

HSNC UNIVERSITY, MUMBAI Board of Faculty of Science & Technology

Board of Studies in the Subjects of Statistics and Data Science & Business Analytics

- 1) Name of Chairperson/Co-Chairperson/Coordinator:-
 - a) Dr Asha Jindal, Associate Professor and Head of Department, Department of Statistics, K. C. college, HSNC University Churchgate, Mumbai –400 020. Email ID- <u>asha.jindal@kccollege.edu.in</u> Mobile no- 9821235627
- 2) Two to five teachers each having minimum five years teaching experience amongst the full time teachers of the Departments, in the relevant subject.
 - a) <u>Dr. S. B. Muley</u>, Assistant Professor, Department of Statistics, K. C. college, HSNC University Churchgate, Mumbai – 400 020. Email ID<u>sakharam.muley@kccollege.edu.in</u>, Mobile No- 9323817918
 - b) Mrs. Pratiksha Kadam, Assistant Professor, Department of Statistics, K. C. college, HSNC University Churchgate, Mumbai – 400 020. Email ID pratiksha.kadam@kccollege.edu.in, Mobile No- 7507162816
 - c) Ms. Shailaja Rane, Assistant Professor, Department of Statistics, K. C. college, HSNC University Churchgate, Mumbai – 400 020. Email ID <u>shailaja.rane@kccollege.edu.in</u>, Mobile No- 7506986359
- 3) One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body;
 - a) Dr Anjum Ara Ahmed; I/C Principal, Rizvi College, Mumbai. Email ID anjumahmed8@gmail.com, Mobile No- 8451046220

- 4) Four external experts from Industry / Research / eminent scholar in the field relevant to the subject nominated by the Parent Body;
 - a. Prof. Suresh Kumar Sharma, Professor, Department of Statistics, Panjab University, Chandigarh.
 Email ID <u>ssharma643@yahoo.co.in</u>, Mobile No-9815911381
 - b. Mr Mukesh Jain, Chief Technological Officer, Capgemini. Email ID <u>mdjain@hotmail.com</u>, Mobile No-7972637347.
 - c. Dr Santosh Gite, Associate Professor, Dept. of Statistics, University of Mumbai, Mumbai. Email ID <u>santgite@yahoo.com</u>, Mobile No- 9167157717.
 - d. Mr Prashant Kumar Nair, Director, Geo Spatial Analytics Global Lead, Intelligent Analytics, Nielsen Connect, Email ID <u>prasif hantkumar.nair@nielsen.com</u>, Mobile No-9833747057.

5. Top rankers of the Final Year Graduate and Final Year Post Graduate examination of previous year of the concerned subject as invitee members for discussions on framing or revision of syllabus of that subject or group of subjects for one year.

- a) **Ms. Mohaddasah Patel** (undergraduate student 18-19) Email Id-<u>mohaddasah.98@gmail.com</u>; Mobile no- 9833781878
- b) Ms. Divya Srivastava (undergraduate student18-19) Email IDdivyasrivastav20@gmail.com; Mobile no- 8879240305

Part –I

Outline of Choice Based Credit System as outlined by University Grants Commission:

R. **** : The Definitions Of The Key Terms Used In The Choice Based Credit System And Grading System Introduced From TheAcademicYear2020-2021AreAs Under:

- 1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a core course.
- 2 **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of adiscipline specific elective paper.
 - 2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Choice Base Credit System :** CBCS allows students to choose interdisciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.

- 4 Honours Program : To enhance employability and entrepreneurship abilities among the learners, through aligning Inter Disciplinary / Intra Disciplinary courses with Degree Program. Honours Program will have
 40 additional credits to be undertaken by the learner across three years essentially in Inter / Intra Disciplinary course.
 A learner who joins Regular Undergraduate Program will have to opt for Honours Program in the first year of the Program. However, the credits for honours, though divided across three years can be completed within three years to become eligible for award of honours Degree.
- 5. **Program:** A Program is a set of course that are linked together in an academically meaningful way and generally ends with the award of a Degree Certificate depending on the level of knowledge attained and the total duration of study, B.Sc. Programs.
- 6 **Course:** A 'course' is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a course must necessarily have academic coherence, i.e. there must be a common thread linking the various components of a course. A number of linked courses considered together are in practice, a 'program'.
- 7. **Bridge Course:** Bridge course is visualized as Pre semester preparation by the learner before commencement of regular lectures. For each semester the topics, whose knowledge is considered as essential for effective and seamless learning of topics of the Semester, will be specified. The Bridge Course can be conducted in online mode. The Online content can be created for the Bridge Course Topics.
- 8 **Module and Unit:** A course which is generally an independent entity having its own separate identity, is also often referred to as a 'Module' in today's parlance, especially when we refer to a 'modular curricular structure'. A module may be studied in conjunction with other learning modules or studied independently. A topic within a course is treated as a Unit. Each course should have exactly 3 Units.
- 9. **Self-Learning: 20% of the topics will be marked for Self-Learning.** Topics for Self-Learning are to be learned independently by the student, in a time-bound manner, using online and offline resources including online lectures, videos, library, discussion forums, fieldwork, internships etc.

Evaluative sessions (physical/online), equivalent to the credit allocation of the Self Learning topics, shall be conducted, preferably, every week for each course. Learners are to be evaluated real time during evaluative sessions. The purpose of evaluative sessions is to assess the level of the students' learning achieved in the topics earmarked for Self-Learning.

The teacher's role in these evaluative sessions will be that of a Moderator and Mentor, who will guide and navigate the discussions in the sessions, and offer concluding remarks, with proper reasoning on the aspects which may have been missed by the students, in the course of the Self-Learning process.

The modes to evaluate self-learning can be a combination of the various methods such as written reports, handouts with gaps and MCQs, objective tests, case studies and Peer learning. Groups can be formed to present self-learning topics to peer groups, followed by Question and Answer sessions and open discussion. The marking scheme for Self Learning will be defined under Examination and Teaching.

The topics stipulated for self-learning can be increased or reduced as per the recommendations of the Board of Studies and Academic Council from time to time. All decisions regarding evaluation need to be taken and communicated to the stakeholders preferably before the commencement of a semester. Some exceptions may be made inexigencies, like the current situation arising from the lockdown, but such ad hoc decisions are tobe kept to the minimum possible.

10. **Credit Point:** Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single course always pay attention to how many hours it would take for a learner to complete a single course successfully. A single course should have, by and large a course may be assigned anywhere between

2 to 8 credit points wherein 1 credit is construed as corresponding to approximately 30 to 40 learning hours.

11. **Credit Completion and Credit Accumulation:** Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single course. Thus, a learner who successfully completes a 4 CP (Credit Point) course may be considered to have collected or acquired 4 credits. learner level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more courses. Thus the learner 'accumulates' course wise credits.

- 12 **Credit Bank:** A Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the course/s for which Credit has been given, the course-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history.
- 13. **Credit Transfer:** (performance transfer)When a learner successfully completes a program, he/she is allowed to transfer his/her past performance to another academic program having some common courses and Performance transfer is said to have taken place.
- 14. **Course Exemption:** Occasionally, when two academic programs offered by a single university or by more than one university, may have some common or equivalent course-content, the learner who has already completed one of these academic programs is allowed to skip these 'equivalent' courses while registering for the new program. The Learner is 'exempted' from 'relearning' the common or equivalent content area and from re-appearing for the concerned examinations. It is thus taken for granted that the learner has already collected in the past the credits corresponding to the exempted courses.

Part-II

O^{****} The fees for transfer of credits or performance will be based on number of credits that a learner has to complete for award of the degree.

The Scheme of Teaching and Examination:

The performance of the learners shall be evaluated in two components: Internal Assessment with 40% marks by way of continuous evaluation and by Semester End Examination with 60% marks by conducting the theory examination.

INTERNAL ASSESSMENT:- It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the credit based system by way of participation of learners in various academic and correlated activities in the given semester of the programme.

