve fitting methods;	4	5
	4.3	Computation of seasonal indices	3	5
5	**Practicum (30 hours)**			
	5.1	Drawing diagrams and graphs for the given data.	15	5
	5.2	Numerical problems on central tendency, dispersion and correlation and regression	15	5
	5.4	Problems based on probability	5	5
	5.5	Computation of trend and seasonal indices.	5	5
5	**Teacher specific course components**			

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	A. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 04

Discipline	Statistics
Semester	III
Type of Course	DSC
Course Code	24USTADSC201
Course Title	Data Analysis in Inferential Statistics Using R/Python
Course Level	200-299
Course Summary	This course covers key concepts in Statistics including sampling distribution, Estimation of parameters, Testing of hypothesis Emphasis is placed on practical applications using R or Python.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Sampling Distributions	Learning Domains *	PO
1	Explain different Sampling Distributions.	Understand	1
2	Describe estimation. Examine properties of a good estimator.	Apply	1
3	Construct confidence intervals for parameters.	Analyze	1,2
4	Understand basic concepts of statistical hypotheses and their applications.	Apply	1
5	Evaluate two types of errors, power of a test and obtain power function.	Evaluate	1,2
6	Explain various parametric test procedure and performing various parametric tests	Analyse	1,2
7	Conduct data analysis using R/ PythonI	Evaluate	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Sampling Distributions (12 hours)**			
	1.1	Derivation of the sampling distribution of sample mean for a normal population, standard errors of sample mean and sample variance.	3	1
	1.2	$\chi 2$ distribution- p.d.f. with n degrees of freedom, properties, assumptions and applications	3	1

	1.3	Student's t- distribution - p.d.f., properties	3	1
	1.4	Snedecor's F- distribution: p.d.f., Distribution of 1/F .properties. Relationship between t, F and $\chi 2$ distributions	3	2
2	**Estimation of Parameters - I (10 hours)**			
	2.1	Types of Estimation - Point Estimation and interval estimation.	3	3
	2.2	Desirable properties of Point Estimator.	2	3
	2.3	Interval estimation- Confidence interval for the mean, difference of means, variance ratio of variances and proportion	5	3
3	**Statistical Inference - I (14 hours)**			
	3.1	Testing of hypothesis- Statistical test. Null and Alternative hypothesis, Types of errors	2	4
	3.2	Significance level, power. Critical Region, P value.	2	4,5
	3.3	Small sample tests – Z-test,, t- test.	4	4,5
	3.4	Chi-square test for testing variance and F test for testing equality of variances.	4	4,5
	3.5	Paired t test.	2	4,5
4	**Statistical Inference - II (9 hours)**			
	4.1	Large Sample test- Z test for testing population means, equality of population means.	1	4
	4.2	Testing population proportion, equality of two population proportions;	4	4,5
	4.3	Chi-Square test - goodness of fit, test of independence;	4	4,5
5	**Practicum (30 hours)**			
	5.1	Numerical problems on sampling distribution.	8	6
	5.2	Numerical examples of Desirable Properties of point estimation	6	6
	5.3	Problem solving- Calculation of significance level, Power, Testing of hypothesis using small samples test using R/python	8	4
	5.4	Problem solving – Testing of hypothesis using large sample test using R/Python	8	5

References

1. Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

2. Gupta, S.P., Statistical Methods. Sultan Chandand Sons: NewDelhi.

3. Medhi, J. Statistical Methods, 2nd Edition, New Age International Pulbishers, 2006

4. Mukhopadhyay, P (1999) Applied Statistics, New Central Book Agency Private Limited, Kolkata.

5. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007) Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

6. John E Freund, Mathematical Statistics, Pearson Edn, New Delhi

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 05

Discipline	Statistics
Semester	III
Type of Course	DSC
Course Code	24USTADSC202
Course Title	Statistical Tools for Decision Making
Course Level	200-299
Course Summary	This course covers key concepts in Statistics including sampling distribution, Estimation of parameters, Testing of hypothesis Emphasis is placed on practical applications using R/Excel.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Estimate probability of events using relevant distributions	Apply	1
2	Estimate the confidence interval for parameters of a distribution	Apply	1
3	Test statistical hypothesis using large samples	Apply	1,2
4	Test statistical hypothesis using Small samples	Apply	1
5	Calculate confidence intervals and test hypothesis using Excel/R/SPSS	Apply	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Sampling Distributions (8 Hours)**			
	1.1	Statistic and Sampling distributions, standard error, sampling distribution of mean and Variance	3	1
	1.2	Chi-square, t and F - Definition, Statistics following these distributions, Use of tables for calculation of probabilities	3	1
	1.3	Inter relations between Chi-square, t and F distributions	2	1
2	**Estimation (12 hours)**			
	2.1	Estimation, definition, types of estimation, Point and interval estimation	2	2