A). Internal Assessment – 40%

40 marks

Practical's (internal Components of the Practical Course)

Sr.	Particulars	Marks
No.		
1	ONE class test / online examination to be conducted in the given semester	15 Marks
2	One assignment based on curriculum (to be assessed by the teacher Concerned	10 Marks
3	Self-Learning Evaluation	10 Marks
4	Active participation in routine class instructional deliveries	05 Marks

1. For Theory Courses

2. For Courses with Practicals

Each practical course can be conducted out of 50 marks with 20 marks for internal and 30 marks for external

Practical's (Internal component of the Practical Course)

Sr. No	Evaluation type	Marks
1	Two Best Practicals /Assignments/Presentation /Preparation of models/ Exhibits	
	Or	10
	One Assignment/ project/presentation to be assessed by teacher concerned	
2	Journal	05
3	Viva	05

The semester end examination (external component) of 60 % for each course will be as follows:

i) **Duration** – 2 Hours ii) Theory Question

Paper Pattern:-

- 1. There shall be four questions each of 15 marks. On each unit there will be one question and the fourth one will be based on entire syllabus.
- 2. All questions shall be compulsory with internal choice within the questions. (Each question will be of 20 to 23 marks with options.)
- 3. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depend on the weightage of the topic.

The marks will be given for all examinations and they will be converted into grade (quality) points. The semester-end, final grade sheets and transcripts will have only credits, grades, grade points, SGPA and CGPA.

3. Project and Assignment:

- Project or Assignment, which can in the following forms
 - Case Studies
 - Videos
 - Blogs
 - Research paper (Presented in Seminar/Conference)
 - Field Visit Report
 - Presentations related to the subject (Moot Court, Youth Parliament, etc.)
 - Internships (Exposition of theory into practice)
 - Open Book Test
 - any other innovative methods adopted with the prior approval of Director Board of Examination and Evaluation.

4.Self-Learning Evaluation

- 20% OF THE TOPICS OF CURRICULUM ARE LEARNED BY THE STUDENT THROUGH SELF LEARNING USING ONLINE / OFFLINE ACADEMIC RESOURSE SPECIFIED IN THE CURRICULUM.

- HENCE 20% OF THE LECTURES SHALL BE ALLOCATED FOR EVALUATION OF STUDENTS ON SELF LEARNING TOPICS

 The identified topics in the syllabus shall be learnt independently by the students in a time bound manner preferably from online resources. Evaluative sessions shall be conducted by the teachers and will carry 10 Marks.

CLUB The self-learning topics into 3-4 GROUPS OF TOPICS ONLY FOR EVALUATION.

• PRESCRIBE TIME DURATION (IN DAYS) FOR COMPLETION OF EACH GROUP OF TOPIC AND EARMARK SELF LEARNING EVALUATION LECTURES IN THE TIMETABLE. HENCE EACH GROUP OF TOPIC CAN BE ASSIGNED 3 REGULAR LECTURES FOR THIS EVALUATION FOR ENTIRE CLASS

3 Sub Topics

Each evaluative session shall carry 3 Marks (3 x 3 Units = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

4 Sub Topics

Each evaluative session shall carry 2.5 Marks (2.5 x 4 Units = 10 Marks)

- EVALUATION OF SELF LEARNING TOPICS CAN COMMENCE IN REGULAR LECTURES ASSIGNED FOR SELF LEARNING EVALUATION IN THE TIMETABLE

3 Evaluative sessions

Each evaluative session shall carry 3 Marks (3 x 3 = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

4 Evaluative sessions

Each evaluative session shall carry 2.5 Marks (2.5 x 4 = 10

Marks). <u>Methods for Evaluation of Self-learning topics:</u>

Seminars/presentation (PPT or poster),
followed by Q&A – Objective questions /Quiz
/ Framing of MCQ questions.
– Debates

- Group discussion
- You-Tube videos (Marks shall be based on the quality and viewership)
- Improvisation of videos
- Role Play followed by question-answers

TEACHERS CAN FRAME OTHER METHODS OF EVALUATION ALSO PROVIDED THAT THE METHOD, DULY APPROVED BY THE COLLEGE EXAMINATION COMMITTEE, IS NOTIFIED TO THE STUDENTS AT LEAST 7 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION AND IS FORWARDED FOR INFORMATION AND NECESSARY ACTION AT LEAT 3 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION

- Viva Voce
- Any other innovative method

SEMESTER END EXAMINATION: - It is defined as the examination of the learners on the basis of performance in the semester end theory / written examinations.

B. Semester End Examination- 60 %

60 Marks

- 1) Duration These examinations shall be of 2 Hours duration.
- 2) Question Paper Pattern:
 - i. There shall be four questions each of 15 marks.
 - ii. All questions shall be compulsory with internal choice within the questions.
 - iii. Question may be sub-divided into sub-questions a, b, c, d & e only and the allocation of marks depends on the weightage of the topic.

THE MARKS OF THE INTERNAL ASSESSMENT SHOULD NOT BE DISCLOSED TO THE STUDENTS TILL THE RESULTS OF THE CORRESPONDING SEMESTER IS DECLARED.

HSNC University Mumbai

(2020-2021)

Ordinances and Regulations

With Respect to

Choice Based Credit System

(CBCS)

For the Programmes Under

The Faculty of Science and Technology

For the Course

Data Science & Business Analytics

Curriculum – First Year Undergraduate Programmes

Semester-I and Semester -II

2020-2021

Data Science & Business Analytics Part 1-Preamble

B. Sc. Data Science and Business Analytics program is of minimum 140 credits cover six semesters. Data is the new oil. The analytics may be input for human decisions or may drive fully automated decisions. It helps decision maker in building strategies to perform deep-dive understanding and provide descriptive, predictive and prescriptive analytics. It is used to run the business effectively and is instrumental in growing the business. It is the area for huge potential for corporate investments. Business Analytics include identifying KPIs, measurement strategy, data analysis, complex statistical model and analysis, data mining and deep understanding of cause-and-effect models. Business analytics can drive key decision making in the organization and help executive decision makers in building strategy, predictive analysis, forecasting, risk analysis, identify and prevent fraud, market analysis, etc. Data Scientists use these skills are able to provide insights into discrete data sets, build complex model and present them in Scorecard format and use the same in executive reviews to lead data-driven discussion and decisions. Some of the impactful use of this is in the areas of Management Information Systems, Financial Service, Marketing Research, Process Improvements, Six Sigma, Process Excellence, Scorecard, Dashboard, End-to-End Product Management, etc.

The program emphasizes both theory and modern applications of Data Science and Business analytics and is structured to provide knowledge and skills in depth necessary for the employability of students in industry, in academics and other government and non-government organizations. The program has some unique features like independent projects, number of elective courses and extensive computer training of statistical computations including standard software packages like C++, SQL, SPSS,

12

SAS, MINITAB, R and PYTHON etc. Due to Cluster University, the department got the academic autonomy and it's been utilized to add the new and need based elective courses. The independent project work is one among the important components of this program. The syllabus has been framed to possess a decent balance of theory, methods and applications of statistics. It is possible for the students to study basic courses from other disciplines like economics, life sciences, computer science and Information Technology in place of optional/electives. The thrust of the course is to prepare students to enter into a promising career after graduation, as also provide to them a platform for pursuing higher studies resulting in post-graduation degrees.

1. Course objective: The main course objectives are

- Provide hands-on training to students to develop and enhance the strong analytical, quantitative modeling skills and business skills for solving team-based, real-world business problems and to make students ready for the role of Data Scientist.
- Provide opportunity to work on some real-life data/problems or simulated data through building the business Intelligence reports, scorecard and dashboard.

SEMESTER-I

US-FDS-101 Business Statistics- I

Objective: The objective of the course is to make the students conversant with various techniques used in summarization, certainty involved in uncertainty in happening of events, decision making and analysis of data. The focus will be both on theoretical as well as practical approach using commonly used Statistical Software.

US-FDS-102 Mathematical Foundation-I

Objective: The primary **objective** to provide **mathematical** background and sufficient experience on various topics of discrete **mathematics** logic and proofs, combinatorics, graphs, algebraic structures, formal languages and differential equations.

US-FDS-103 C++ programming

Objective: Develop a greater understanding of the issues involved in programming language design and implementation, Develop an in-depth understanding of functional, logic, and objectoriented programming paradigms, Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing, Develop an understanding of the compilation process

US-DS-104 MS Excel

Objective: MS Excel skill will make able to:Indicate the names and functions of the Excel interface components, Enter and edit data, Format data and cells, Construct formulas, including the use of built-in functions, and relative and absolute references, Create and modify charts, Preview and print worksheets, Use the Excel online Help feature along with Data visualization and Data Analytics.

US-FDS-105 Introduction to Cyber Security

Objective: To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks. To develop graduates that can identify, analyze, and remediate computer **security** breaches.

SEMESTER-II

US-FDS-201 : Business Statistics- II

Objective: The objective of the course is to provide a systematic account of theory of testing and closely related theory of point estimation and confidence sets, together with their applications

US-FDS- 202: <u>Applied Linear Algebra</u>

Objective: Techniques of linear algebra useful in various Statistics courses will be covered in this course. After learning this course, the students will be well equipped to apply these techniques in many major Statistics courses like Linear Inference, Multivariate Analysis and Operations Research etc.

US-FDS-203: <u>R programming</u>

Objective: The objective of the course is to make the students conversant with various techniques used in summarization and analysis of data. The focus will be both on theoretical as well as practical approach using FOSS Statistical Software.

US-FDS-204: Database Management System with SQL

Objective: Learning SQL skill, which stands for Structured Query Language, is a programming language that is used to communicate with and manipulate databasesIn order to control the information in those databases, SQL is used, which allows users to retrieve the specific data they are looking for when they need it.

US-FDS-205: Business Analytics

Objective: Learning Business Priorities, Effective communication starts with a purpose, knowing what you want to accomplish helps you communicate more, Reaching the Right Audiences. To learn process of turning raw data into useful information. It is a process of sorting a large amount of data to find out patterns and establish trends and developing relationships.

2. Salient features, how it has been made more relevant.

- 1) Syllabus is prepared by top most industry experts, eminent statisticians, Data Scientist and reputed faculties of KC College.
- Skills covered includes Statistics, Data Analytics, Business Analytics, Data Visualization, machine learning algorithm, Text Mining, Forecasting/ Predictive Analytics, Hypothesis Testing etc.
- 3) Tools and Technology covered includes R, Python, My SQL, tableau, c++, SPSS, Minitab, Excel, Maya and many more.
- 4) Course includes several Assignments and Case Studies.
- 5) Getting industrial experience by working on industry relevant live projects and internship.
- 6) University/ College has tie up with 100+ companies to provide job to many students.
- 7) University/ College has a dedicated placement cell for the participants who will complete course.
- 8) Teaching Faculties will include good blend of Academicians and Industry Experts.
- 9) Focus is to prepare Participants with clear, concise concept to experts in data Science field to add quality and value to institute they join.
- 10) University/ College has well placed Alumni working at top position.

3. Learning Outcomes.

Students will learn Analytics from basics concepts to creating basic models for predictions. Students will learn how analytics is actually used large corporations like Microsoft, Jio, Amazon and other top companies globally. In the hands-on session, Students will gain skills on identifying opportunities for Analytics, Machine Learning, IoT, AI, Blockchain, coming up with right set of metrics/KPIs, use cases, defining the metrics, measuring and implementing it. Students will be able to come up with specific Analytics Opportunities, Define Metrics and KPIs successfully for any business.

Part 2- The Scheme of Teaching and Examination is as under:

Bridge course and Remedial English

-					
Sr.	Bridge course and Remedial English	Subject	Remarks		
No.		Code			
1	Bridge course in Mathematics and Statistics*		Non-Credit and		
	Dirage course in maintenances and Statistics		requires for the		
			students with non-		
			mathematics back		
			ground		
2	Remedial English Course**		Non-Credit and		
			compulsory to all		
			students but decision		
			is based on English		
			communication test.		
* A	* Appendix-1 ** Appendix-2				

Semester – I Summary

Sr. No		Cho	ice Based Credit System	Subject Code	Remarks	
1	 Core Course (Business Statistics – I, Mathematical Foundation-I, Data Mining, C++ Programming), (Practicals of US-FDS-101, US-FDS-102, US-FDS- 103, US-FDS-104, US-FDS-105) 					
2	Elective	Discipli	ne Specific Elective (DSE) Course			
	Course	2.1	Interdisciplinary Specific Elective (IDSE)	US-FDS-104		
			Course (MS Excel)		l	
		2.2	Dissertation/Project			
		2.3	Generic Elective (GE) Course			
3	Ability E	nhancem	US-FDS-105	l		
	Cyber Security)					
	Skill Enh	ancement	t Courses (SEC)			

Sr. No.	Subject Code	Subject Title	Pe	riods	Per V	Veek			Sea	Seasonal Evaluation Scheme			Tot al Mark s
			Units	S. L.	L	Т	Р	Credit	S. L. E	СТ	ТА	SEE	
1	US- FDS- 101	Business Statistics - I	3	$\frac{1}{5}$	3	0	2	3	10	20	10	60	100
2	US- FDS- 102	Mathematical Foundation-I	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
3	US- FDS- 103	C++ Programming	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
4	US- FDS- 104	MS Excel	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
5	US- FDS- 105	Introduction to Cyber Security	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
6	US- FDS- 1P1	Practicals of US-FDS-101, US- FDS-102, US- FDS-103, US- FDS-104,	3 practi cal per batch	0	0	0	5	5	0	0	0	50 marks per practical	150
	Tota						20		Tot	al Ma	urks	650	

First Year Semester I Internal and External Detailed Evaluation Scheme

* Three hours per week to be taken for CONTINUOUS self –learning Evaluation.

First Year Semester I - Units – Topics – Teaching Hours

S.N	Subject Code	Subject Unit Title		Hours	Total No. of Hours	Credit	Tot al Marks
	US-	Ι	Summarization Measures	15		3	
	FDS-	II	Elementary Probability Theory and	15	45		100
1	101		Some Standard Distributions				+10)
		III	Decision Theory	15			
	US-	Ι	Discrete Mathematics	15		3	
	FDS-	II	Introduction to Combinatorics and	15	45		100
2	102		Graph Theory				(60+30
-	102	III	Differential Equations	15			+10)
	US-	Ι	Basics of C++	15		3	
	FDS-	II	Statements, Operators and Functions	15	45		100
3	103	III	Arrays, Pointers and Strings	15			(60+30 +10)
	US-	Ι	Basics of Excel	15		3	
	FDS-	II	Intermediate Excel	15	45		100
		III	Statistical Computations	15			(60+30

4	104						+10)
5	US-	Ι	Social Media Security	15		3	100
	FDS-	II	Security Guidelines	15	45		(60+3)
	105	III	Social Engineering and IT Security	15			0+10)
	US-	Ι	Practicals of US-FDS-101, US-	45		5	
	FDS-	II	FDS-102, US-FDS-103, US-FDS-	45	45 x		150
6	106	111	104,	45	3=135		
			TOTAL			20	650

• Lecture Duration =1 Hour.