	2.2	Desirable properties of point estimates	1	2
	2.3	Interval estimation, confidence level, confidence interval,	1	2
	2.4	Confidence interval for mean of a population with known and unknown standard deviation for large and small samples	2	2
	2.5	Confidence interval for difference of two population means with known and unknown standard deviation for large and small samples	2	2
	2.6	Confidence interval for proportion of a population	2	2
	2.7	Confidence interval for difference of two population proportions	2	2
3	**Testing of Hypothesis – I (07 hours)**			
	3.1	Testing, hypothesis, types of hypothesis - Null and alternate hypothesis, simple and composite	2	3
	3.2	Errors in testing, Types of errors, significance level, power, p value, Critical region and acceptance region, One tailed and two tailed tests	2	3
	3.3	Logic of hypothesis test using sample, steps for hypothesis testing using critical value approach, steps for hypothesis testing using P value approach,	3	3
4	**Testing of Hypothesis – II (18 hours)**			
	4.1	Testing the significance of mean of a population with known and unknown standard deviation for large and small samples	3	3 , 4
	4.2	Testing the significance of difference of two population means with known and unknown standard deviation for large and small samples	3	3, 4
	4.3	Testing the significance of proportion of a population	3	3
	4.4	Testing the significance of difference of two population proportions	3	3
	4.5	Paired sample t test	2	4
	4.6	Testing the significance of variance of a population	2	4
	4.7	Testing the significance of difference of two population variances	2	4
5	**Practicum (30 hours)**			
	5.1	Calculation of standard error using Excel/R/SPSS	5	5
	5.2	Construction of confidence interval for population mean and difference of two population means using Excel/R/SPSS	5	5
	5.3	Construction of confidence interval for population proportion and difference of two population proportions using Excel/R/SPSS	5	5

	5.4	Test the hypothesis regarding mean and difference between means of two populations using Excel/R/SPSS	5	5
	5.5	Test the hypothesis regarding proportion and difference between proportions of two populations using Excel/R/SPSS	5	5
	5.6	Test the hypothesis regarding variance and difference between two population variances using Excel/R/SPSS	5	5

References

1. S.C. Gupta and V.K. Kapoor (2014): Fundamentals of Mathematical Statistics, Sultan Chand and sons
2. Hogg, R.V. and Craig A.T. (1970). Introduction to Mathematical Statistics, Amerind Publishing Co, Pvt. Ltd.
3. V.K. Rohatgi (2015) : An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
4. Mood A.M., Graybill F.A. and Boes D.C.(2017): Introduction to Theory of Statistics, 3 rd edition, McGraw Hill.

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 06

Discipline	Statistics
Semester	IV
Type of Course	DSC
Course Code	24USTADSC203
Course Title	Statistical Tools for Qualitative Research
Course Level	200-299
Course Summary	This course covers different types of scales for measurement, Analyse and interpret qualitative data non parametric tests and practical applications using Excel/ R.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO
1	Iidentify and use the proper the scales of measurement for data collection	Apply	1, 2
2	Analyse and interpret qualitative data	Analyse	1,2
3	Conduct non parametric test and report the results	Analyse	1,2
4	Perform non parametric tests using Excel/R	Apply	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Measurement - Scaling, Reliability and Validity (10 Hours)**			
	1.1	Scales of measurement, scale characteristics and levels of measurement, Primary scales of measurement, Nominal, ordinal, interval and ratio scales.	2	1
	1.2	Rating Scales - Dichotomous scale, Category scale, Likert scale, Semantic differential scale, Numerical scale, Itemised rating scale, Fixed or constant sum scale, Stapel scale, Graphic rating scale.	3	1
	1.3	Ranking Scales -Paired comparison scale, Forced choice scale, comparative scale	2	1