• One Credit =15 hours

L: Lecture: Tutorials P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination , PA-Project Assessment, AT- Attendance

Part -3 Detailed Scheme Theory

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT

US-FDS-101 Business Statistics- I

(Total Hours : 45 Lectures)

Unit	Content	No. of
		Lectures
1	Summarization Measures	
	1.1 Introduction to definition of Statistics, Application and scope of Statistics	
	1.2 Conceptofpopulationandsample.Finite,Infinitepopulation,para meter and statistic	
	1.3 Types of data: Qualitative and quantitative data; Time series data and cross section data, discrete and continuous data.	
	1.4 Different types of scales: nominal, ordinal, interval and ratio.	
	1.5 Simple Random Sampling	
	1.6 Concept of central tendency of data .Requirements of good measure.	
	1.7 For Raw Data, Ungrouped Frequency Data, Grouped Frequency Data:	
	i. Mathematical averages Arithmetic mean (Simple, weighted mean, combined mean), Geometric mean, Harmonic mean,	15
	ii. Locational averages: Median, Mode and	
	iii. Partition Values: Quartiles, Deciles and Percentiles.	
	iv. Merits and demerits of different measures & their applicability.	
	1.8 Concept of dispersion. Requirements of good measure.	
	1.9 Absolute and Relative measures of dispersion: Range, Quartile Deviation, Mean absolute deviation, Standard deviation.	
	1.10Variance and Combined variance, raw moments and central moments and relations between them. Their properties	
	1.11Concept of Skewness and Kurtosis: Coefficient of skewness	
	and kurtosis based on moments.	
2	Elementary Probability Theory and Some Standard Distribution	
	2.1 Probability Theory: Concept of random experiment/trial and	
	possible outcomes; Sample Space and Discrete Sample Space;	
	Events their types, Algebra of Events, Mutually Exclusive and	
	Exhaustive Events, Complimentary events.	15
	Classical definition of Probability, Addition and Multiplication	
	theorems (without proof), conditional probability.	
	Theorem (without proof), Simple examples.	

	 2.2 Random Variable: Probability distribution of a discrete and continuous random variable; Expectation and Variance of random variable, simple examples on probability distributions. 2.3 Discrete Probability Distribution: Binomial, Poisson (Properties and applications only, no derivations are expected). 2.4 Continuous Probability distribution: Normal Distribution 	
	(Properties and applications only, no derivations are expected)	
3	Decision Theory	
	 3.1 Decision making situation, Decision maker, Courses of Action, States of Nature, Pay-off and Pay-off matrix. 3.2 Decision making under uncertainty, Maximin, Maximax, Minimax regret and Laplace criteria; simple examples to find optimum decision. 3.3 Formulation of Payoff Matrix. Decision making under Risk, Expected Monetary Value (EMV). 3.4 Decision Tree; Simple Examples based on EMV. Expected Opportunity Loss (EOL), simple examples based on EOL. 	15

Self-Learning topics (Unit wise)

Sub Unit	Topics
2.1	Probability Theory: Concept of random experiment/trial and possible
	outcomes; Sample Space and Discrete Sample Space; Events their types,
	Algebra of Events, Mutually Exclusive and Exhaustive Events, Complimentary
	events.
	Classical definition of Probability, Addition and Multiplication theorems,
	(without proof), conditional probability.
	Independence of Events: $P(A \cap B) = P(A) P(B)$. Simple examples.
2.2	Random Variable: Probability distribution of a discrete and continuous random
	variable; Expectation and Variance of random variable, simple examples on
	probability distributions.
2.3	Discrete Probability Distribution: Binomial, Poisson (Properties and
	applications only, no derivations are expected).

Online Resources

'Introduction to Probability and Statistics' by Prof. G. Srinivasan from IIT Madras available on the Swayam portal <u>https://nptel.ac.in/courses/111/106/111106112/</u>

'Introduction to Probability Theory and Stochastic Processes' by Prof. S Dhramaraja from IIT Delhi available on the Swayam portal <u>https://nptel.ac.in/courses/111/102/111102111/ for unit</u>

Statistics for Business Economics' by Dr. Patel from University School of Sciences available on the Swayam portal <u>http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/227</u>

'Business Statistics' by Dr Mukesh Kumar Barua from IIT Roorkee available on the Swayam portal <u>https://nptel.ac.in/courses/110/107/110107114/</u>

US-FDS-102 Mathematical Foundation-I

Unit	Content	No. of
		Lectures
1	Discrete Mathematics[15 H]1.1 Logic, sets, relations, functions.1.2 The concept of algorithms and algorithmic thinking in problem solving1.3 Summation techniques: manipulations of sums and multiple sums, finite calculus1.4 Asymptotics and the big-Oh notation	15
2	 Introduction to Combinatorics and Graph Theory [15 H] 2.1 Counting techniques, pigeonhole principle, inclusion-exclusion. 2.2 Recurrence relations, solving recurrences using generating functions. 2.3 Master Theorem for solving recurrences. 2.4 Graphs 2.5 Basic graph algorithms 2.6 Trees 2.7 Applications of graphs 	15
3	Differential Equations3.1 First order equations3.2 Second order linear equations with constant coefficients3.3 Series solutions3.4 The Laplace transform method3.5 Systems of linear differential equations and Applications	15

Self-Learning topics (Unit wise)

Sub Unit	Topics
1.1	Logic, sets, relations, functions.
2.1	Counting techniques, pigeonhole principle, inclusion-exclusion.
2.4	Graphs
2.5	Basic graph algorithms
2.6	Trees

Online Resources

'Discrete Mathematics' by Prof.Sajith Gopalan,Prof.Benny George K from IIT Guwahati available on the Swayam portal <u>https://nptel.ac.in/courses/106/103/106103205/</u>

'Discrete Mathematics' by Prof. Sourav from Chennai Mathematical Institute available on the Swayam portal <u>https://nptel.ac.in/courses/111/106/111106086/</u>

'Differential equations for engineers' by Prof. Srinivasa Manam from IIT Madras available on the Swayam portal <u>https://nptel.ac.in/courses/111/106/111106100/</u>

US-FDS-103 C++ programming

(Total Hours : 45)

Unit	Content	No. of
		Lectures
1	 Basics of C++ 1.1 Advantage of Structured Programming, Interpreter and Compiler Program. Advantages of OO Programming. 1.2 Introduction to C++: Origin of C++. A Sample C++ program. Layout of simple C++ program. Compiling and running a C++ program. 1.3 Variables and Assignments: variables, identifiers, variable declarations, Assignment Statements, reference variable, symbolic constant, Input and Output: cin, cout, escape sequences, include directives and Namespaces, Indenting and Comments, Operator precedence, Data types and expressions, Arithmetic operators, Type compatibilities. 	15
2	 Statements, Operators and Functions 2.1 Compound statements, Iterations or Looping: while, for, do while, nested loops, Decision making: if – else, nested if else, switch, break and continue, Manipulators: endl, setw, size of, Increment and decrement operators, Type Cast Operators, Scope resolution operators. 2.2 Functions: Function Prototypes, built in functions and user defined functions, Function overloading, Call by reference, and Call by value, const member functions. Inline Functions and recursive functions, Math Library Functions. 	15
3	 Arrays, Pointers and Strings [15H] 3.1 Derived Data types (Arrays, pointers, functions): Introduction to arrays, arrays in functions, 2-D arrays, Multidimensional arrays, Introduction to pointers, void pointers, pointers in function, pointer to constant and constant pointer, generic pointer. 3.2 Strings, Vectors and Structures: String functions: strcmp, strcat, strlen, strcpy. Vector Basics. Introduction to Structures. 	15

	8 8 8 8 8 8 8 8
Sub Unit	Topics
1.2	Introduction to C++: Origin of C++. A Sample C++ program. Layout of simple C++ program. Compiling and running a C++ program.
2.1	Compound statements, Iterations or Looping: while, for, do while, nested loops, Decision making: if – else, nested if else, switch, break and continue, Manipulators: endl, setw, size of, Increment and decrement operators, Type Cast Operators, Scope resolution operators.