	1.4	Goodness of measurement - validity and reliability, content validity, face validity, criterion related validity, concurrent validity, predictive validity, test retest reliability, split half reliability	3	1
2	**Qualitative research (10 hours)**			
	2.1	Qualitative data – sources of qualitative data, Collection of qualitative data	2	2
	2.2	Analysis of Qualitative data- Principle of fitness for purpose, thick description and reflexivity	2	2
	2.3	Ethics in qualitative data Analysis	2	2
	2.4	Data reduction, data display, Drawing conclusions	2	2
	2.5	Computer assisted qualitative data analysis	2	2
3	**Introduction to Non Parametric Tests and Chi Square tests (10 Hours)**			
	3.1	Classification of statistical tests – Parametric and non parametric tests.	2	3
	3.2	Criteria regarding scale, population parameter and assumption about population distribution for parametric and non parametric tests.	2	3
	3.3	Advantages and limitations of non parametric tests	2	3
	3.4	Chi square test goodness of fit, Chi square test of independence, Chi square test of homogenity	4	3
4	**Other non parametric tests (15 Hours)**			
	4.1	One sample runs test, Sign test	3	3
	4.2	Two independent samples non parametric tests - Mann Whitney U Test, Steps for conducting Mann Whitney U test	3	3
	4.3	Two related samples non parametric tests - Sign Test for matched pairs, Steps for conducting Sign Test	3	3
	4.4	k related samples non parametric tests – Friedman Two way ANOVA Test, Steps for conducting Friedman Two way ANOVA Test	3	3
	4.5	k independent samples non parametric tests – Kruskal Wallis Test, Steps for conducting Kruskal Wallis Test	3	3
5	**Practicum (30 hours)**			

	5.1	Test of Goodness of fit, independence and homogeneity using using Excel/R	5	5
	5.2	One sample runs test, Sign test using Excel/R	5	5
	5.3	Mann Whitney U test using Excel/R	5	5
	5.4	Sign Test for matched pairs,t using Excel/R	5	5
	5.5	Friedman Two way ANOVA Test using Excel/R	5	5
	5.6	Kruskal Wallis Test test using Excel/R	5	5
5	**Teacher specific course components**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Field based collection and interactions, Online Learning, Blended Learning, and other innovative learning approaches.
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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 07

Discipline	Statistics
Semester	V
Type of Course	DSC
Course Code	24USTADSC301
Course Title	Sample Survey Analysis and Design of Experiments
Course Level	300-399
Course Summary	The course explores in detail the basic concepts of sampling techniques. This course provides a thorough exploration of statistical modelling and analysis. ANOVA (Analysis of Variance) and Experimental Design. This course provides a basis to introduce real-life applications.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	To Explain the basic concept of sample survey.	Understand	1
2	To Apply various sampling schemes like SRS, Stratified sampling and Systematic sampling	Apply	2
3	To Compare the efficiencies of estimates obtained using different sampling techniques and discuss the merits and demerits and demerits	Analyse	2
4	To Explain the principles of experimentation	Understand	1
5	To prepare one-way and two-way analysis of variances	Apply	1
6	To Design and analyse CRD, RBD, LSD	Apply	2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Basic Concepts and Simple Random Sampling (15 hours)**			
	1.1	Explain the basic concepts of sampling.	2	1
	1.2	Discuss the advantages and disadvantages of sampling over census.	2	1
	1.3	Distinguish between Probability and non-probability	3	1

		sampling- Judgment, Mixed Sampling, Quota sampling, Sampling and Non sampling errors		
	1.4	Distinguish between simple random sampling with and without replacement and explain the procedures of selecting a sample.	3	2
	1.5	Evaluation of the estimates of population mean and total for variables, variance of the estimates, and the confidence interval containing population mean	3	2
	1.6	Determination of the estimates for population proportion of SRS for attributes	2	2
2	**Stratified Random Sampling (10 hours)**			
	2.1	Definition of a stratified sample. Stratified random sampling: Estimation of the population mean and population total-their variances and estimates of the variances	4	3
	2.2	Explain allocation of sample size in different strata, using proportional allocation and optimum allocation with and without varying cost	4	3
	2.3	Comparison of Stratified Sampling with Simple Random Sampling	2	3
3	**Design of Experiments (12 hours)**			
	3.1	Explain the concept of design of experiments	2	4
	3.2	Explain Fundamental principles of experimentation and need for design of experiments	3	4, 5
	3.3	Define ANOVA, State uses of ANOVA and assumptions	2	4, 5
	3.4	State the model for one way, two way and three way classification. Perform one way two way analysis of variance	5	4, 5
4	**Experimental Designs (8 hours)**			
	4.1	Define CRD and state its advantages	1	6
	4.2	Design and analyze CRD	2	6
	4.3	Define RBD and state its advantages.	1	6
	4.4	Design and analyse RBD	2	6
	4.5	Define LSD and state its advantages	1	6
	4.6	Design and analyse LSD	1	6
5	**Practicum (30 hours)**			
	5.1	Numerical examples to select an SRS with and without replacement from finite populations.	8	6
	5.2	Numerical examples for SRSWOR, estimate the mean, standard error and the sample size	6	6
	5.3	Numerical examples of one way two way and three way classified data	8	4
	5.4	Numerical examples of CRD, RBD and LSD	8	5