Self-Learning topics (Unit wise)

Online Resources

Computer Science and Engineering NPTEL Prof. Abhiram Ranade, IIT Bombay https://nptel.ac.in/courses/106/101/106101208/

US-DS-104 MS Excel

S	-DS-1	04 MS Excel (Total Hor	ırs: 45)
	Unit	Content	No. of
			Lectures
	1	Basics of Excel	
		1.1 Creating and Navigating worksheets and adding information to	
		worksheets	
		i). Types of data, entering different types of data such as	
		texts, numbers, dates, functions.	
		ii). Quick way to add data Auto complete, Autocorrect, Auto	
		fill, Auto fit. Undo and Redo.	
		iii). Moving data, contiguous and non-contiguous selections,	
		Selecting with keyboard. Cut-Copy, Paste. Adding and	
		moving columns or rows. Inserting columns and rows.	
		iv). Find and replace values. Spell check. v) Formatting cells,	
		Numbers, Date, Times, Font, Colors, Borders, Fills.	
		1.2 Multiple Spreadsheets:	
		i). Adding, removing, hiding and renaming worksheets.	
		ii). Add headers/Footers to a Workbook. Page breaks,	15
		preview.	
		iii). Creating formulas, inserting functions, cell references,	
		Absolute, Relative (within a worksheet, other worksheets	
		and other workbooks).	
		iv). Creating and using templates.	
		v). Creating and Linking Multiple Spreadsheets.	
		vi). Using formulas and logical operators.	
		vii). Creating and using named ranges.	
		1.3 Functions:	
		i). Database Functions LOOKUP, VLOOKUP, HLOOKUP	
		ii). Conditional Logic functions IF, COUNTIF, SUMIF	
		iii). String functions LEFT, RIGHT, MID, LEN, UPPER,	
		LOWER, PROPER, TRIM.	
		iv). Date functions TODAY, NOW, DATE, TIME, DAY,	

	MONTH, YEAR, WEEKDAY, DAYS360						
2	 Intermediate Excel 2.1 Advance Functions: a) What- if-Analysis: Scenario Manager, Goal Seek, Data Table b) Financial functions: FV, PV, PMT, PPMT, IPMT, NPER, RATE, NPV, IRR. c) Mathematical and Statistical functions. ROUND, ROUNDDOWN, ROUNDUP, CEILING, FLOOR, INT, MAX, MIN, MOD, SQRT, ABS, AVERAGE. d) Data Analysis i). Filter with customized condition. ii). The Graphical representation of data(All types of Graphs, Diagrams etc). iii).Sorting, Subtotal. iv). Pivot Tables- Building Pivot Tables, Pivot Table regions, Rearranging Pivot Table. 	15					
3	 Statistical Computations 3.1 Some Probability Distributions: Plotting of pmf/pdf, cdf, computation of probabilities of Binomial, Poisson, Normal, Exponential 3.2 Operations Research Techniques: Concept and Mathematical Formulation of Linear Programming Problem, Transportation Problems and Assignment Problems. Numerical problems of all above using Solver. 3.3 Concept and Numerical Problems with Excel add-in MegaStat and/or Data Analysis ToolPak. 	15					

Self-Learning topics (Unit wise)

Sub Unit	Topics
	Need to be developed

Online Resources

Not existing

US-FDS-105 Introduction to Cyber Security

(Total Hours : 45H)

Unit	Content				
		Lectures			
1	Social Media Security[15 H]1.1 Introduction to Cyber Space: History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies1.2 Choosing the Best Browser according to the requirement and email security: Guidelines to choose web browsers, Securing web browser, Antivirus, Email security1.3 Guidelines for secure password and wi-fi security1.4 Guidelines for secure password and wi-fi security1.5 Two-steps authentication1.6 Password Manager1.7 Wi-Fi Security1.8 Guidelines for social media and basic Windows security1.9 Guidelines for social media security1.10 Tips and best practices for safer Social Networking1.11 Basic Security for Windows1.12 User Account Password	15			
11	 Security Guidelines [15 H] 2.1 Smartphone security guidelines: Introduction to mobile phones, Smartphone Security, Android Security, IOS Security 2.2 Cyber Security Initiatives in India: Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance 2.3 Online Banking, Credit Card and UPI Security: Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security, Micro ATM, e-wallet and POS Security, Security of Micro ATMs. 2.4 e-wallet Security Guidelines 2.5 Security Guidelines for Point of Sales(POS) 	15			
	 Social Engineering and IT Security [15H] 3.1 Social Engineering: Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime. 3.2 Cyber Security Threat Landscape and Techniques: Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques. 3.3 IT Security Act and Misc. Topics: IT Act, Hackers-Attacker-Countermeasures, Web Application Security, Digital Infrastructure Security, Defensive Programming 3.4 Information Destroying and Recovery Tools 3.5 Recovering from Information Loss 3.6 Destroying Sensitive Information 3.7 CCleaner for Windows 	15			

Self-Learning topics (Unit wise)

Sub	Topics								
Unit									
2.3	Online Banking, Credit Card and UPI Security: Online Banking Security, Mobile								
	Banking Security. Security of Debit and Credit Card, UPI Security. Micro								
	ATM, e-wallet and POS Security, Security of Micro ATMs.								
2.4	e-wallet Security Guidelines								
2.5	Security Guidelines for Point of Sales(POS)								
3.1	Social Engineering: Social Engineering, Types of Social Engineering, How Cyber								
	Criminal Works, How to prevent for being a victim of Cyber Crime								

Online Resources

<u>https://www.youtube.com/watch?v=pAzurIg-vsM</u> Online Banking Security by Dr. Jeetendra Pande

<u>https://www.youtube.com/watch?v=seqg0Sh_mwg-</u> Social Engineering by Dr. Jeetendra Pande

<u>https://www.youtube.com/watch?v=rr4bDK8vXxw</u> Security of Electronics wallets by Dr. Jeetendra Pande

https://www.youtube.com/watch?v=GnE3FgnSIbs Micro atm by Dr. Jeetendra Pande

https://www.youtube.com/watch?v=wPKWMiH8mx4 POS security by Dr. Jeetendra Pande

Part -4 Detailed Scheme Practical

<u>Code</u> Practical: US-FDS-1P1 Title of Paper: Practicals of US-FDS-101, US-FDS-102, US-FDS-103, US-FDS-104

Unit	Content	No. of				
		Lectures				
1	1. Creating and Navigating worksheets and adding information to					
	worksheets.					
	2. Multiple Spreadsheets					
	3. Data Analysis: Sort, Filter, Frequency Tables, Subtotal and Pivot					
	Tables.	3 hours				
	4. Functions: Mathematical, Statistical and Financial Functions	per Batch				
	5. Advance Functions	per				
	6. Descriptive Statistics	Practical				
	7. Distributions					
	8. Analysis ToolPak					
	9. Decision Theory					
П	1. Write a C++ program for finding greatest of three number.	03 hours				
	2. Write a C++ program for solving the quadratic equation.	per Batch				
	3. Write a C++ program to print all the prime numbers in a given range.	per Practical				
	4. Write a C++ program for displaying the Fibonacci series.	Tuctical				
	5. Write a C++ program for converting number to words.					
	(switch,break,continue)					
	6. Write a C++ function for swapping two numbers without using third					
	variable.					
	7. Write a recursive function for factorial of given number.					
111	1. Write your own function for string reverse, string palindrome,	03 hours				
	string comparision	per Batch				
	2. Write a program for sorting the number in ascending and descending order	per Practical				
	3. Write a program for Matrix addition and multiplication					
	4. Write a program for implementing the concept of structures					
	5 Write a program for finding the greatest and smallest number using					
	vector.					
	6. Write a program for implementing the concept of call by value and					
	call by reference.					
	7. Write a program for generating the report card.					