References

1. Cochran, W.G. (2007).Sampling Techniques, (3rd Edn.), John Wiley and Sons.
2. Singh,D. and Choudhary,F.S.(2020)Theory and Analysis of Sample Survey Designs, (2nd Edn.) ,New Age International Publishers.
3. Mukhopadhyay, P. (2013). Theory and Methods of Survey Sampling, (2nd Edn.) Prentice-Hall of India.
4. Sampath.(2005).Sampling Theory and Methods,(2nd Edn.),Alpha Science International Limited.1. Gupta, S.C. and. Kapoor,V.K .(2018).Fundamentals of Applied Statistics, Sultan Chand & Co. New Delhi.
5. Joshi, D.D. (2020).Linear Estimation and Design of Experiments,(2nd Edn.),New Age International (P) Limited Publishers.
6. Das, M.N. and Giri, N.C. (2017).Design and Analysis of Experiments, (3rd Edn.), New Age International (P) Limited Publishers.
7. Montgomery, D.C. (2013).Design and Analysis of Experiments: International Student Version, (8th Edn.),Wiley India Pvt. Ltd.
8. Cochran, W.G. and Cox, G.M. (1992). Experimental Designs, (2nd Edn.), WileyClassics Library.
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<table>
<tr><td>Teaching and Learning Approach</td><td>Classroom Procedure (Mode of transaction)
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DSC - 08

Discipline	Statistics
Semester	VI
Type of Course	DSC
Course Code	24USTADSC302
Course Title	Time Series Analysis and Stochastic Processes
Course Level	300-399
Course Summary	This course aims to introduce the concept of time series and its statistical analyses. Explores in detail the concepts stochastic processes, and their properties.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Explain the importance of time series analysis in real life problems.	Apply	1,2
2	Apply the concept of additive and multiplicative models in decomposing the components of a time series data	Apply	1,2
3	Estimate the trend component, present in a time series.	Apply	1,2
4	Synthesize various concepts of Stochastic process and apply	Apply	1,2
5	Explore various properties of Markov process	Evaluate	2
6	Analyse Random walk	Analyse	2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Introduction to time series data (12 hours)**			
	1.1	Time series, components of time series, additive and multiplicative models..	4	1
	1.2	Determination of trend, analysis of seasonal fluctuations, test for trend and seasonality.	5	1
	1.3	Exponential and moving average smoothing, holt-winter smoothing, forecasting based on smoothing.	3	3
2	**Study of stationarity (14 hours)**			
	2.1	Time series as a discrete parameter stochastic process	3	3

	2.2	Auto covariance and auto correlation functions and their properties, stationary processes.	4	3
	2.3	Test for stationarity. Unit root test.	3	3
	2.4	Stationary processes in the frequency domain, spectral analysis of lime series.	4	3
3	**Introduction to stochastic processes**: **(13 hours)**			
	3.1	Classification of stochastic processes according to state space and time space, wide sense and strict sense stationary processes, processes with stationary independent increments	2	4
	3.2	Markov process, Markov chains-transition probability matrices, Chapman-Kolmogorov equation	3	4,5
	3.3	First passage probabilities, generating functions, classification of states, criteria for recurrent and transient states.	3	4,5
	3.4	Mean recurrence time, mean ergodic theorem, the basic limit theorem of Markov chains (statement only).	3	4,5
	3.5	Reducible and irreducible Markov chains, stationary distributions, limiting probabilities and absorption probabilities	2	4,5
4	**Random Walk (6 hours)**			
	4.1	Random walk, gambler's ruin problem	2	6
	4.2	Galton-Watson branching process, generating function relations	2	6
	4.3	Mean and variance functions, extinction probabilities, criteria for extinction	2	6
5	**Practicum (30 hours)**			
	5.1	Plotting a real life time series, and detecting various features (trend, periodic behaviors etc.). Suggested data sets: Sun spot data, Dollar-Rupee exchange rates, Stock market data, etc.	8	6
	5.2	Fitting and plotting of mathematical curves: modified exponential curve, Gompertz curve	6	6
	5.3	Fitting of trend by Moving Average Method. 4. Plotting de-trended series. 5. Measurement of Seasonal indices Ratio-to-Moving Average method.	8	4
	5.4	Apply various concepts of Stochastic process , Markov process .Analyse Random walk	8	5

References

1. Chatfield, C. (2003). The Analysis of Time Series - An Introduction (6th Edn.)), Chapman and Hall. 2. Abraham, B. and Ledoltcr, J.C. (2005).Statistical Methods for Forecasting, (1st Edn.) Wiley.
2. Brockwell, P.J and Davis, R.A. (2016). Introduction to Time Series and Forecasting (3rd Edn). Springer-Verlag.
3. Box, G.E.P and Jenkins, G.M., Reinsel, G.C. and Ljung, G.M. (2015) Time Series Analysis, Forecasting and Control, (5th Edn.) Wiley.
4. Kendall, M.G. (1978) Time Series, (2nd Edn.), Charles Griffin and Co Ltd.
5. Medhi J. (2017) Stochastic Processes, Second Edition, Wiley Eastern, New Delhi
6. Ross S.M. (2007) Stochastic Processes. Second Edition, Wiley Eastern, New Delhi
7. Ross S.M. (2014) Introduction to Probability Models. Eleventh Edition, Elsevier.

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 09

Discipline	Statistics
Semester	VII
Type of Course	DSC
Course Code	24USTADSC401
Course Title	Multivariate Data Analysis
Course Level	400-499
Course Summary	This course aims to introduce the concept of analyse data using multiple response and multiple dichotomy analysis. Analyse the trend in data, perform discriminant analysis, conjoint analysis for product design and factor analysis for data reduction.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Analyze data using multiple response and multiple dichotomy analysis	Analyse	1 2
2	Perform brand positioning using multidimensional scaling	Apply	1 2
3	Analyze the trend in data, Use logistic regression for classification and prediction.	Analyse Apply	1 2
4	Perform discriminant analysis for classification and prediction and cluster analysis for segmentation	Analyse Evaluate	1 2
5	Perform Conjoint analysis for product design and factor analysis for data reduction	Apply	1 2
Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)			

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Multiple response and multiple dichotomy analysis (08 Hours)**			
	1.1	Multiple response Analysis – Purpose and application areas, Uses, data entry in SPSS, interpretation of output	2	1

	1.2	Multiple response Analysis- Case study with secondary data, Analysis of secondary data, reporting the results and interpretation of results, decision making	2	1
	1.3	Dichotomy Analysis – Purpose and application areas, Uses, data entry in SPSS, interpretation of output	2	1
	1.4	Dichotomy Analysis - Case study with secondary data, Analysis of secondary data, reporting the results and interpretation of results, decision making	2	1
2	**Multidimensional scaling (8 hours)**			
	2.1	Multidimensional scaling, perceptual mapping technique, application area, uses	2	2
	2.2	Basic Methods of Multidimensional scaling, Attribute based approach, Similarity/dissimilarity based approach	2	2
	2.3	Multidimensional scaling, Case study with secondary data, Analysis of secondary data. Data entry in SPSS editor	2	2
	2.4	Multidimensional scaling, reporting the results and the interpretation of results, decision making, Euclidean distance model, Scatterplot of linear fit, scatterplot of non linear fit, Transformation scatter plot.	2	2
3	**Trend Analysis, Classification and prediction using logistic regression (8 Hours**			
	3.1	Trend Analysis, linear, quadratic and cubic	2	3
	4.2	Data entry for tend analysis, Case study with secondary data, Analysis of secondary data. Interpretation of SPSS output	2	3
	3.3	Logistic regression, application areas, uses. Interpretation of individual coefficients, Case study using secondary data	2	3
	3.4	Logistic regression versus Linear discriminant analysis, Pros and cons of usage of logistic regression in real life situation	2	3
4	**Discriminant analysis for classification and prediction and cluster analysis for segmentation (10 Hours)**			
	4.1	Discriminant analysis, areas of application, applications in selection, classification and prediction	2	4
	4.2	Classification matrix, Group centroids, decision rule for classifying objects, relative strength of explanatory variables	2	4
	4.3	Predicting group membership, Accuracy of classification, stepwise/fixed model, Apriori probability of classification into groups, case study	2	4
	4.4	Cluster analysis, hierarchical and non hierarchical clustering methods, k means clustering method.	2	4
	4.5	Interpretation of final cluster centers to name the clusters.	2	4