References:

US-FDS-101 Business Statistics- I

- 1. Medhi J.: Statistical Methods, An Introductory Text, Second Edition, New Age InternationalLtd.
- 2. Agarwal B.L.: Basic Statistics, New Age InternationalLtd.
- 3. Spiegel M.R.: Theory and Problems of Statistics, Schaum's Publications series. TataMcGraw-Hill.
- 4. Kothari C.R.: Research Methodology, Wiley EasternLimited.
- 5. David S.: Elementary Probability, Cambridge UniversityPress.
- 6. Hoel P.G.: Introduction to Mathematical Statistics, Asia PublishingHouse.
- 7. Hogg R.V. and Tannis E.P.: Probability and Statistical Inference. McMillanPublishing Co. Inc.
- 8. Pitan Jim: Probability, Narosa PublishingHouse.
- 9. Goon A.M., Gupta M.K., Dasgupta B.: Fundamentals of Statistics, Volume II: The World Press Private Limited, Calcutta.
- 10. Gupta and Kapoor: Fundamentals of Applied Statistics, S. Chand
- 11. Gupta and Kapoor: Fundamentals of Mathematical Statistics, S. Chand
- 12. Sharma S. D.: Operations Research, Kedar Nath Ram Nath
- 13. Taha Hamdy A.: Operations Research-An Introduction, Tenth Edition, Pearson

US-FDS-102 Mathematical Foundation-I

- 1. Coddington, E. A. (1989). An introduction to ordinary differential equations. New York: Dover.
- 2. Raisinghania, M. (2013, Fifteenth Edition). Ordinary and Partial Differential Equations. S. Chand.
- 3. Rosen, K. (2012, Seventh Edition). Discrete Mathematics and its Applications. Mc Graw Hill.

US-FDS-103 C++ programming

- 1. Problem Solving with C++ , Walter Savitch, Sixth Edition, Pearson Education
- 2. J.R.Hubbard, Schaum's outlines "Programming with C++", Second Edition, Tata McGraw-Hill
- 3. Y.P.Kanetkar, "Let us C++", seventh edition, BPB publication
- 4. Object Oriented programming with C++, E Balagurusamy, Third Edition, Tata McGraw Hill.
- 5. Pure C++ programming, Amir Afzal, Pearson Education.
- 6. Computer Science A structured Approach using C++ by B. Forouzan, R. F. Gilberg, Cengage Publication.

US-DS-104 MS Excel

1. Excel Statistics-A Quick Guide, Nel J. Salkind, Sage Publications.

US-FDS-105 Introduction to Cyber Security

- 1. Introduction to Cyber Security available at <u>http://uou.ac.in/foundation-course</u>
- 2. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
- 3. Cyber Security Techniques <u>http://uou.ac.in/progdetail?pid=CEGCS-17</u>
- 4. Cyber Attacks and Counter Measures: User Perspective <u>http://uou.ac.in/progdetail?pid=CEGCS-17</u>
- 5. Information System <u>http://uou.ac.in/progdetail?pid=CEGCS-17</u>

Part 5- The Scheme of Teaching and Examination is as under: First Year Semester- II Summary

Sr.		Cho	Subject Code	Remarks	
No.					
1	Core Cou	urse (Bus	US-FDS-		
	Algebra,	R program	201, US-		
	US-FDS	5-202. U	S-FDS-203, US-FDS-204, US-FDS-	FDS-202,	
	205)	, 202, 0	US-FDS-		
	203)		203, US-		
				FDS-2P2	
2	Elective	Discipli	ne Specific Elective (DSE) Course		
	Course	2.1	Interdisciplinary Specific Elective (IDSE)	US-FDS-204	
			Course (Database Management System		
			with SQL)		
		2.2			
		2.3			
3			US-FDS-205		
	Ability E	nhanceme	ent Courses (AEC) (Business Analytics)		
	Skill Enh	ancement	Courses (SEC)		

First Year Semester -II Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week						Seas	sonal H	Evalua	tion Scheme	Tot al Marks
			Units	S. L.	L	Т	Р	Credit	S. L. E	СТ	ТА	SEE	
1	US- FDS- 201	Business Statistics- II	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
2	US- FDS- 202	Applied Linear Algebra	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
3	US- FDS- 203	R programming	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
4	US- FDS- 204	Database Management System with SQL	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
5	US- FDS- 205	Business Analytics	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
6	US- FDS- 2P2	Practicals of US-FDS-201, US-FDS-202, US-FDS-203, US-FDS-204, US-FDS-205	3 Practical per batch	0	0	0	15	6	0	0	0	50 marks per practical	150
	Total						20		То	tal M	larks	650	

* Three hours per week to be taken for CONTINUOUS self -learning Evaluation.

Sr. No.	Subject Code	Subject Title	Periods Per Week						Seasonal Evaluation Scheme				Tot al Marks
			Units	S. L.	L	Т	Р	Credit	S. L. E	СТ	TA	SEE	
1	US- FDS- 201	Business Statistics- II	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
2	US- FDS- 202	Applied Linear Algebra	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
3	US- FDS- 203	R programming	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
4	US- FDS- 204	Database Management System with SQL	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
5	US- FDS- 205	Business Analytics	3	$\frac{1}{5}$	3	0	0	2	10	20	10	60	100
6	US- FDS- 2P2	Practicals of US-FDS-201, US-FDS-202, US-FDS-203, US-FDS-204, US-FDS-205	3 Practical per batch	0	0	0	15	6	0	0	0	50 marks per practical	150
	Total	Hours / Credit						20		Tot	tal M	arks	650

First Year Semester – II Units – Topics – Teaching Hours

• Lecture Duration =1 Hour.

• One Credit =15 hours

L: Lecture: Tutorials P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination , PA- Project Assessment, AT- Attendance

Part -6 - Detailed Scheme Theory

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective UNIT

US-FDS-201 :Business Statistics- II

Unit	Content	No of
Onit	content	Lectures
1	 Estimation Concept of Parameter, statistic, estimator and estimate. Properties of good estimator (Only names), unbiasedness and standard error of an estimator. Central Limit theorem (statement only). Sampling distribution of sample means and sample proportion (For large sample only). Standard errors of sample mean and sample proportion. Point and Interval estimate of single mean, single proportion, Difference between two population mean and Difference between two population mean and Difference between two population proportions from sample of large size. Concept of hypothesis, Simple Hypothesis and composite hypothesis, Null and alternate hypothesis, Types of errors, Critical region, Level of significance. 	15
2	 Statistical Tests 2.1 Large sample tests (using central limit theorem, if necessary) i). For testing specified value of population mean ii). For testing specified value of population proportion iii). Test for Difference between Two Population Means iv). Test for Difference between Two Population Proportions. (Development of critical region is not expected.) 2.2 Applications of t: Test procedure of 2.3 Test of significance for specified value of mean of Normal population. 2.4 Test of significance for difference between means of (i) two independent Normal populations with equal variances (ii) Dependent samples (Paired t test) 2.5 Confidence intervals for (i) Mean of Normal population, (ii) difference between means of two independent Normal populations having the same variance 2.6 Applications of Chi-Square: Test procedures of 2.7 Test of significance for specified value of variance of a Normal population 2.8 Test for goodness of fit 2.9 Test Procedure for independence of attributes. (i) r x c contingency table (ii) 2 x 2 contingency table 	15

	2.10 Confidence interval for the variance of a Normal	
	population when (i) mean is known, (ii) mean is unknown.	
	2.11 Applications of F: Test procedure for testing equality of	
	variances of two independent Normal populations i. Mean is	
	known ii. Mean is unknown. Confidence interval for ratio of	
	variances of two independent Normal populations.	
3	Analysis of Variance	
	3.1 Introduction, Uses, Cochran's Theorem (Statement only).	
	3.2 One way classification with equal & unequal observations per	
	class, Two way classification with and without replications:	45
	Mathematical Model, Assumptions, F-test, Analysis of variance	15
	table. Statement of estimators of the parameters, Variance of	
	the estimators, Estimators of treatment contrasts, Standard	
	Error and Confidence limits for elementary treatment contrasts.	