5	**Conjoint analysis for product design and factor analysis for data reduction (11 Hours)**			
	5.1	Conjoint analysis, application, uses, benefits, trade off between various attribute values in decision making process	2	5
	5.2	Conversion of rank order data into interval scaled measures, case study, recoding the input data ad dummy variables through effects coding and running regression model	2	5
	5.3	Factor analysis, applications in data reduction, a tool for combining variables, factors and original variables	2	5
	5.4	Data entry for factor analysis, two stages in factor analysis, Factor extraction and factor rotation	2	5
	5.5	Use of Eigen values for determining the number factors to be extracted, Factor loadings, interpretation of factors.	3	5
6	**Practicum (30 hours)**			
	6.1	Case study based on the primary data for analysis using multiple response and multiple dichotomy analysis	8	1
	6.2	Case study based on the primary data for analysis using multidimensional scaling method	7	2
	6.3	Case study based on the primary data for analysis of trend in data, Use logistic regression for classification and prediction.	15	3

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

DSC - 10

Discipline	Statistics
Semester	VIII
Type of Course	DSC
Course Code	24USTADSC402
Course Title	Analytical Tools for Multivariate Analysis and Multivariate Distributions
Course Level	400-499
Course Summary	Students will comprehend real vectors, orthogonality and Gram-Schmidt orthogonalization process understanding bivariate and multivariate distributions, interpreting results from the distribution of quadratic forms, and applying these skills in practical scenarios using R software.
Hours	75 (Lecture/Tutorial – 45, Practicum – 30)
Credits	4

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Interpret vector space, linear dependence and independence of vectors, spanning vector space, projection of vector.	Understand	1,2
2	Solve theory of equations, generalized inverse of matrix, quadratic forms, linear transformations.	Apply	1,2
3	Explain random vectors, mean vector and dispersion matrix	Analyse	1,2
4	Apply multivariate normal distribution in real-life situations.	Apply	1,2
5	Build characterizations of multivariate distribution.	Create	1,2
6	Obtain the distribution of quadratic forms.	Apply	2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Real vectors (12 hours)**			
	1.1	Real vectors (generalization of co-ordinates), Angle and Norm of vectors, Orthogonality and Gram-Schmidt orthogonalization process. Axiomatic approach and examples.	5	1
	1.2	Subspaces, intersection and sum of subspaces. Span of a set,	4	1

		Linear dependence and independence, dimension and basis, dimension theorem.		
	1.3	Direct Sum and Complement subspace, Orthogonal Projection of a vector	3	1
2	**G-inverse and Quadratic Form (14 hours)**			
	2.1	System of homogeneous and non-homogeneous linear equations.	3	2
	2.2	Projection matrix and application to least square method.	3	2
	2.3	Generalized inverse, Moore-Penrose inverse.	4	2
	2.4	Quadratic forms: Classification & canonical reduction, Linear transformations.	4	3
3	**Multivariate Distributions (13 hours)**			
	3.1	Random vectors, mean vector, dispersion matrix	2	4
	3.2	Bivariate normal distribution, pdf, marginal distributions, conditional distributions and independence.	3	4
	3.3	Multivariate normal distribution, characteristic function, marginal distributions, and conditional distributions, properties, characterizations, orthogonal transformation	3	5
	3.4	Multinomial distribution and its basic properties.	5	5
4	**Distribution of Quadratic Forms (6 hours)**			
	4.1	Distribution of quadratic forms, Scalar quadratic forms, Cochran's theorem	6	6
5	**Practicum (30 hours)**			
	5.1	Linear independence and dependence. Orthogonality and Gram-Schmidt Orthogonalization Process.	8	6
	5.2	Basis and Dimension Basis of sum intersection and complement of subspaces. Projection of vectors on a subspace	6	6
	5.3	Finding G-inverse of a matrix .Problems on quadratic forms Problems related to characteristic roots and vectors. Problems related to characteristic roots and vectors.	8	4
	5.4	Multivariate normal distribution (variance-covariance matrix). Quadratic forms (positive definite). Multinomial distribution.	8	5

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1. Hadley G. (2020). Linear Algebra, Narosa Publishing House

2. Rao A.R. and Bhimasankaram P. (2000):Linear Algebra(2nd Edn.),Hindustan Book Agency.
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4. Rao C.R. (2009). Linear Statistical Inference & its Applications (2nd Edn.), Wiley.
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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

4. SYLLABUS FOR MULTI-DISCIPLINARY COURSES (MDC) IN STATISTICS

COURSE 01

Discipline	Statistics
Semester	I/II
Type of Course	MDC
Course Code	**24USTAMDC101**
Course Title	Introduction to Elementary Statistics
Course Level	100-199
Course Summary	To acquire the basic knowledge of meaning and scope of statistics, population and sample, statistical data collection and visualisation of data. This course also provides knowledge about Descriptive measures and concepts of correlation.
Hours	60 (Lecture/Tutorial – 30, Practicum – 30)
Credits	3

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Understand the meaning and scope of Statistics	Understand	1,2
2	Understand the advantages and disadvantages of Statistics	Understand	1
3	Describe concepts of data and methods of data collection	Analyse	1
4	Visualization of data using Diagrams and Graphs.	Apply	1;2
5	Understand and apply different measures of Descriptive Statistics	Evaluate	1,2
6	Understand the concepts of correlation.	Analyse	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Introduction to Statistics (10 hours)**			
	1.1	Statistics – Definition and scope	2	1
	1.2	Statistics – Applications, advantages and disadvantages	2	2
	1.3	Statistical population and sample, Data; Primary and Secondary data, quantitative and qualitative data	2	3
	1.4	Diagrammatic representation of data – Bar diagram and pie chart	2	4
	1.5	Graphical representation of data- Histogram and frequency curve.	2	4
2	**Descriptive Statistics. (10 hours)**			

	2.1	Central tendency -Definition	1	5
	2.2	Measures of central tendency – Mean, Median and Mode	3	5
	2.3	Dispersion – Absolute and relative measures of dispersion.	1	5
	2.4	Measures of dispersion – Range, mean deviation and standard deviation. Coefficient of variation	5	5
3	**Correlation (10 hours)**			
	3.1	Concepts of correlation	5	6
	3.2	Scatter diagram, Karl Pearson's method of correlation.	5	6
4	**Practicum (30 hours)**			
	3.1	Visualisation of data- Diagrammatic and graphical representation of data	8	4
	3.2	Measures of central tendency –Mean, median and mode	6	6
	3.3	Measures of Dispersion – Range, Mean deviation and Standard Deviation.	8	4
	3.4	Correlation – scatter plot method and Karl Pearson's correlation coefficient.	8	5

References:

1. Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Gupta, S. P. Statistical Methods, Sultan Chand and Sons.
3. Mukhopadhyay, P (2009) Theory and Methods of Survey Sampling, Second Edition, PHI Learning (P) Ltd. sampling scheme.
4. Hogg, R.V. and Craig A.T. (1970). Introduction to Mathematical Statistics, Amerind Publishing Co, Pvt. Ltd.
5. Rangaswamy, R (2010) A textbook on Agricultural Statistics, New Age International publishers.
6. Kothari, C. R. (2014) Research methodology, Second revised edition, New Age International publisher.

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	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

COURSE 02

Discipline	Statistics
Semester	III
Type of Course	MDC
Course Code	24USTAMDC201
Course Title	Statistical Data Analysis Using Excel/R
Course Level	200-299
Course Summary	This course helps to acquire foundational knowledge of various types of data, Diagrammatic and graphical representation of data Descriptive Statistics,
Hours	45 (Lecture/Tutorial – 45)
Credits	3

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO
1	Visualization of data using R/Excel	Apply	1
2	apply Descriptive measures of central tendency.	Apply	2
3	apply Descriptive measures of Dispersion.	Apply	1,2
4	Explain basic concepts of statistical hypotheses and their applications.	Apply	1,2