Self-Learning topics (Unit wise)		
Sub Unit	Topics	
1.3	Central Limit theorem (statement only).	
1.4	Sampling distribution of sample means and sample proportion (For large sample only).	
1.5	Standard errors of sample mean and sample proportion.	
1.6	Point and Interval estimate of single mean, single proportion,	
1.7	Concept of hypothesis, Simple Hypothesis and composite hypothesis, Null and alternate hypothesis, Types of errors, Critical region, Level of significance.	
2.1.3	For testing specified value of population proportion	

Online Resources

1. 'Probability and Statistics' by Prof. Somesh Kumar from IIT Kharagpur available on the Swayam portal

https://nptel.ac.in/courses/111/105/111105090/

2. 'Statistics for Business Economics' by Dr. Patel from University School of Sciences available on the Swayam portal

http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/227

3. 'Business Statistics' by Dr Mukesh Kumar Barua from IIT Roorkee available on the Swayam portal

https://nptel.ac.in/courses/110/107/110107114/

for unit I and unit II.

us-FDS- 202: <u>Applied Linear Algebra</u>

		Lectures
1	Matrices Matrices: Definition, Properties, Basic operations, Determinants of Matrices and applications of determinants for 3rd and Higher order, Inverse of matrix, Trace of matrix, Partition of matrix, Rank of matrix, echelon forms, canonical form, generalized inverse, Solving linear equations, Characteristic roots and characteristic vectors, properties of characteristics roots, Idempotent matrix, Quadratic forms, positive and Positive semi definite matrix	15
2	 Vector Spaces 2.1 Definitions and Examples. 2.2 Vector Subspaces. 2.3 Linear Independence. 2.4 Basis and Dimensions of a Vector Space. 2.5 Row and Column Spaces of a matrix. Row rank and Column rank 	15
3	Linear Transformations 3.1 Definitions and Examples. 3.2 Representation by a matrix. 3.3 Kernel and Image of a Linear Transformation. 3.4 Rank-Nullity theorem. 3.5 Linear Isomorphism. 3.6 L (V, W) is a vector space. Dimension of L(V,W) (Statement only)	15

Self-Learning topics (Unit wise)

Sub Unit	Topics
1	Matrices: Definition, Properties, Basic operations, Determinants of Matrices and
	applications of determinants for 3rd and Higher order, Inverse of matrix, Trace of matrix, Partition of matrix, Rank of matrix, echelon forms, canonical form, generalized inverse, Solving linear equations

Online Resources

1. 'Basic Linear Algebra' by Prof. I. K. Rana from IIT Bombay available on the Swayam portal

https://nptel.ac.in/courses/111/101/111101115/

for unit 1.

2. 'Linear Algebra' by Prof. Pranav Haridas from Kerala School of Mathematics available on the Swayam portal

https://nptel.ac.in/courses/111/106/111106135/

3. 'Introduction to Abstract and Linear Algebra' by Prof. Sourav Mukhopadhyay from IIT Kharagpur available on the Swayam portal<u>https://nptel.ac.in/courses/111/105/111105112/</u>

US-FDS-203: <u>R-programming</u>

Unit	Content	No. of
		Lectures

1	Fundamentals of R	
1	 Fundamentals of R 1.1 Introduction to R features of R, installation of R, Starting and ending R session, getting help in R, 1.2 Value assigning to variables. 1.3 Basic Operations: +, -, *, ÷, ^, sqrt. 1.4 Numerical functions: log 10, log , sort, max, unique, range, length, var, prod, sum, summary, dim, sort, five num etc. 1.5 Reading and writing data: From and to CSV files and HTML. 1.6 Data Type: Vector, list, matrices, array and data frame 1.7 Variable Type: logical, numeric, integer, complex, character and factor. 1.8 Operations on matrices. 1.9 Control statements: if, if-else, if-else-if, while loop, for loop. 	15
	1.10 Defining functions and Printing outputs.	
2	 Data Handling 2.1 Data Manipulation: Selecting random N rows, removing duplicate row(s), dropping a variable(s), Renaming variable(s), sub setting data, creating a new variable(s), selecting of random fraction of row(s), appending of row(s) and column(s), simulation of variables. 2.2 Data Processing: Data import and export, setting working directory, checking structure of Data :Str(), Class(),, Changing type of variable (for eg as.factor, as.numeric) 2.3 Introduction to dplyr and data.table packages 2.4 Data Visualisation using simple functions and ggplot: Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot eg plot(), correlation plot. 	15
3	 Statistical Computing 3.1 Descriptive Statistics: Averages, Positional Averages, Dispersion, Skewness, Kurtosis, Correlation Curve Fitting and Regression 3.2 Some Probability Distributions: Plotting of pmf/pdf, cdf, computation of probabilities of Binomial, Poisson, Normal, Exponential 3.3 Statistical Tests for t, Chi-square, F and ANOVA 3.4 Operations Research Techniques: a. Concept and Mathematical Formulation of Linear Programming Problem, Transportation Problems and Assignment Problems. Numerical problems of all above using lpSolve. 	15

Self-Learning topics (Unit wise)		
Sub Unit	Topics	
1.1	Introduction to R features of R, installation of R, Starting and ending R session, getting help in R	
1.8	Operations on matrices.	
2.4	Data Visualisation using simple functions and ggplot: Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot eg plot(), correlation plot.	
3.1	Descriptive Statistics: Averages, Positional Averages, Dispersion, Skewness, Kurtosis, Correlation Curve Fitting and Regression	

Online Resources

1. 'Introduction to R Software' by Prof. Shalabh from IIT Kanpur available on the Swayam portal

https://nptel.ac.in/courses/111/104/111104100/

 Descriptive Statistics with R Software' by Prof. Shalabh from IIT Kanpur available on the Swayam portal

https://nptel.ac.in/courses/111/104/111104120/

for unit I, unit II and unit III.

3. 'Introduction to R' by Santu Ghosh from Rajiv Gandhi University of Health Sciences available on the Swayam portal

http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_pg.php/1851

US-FDS-204: Database Management System with SQL

Unit	Content	No. of
		Lectures
1	Introduction & DBMS Architecture	
	1.1 Data, Database, Database management system	
	1.2 Characteristics of the Database Approach	
	1.3 Advantages and Disadvantages of DBMS	
	1.4 Data Models, Categories of Data models, Schemas, Instance	
	and Database states	15
	1.5 Data Independence	
	1.6 The Three schema architecture	
	1.7 DBMS language and interface	
	1.8 Classifications of Database Management Systems	
2	Basics of MySQL	
	2.1 Introduction of MySQL as a DBMS	
	2.2 Relational Database	
	2.3 Creating a Database, CREATE Table statement	
	2.4 SELECT Statement	15
	2.5 COUNT, DISTINCT, LIMIT Statements	
	2.6 INSERT Statement	
	2.7 UPDATE and DELETE Statements	

	2.8 DROP Statement	
3	Advanced SQL	
	3.1 Using String Patterns, Ranges	
	3.2 Sorting and Grouping	
	3.3 Built-in Database Functions	
	3.4 Date and Time Built-in Functions	
	3.5 Numeric Built-in Functions	
	3.6 String Built-in Functions	15
	3.7 Sub-Queries and Nested Selects	
	3.8 Working with Multiple Tables	
	3.9 WHERE and HAVING Clause	
	3.10 LIKE Clause	
	3.11 Transactions: ROLLBACK and COMMIT	

Self-Learning topics (Unit wise)		
Sub Unit	Topics	
1.1	Data, Database, Database management system	
1.2	Characteristics of the Database Approach	
1.4	Data Models, Categories of Data models, Schemas, Instance and Database states	
2.1	Introduction of MySQL as a DBMS	
2.2	Creating a Database, CREATE Table statement	
2.3	SELECT Statement	

Online Resources

1. 'Database Management System' by Prof. Partha Pratim Das from IIT Kharagpur available on the Swayam portal

https://nptel.ac.in/courses/106/105/106105175/ for unit I and Unit II.