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**Data visualization (10 hours)**			
	1.1	Statistical Data collection, Classification and Tabulation	4	1
	1.2	Diagrammatic representation of data- Bar diagrams and pie chart	3	1
	1.3	Graphical representation of data – Histogram and frequency polygon.	3	1
2	**Descriptive measures (8 hours)**			
	2.1	Measures of central tendency Mean, Median and Mode	4	2
	2.2	Measures of Dispersion – Range, Mean Deviation and Standard Deviation.	4	3
3	**Testing of hypothesis (12 hours)**			
	3.1	Testing the significance of mean of a population with	4	4

		known and unknown standard deviation for large and small samples		
	3.2	Testing the significance of difference of two population means with known and unknown standard deviation for large and small samples	4	4
	3.3	Paired t test	2	4
	3.4	Chi-square test of independence	2	4
4	**Practicum (30 hours)**			
	4.1	Using Excel/R plot diagrams and graphs	10	1
	4.2	Applications of measures of central tendency and dispersion using Excel/R	10	2,3
	4.3	Testing of hypothesis - z test, t test, paired t test and chi-square test using Excel/R	10	4

References:

1. Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

2. Gupta, S.P., Statistical Methods. Sultan Chandand Sons: NewDelhi.

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5. Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh. (2009) Statistics Using R, 2nd edition, Narosa Publishing Ho Book Agency Private Limited, Kolkata, use.

6. Tilman M. Davies. (2016) The Book of R, A First Course in R Programming and Statistics, No Starch Press.

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Field based collection and interactions, Online Learning, Blended Learning, and other innovative learning approaches.

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:** Quiz, Oral Presentation, Self and Peer assessments, Written test, Open book test, Problem based assignment, Field study report/Group discussion. *Any other method as may be required for specific course by the course faculty*. **Practicum:** Observation of practicum skills, , Laboratory record, *Any other method as may be required for specific course by the course faculty*.
	B. End Semester Examination (ESE) **Theory:** Written test/Standardized Test (MCQ)/Open book/ Problem based assignments/Individual project report/Team project report**.**

5. SYLLABUS FOR SKILL ENHANCEMENT COURSE (SEC) IN STATISTICS

COURSE 01

Type of Course	SEC

Course Code	24USTASEC201
Course Title	Data Analysis Using SPSS
Course Level	200-299
Course Summary	This course aims to introduce SPSS, Diagrammatic and graphical representation of data using SPSS, Descriptive measures, correlation and regression and different types of statistical testing using SPSS.
Hours	60 (Lecture/Tutorial – 30, Practicum – 30)
Credits	3

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO
1	Create a data file in SPSS data editor, import a data from excel, transformation of data	Create Understand	1,2
2	Create diagrams and graphs using SPSS, Calculate the descriptive measures of statistics using SPSS and interpret the findings	Analyse	1,2
3	Calculate correlation coefficient, perform regression analysis.	Analysis Evaluate	2
4	Perform hypothesis testing.	Apply	1

COURSE CONTENT

Module	Units	Course description	Hrs	CO No.
1	**SPSS Data Editor – Managing the data files (8 Hours)**			
	1.1	Introduction to SPSS, Entering data in SPSS, Importing data from other sources.	2	1
	1.2	Statistical output, editing and saving of data and output	2	1
	1.3	Manipulation of data – sorting and selecting cases, splitting of data files, merging data from separate files, recoding variables, computing new variables, transformations	2	1
	1.4	Detecting univariate outliers, assessing distribution shape, normality, skewness and kurtosis, transformation of data as a remedy to violation of statistical assumptions	2	1
2	**Descriptive Statistics Procedures (6 hours)**			
	2.1	Frequencies and frequency distribution of categorical variables, reading to interpret the frequency table	2	2

	2.2	Descriptive measures of quantitative variables, mean, median, standard deviation, quartiles, skewness and kurtosis	2	2
	2.3	Diagrams and graphs – Bar diagrams, pie diagrams, Histogram, box plot	2	2
3	**Correlation and regression Analysis (7 Hours)**			
	3.1	Bivariate correlation, scatter plot, identification of type of correlation using scatter plot	3	3
	4.2	Simple linear regression, Regression equations of Y on X and X on Y. Fitting of regression lines	4	3
4	**Hypothesis Testing (9 Hours)**			
	4.1	t test with one sample, independent groups t test, dependent sample or paired sample t test	6	4
	4.2	Chi square test of independence	3	4
5	**Practicum (30 hours)**			
	5.1	Working with SPSS data Editor for file management – Case study with output and report with interpretation	5	1
	5.2	Create diagrams and graphs using SPSS – Case study with interpretation of diagrams	5	1,2
	5.3	Obtain the descriptive measures using SPSS – Case study with interpretation of findings	5	1,3
	5.4	t test with one sample, independent groups t test, dependent sample or paired sample t test Chi square test of independence case study with output analysis	5	1,4
5	**Teacher specific course components**			

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