- 2. 'Fundamentals of database systems' by Prof. Arnab Bhattacharya from IIT Kanpur available on the Swayam portal <u>https://nptel.ac.in/courses/106/104/106104135/</u>
- 3. 'Introduction to Database Systems' by Prof. Sreenivasa Kumar from IIT Madras University of Health Sciences available on the Swayam portal

https://nptel.ac.in/courses/106/106/106106220/

US-FDS-205: Business Analytics

Unit	Content	No. of
		Lectures
1	Business Analytics Landscape	
	1.1 Overview of Startup Landscape	
	1.2 Product Lifecycle Management	
	1.3 Details of Business Analytics	15
	1.4 Competing on Analytics	
	1.5 Getting started with Business Analytics	
2	Introduction to Data Mining	
2	2.1 Introduction: Basic concept of Data mining need challenges and	15
	application of Data mining.	13

	2.2 Discussion of Some case studies of data mining.	
	2.3 On-line Analytical Processing.	
	2.4 Major Issues in data mining.	
	2.5 Getting to know your data: data objects and attribute types, basic	
	statistical descriptions of Data, Data Visualization, Measuring Data	
	Similarity and dissimilarity.	
3	Data Preparation & Basic Mining tools	
	3.1 Data Pre-processing: An Overview, Data Cleaning, Data	
	Integration, Data Reduction, Data transformation and data	
	discretization, Normalization and Smoothing of data.	
	Associations and Correlations: Basic Concepts and methods.	15
	3.2 Classification: Basic concepts decision Tree	
	3.3 Induction, Rule-Based Classification, Model Evaluation and	
	Selection.	

Self-Learning topics (Unit wise)

Sub Unit	Topics
2.1	Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data transformation and data discretization, Normalization and Smoothing of data. Associations and Correlations: Basic Concepts and methods.
2.2	Classification: Basic concents decision Tree
	classification. Basic concepts decision free

Online Resources

'Data Mining' by Prof. Pabitra Mitra from IIT Kharagpur available on the Swayam portal

https://nptel.ac.in/courses/106/105/106105174/ for unit II.

'Data Mining' by Mr. L. Abraham David from St.John's College, Palayamkottai Tirunelveli available on the Swayam portal

http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/31

'Business Analytics and Data Mining Modelling using R' by Dr. Gaurav Dixit from IIT Roorkee available on the Swayam portal <u>https://nptel.ac.in/courses/110/107/110107092/</u>

'Business Analytics and Data Mining Modelling using R Part II' by Dr. Gaurav Dixit from IIT Roorkee available on the Swayam portal <u>https://nptel.ac.in/courses/110/107/110107095/</u>

Part – 7- Detailed Scheme Practicals

Practical : <u>US-FDS-2P2</u>

Title of Paper: <u>Practicals of US-FDS-201, US-FDS-202, US-FDS-203, US-FDS-204, US-FDS-205</u>

Unit	Content	No. of
		Lectures
	1. Introduction to R Software	03

	2. Descriptive Statistics-I	Lectures
	3. Descriptive Statistics-II	per
	4. Correlation, Curve Fitting and Regression	Batch
	5. Distributions	per Bractical
	6. Statistical Tests	FIACUCAI
	7. ANOVA	
	8. Operations Research Technique	
П	Practicals based on Applied Linear Algebra & Business Analytics	
111	Practicals based on MySQL	

REFERENCE BOOKS:

US-FDS-201 : Business Statistics- II

- 1. Medhi J.: Statistical Methods, An Introductory Text, Second Edition, New Age InternationalLtd.
- 2. Agarwal B.L. : Basic Statistics, New Age InternationalLtd.
- 3. Spiegel M.R. : Theory and Problems of Statistics, Schaum's Publications series. TataMcGraw-Hill.
- 4. Kothari C.R. : Research Methodology, Wiley EasternLimited.
- 5. David S. : Elementary Probability, Cambridge UniversityPress.
- 6. Hoel P.G. : Introduction to Mathematical Statistics, Asia PublishingHouse.
- 7. Hogg R.V. and Tannis E.P. : Probability and Statistical Inference. McMillanPublishing Co. Inc.
- 8. Pitan Jim : Probability, Narosa PublishingHouse.
- 9. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II : The World Press Private Limited, Calcutta.
- 10. Gupta and Kapoor: Fundamentals of Applied Statistics, S. Chand
- 11. Gupta and Kapoor: Fundamentals of Mathematical Statistics, S. Chand

us-FDS- 202: Applied Linear Algebra

- 1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India, New Delhi, 1999.
- 2. M. Artin, Algebra, Prentice Hall of India, New Delhi, (1994).
- 3. K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India New Delhi, (1998).
- 4. S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New Yark, (1986).
- 5. A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata McGraw Hill, New Delhi (1994).
- 6. G. Schay, Introduction to Linear Algebra, Narosa, New Delhi, (1998).
- 7. L. Smith, Linear Algebra, Springer Verlag, New York, (1978).
- 8. G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).
- 9. T. Banchoff and J. Werner, Linear Algebra through Geometry. Springer-Verlag, New Yark, (1984).
- 10. H. Anton and C. Rorres, Elementary Linear Algebra with Applications, Seventh Ed., Wiley, (1994).

US-FDS-203: <u>R programming</u>

- 1. Crawley, M. J. (2006). Statistics An introduction using R. John Wiley, London
- 2. Purohit, S.G.; Gore, S.D. and Deshmukh, S.R. (2015). Statistics using R, second edition. Narosa Publishing House, New Delhi.
- 3. Shahababa, B. (2011). Biostatistics with R, Springer, New York
- 4. Verzani, J. (2005). Using R for Introductory Statistics, Chapman and Hall /CRC Press, New York
- 5. Asha Jindal (Ed.)(2018), Analysing and Visualising Data with R software- A Practical Manual, Shailja Prakashan and K.C.College.
- 6. <u>http://www.sthda.com/english/wiki/be-awesome-in-ggplot2-a-practical-guide-to-be-highly-effective-r-software-and-data-visualization</u>

US-FDS-204: Database Management System with SQL

- 1. Raghu Ramakrishnan, J. G. (2003). Database Management Systems, . McGraw-Hill.
- 2. Ramez Elmasri, S. N. (2013, Sixth Edition). Database Systems. Pearson.
- 3. Tahaghogh, S. M. (2006). Learning MySQL: Get a Handle on Your Data. O'Reilly.

US-FDS-205: Business Analytics

- 1. Dunham, Margaret H, Data Mining: Introductory and Advanced Topics, Prentice Hall.
- 2. Witten, Ian and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Morgan Kaufmann.
- 3. Han, J., Kamber, M., & Pei, J. Data mining: Concepts and techniques (3rd ed.). Waltham: Morgan Kaufmann, 2011.
- 4. Baeza and Yates, Modern Information Retrieval, Addison Wesley.
- 5. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw Hill.
- 6. Ramez elmasri and shamkant b.Navathe, "fundamental data base systems", third edition, Pearson Education, 2008.

Appendix-1

HSNC University, Mumbai Bridge course in Mathematics and Statistics for students of Data science and Business Analytics

For students who come from non-mathematics back ground and who are aspiring to become data analysts or data scientists HSNC University offers a preparatory bridge course consisting of Data science fundamentals.

This program will prepare you to successfully study data science and business analytics at the graduation level by introducing basic concepts.

Course structure:

(Total 20 lectures of one hour duration each)

The program consists of the following courses:

Unit 1: Set Theory, Relations and functions: (03 lectures of one hour each)

Sets : Sets and their representation, Different types of sets, Venn diagrams, Union and intersection of sets, Difference of sets and complement of a set. Practical problems on sets.

Relations and Functions:

Ordered pairs, Definition of Relation, Pictorial diagrams, Domain, Co-domain, Range of a relation

Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function

Real valued functions, domain and range of these functions: Constant, Identity, Polynomial, Rational, Modulus, Signum, Exponential, Logarithmic, Greatest integer functions (with their graphs)

Sum, difference, product and quotients of functions.

Simple problems based on Relations and functions.

References:

- 1. P.B. Bhattacharya, S.K.Jain, S.R. Nagpaul, First Course in Linear Algebra, Wiley, 1983
- 2. G. Hadley, Linear Algebra, Narosa Publishing, 1992.
- 3. J.P. Singh, Discrete Mathematics for Under graduates, Ane Books, 2014.
- 4. Mathematical analysis by S C Malik

Unit 2: Algebra (05 lectures of one hour each)

Linear and Quadratic equations, Linear inequalities, Permutation and combination. Simple problems based on Algebra.

Vectors

Definition of vectors. Concept of Dot product and Cross product. Simple problems based on these topics.

Matrices

Representation of the data in a Matrix form. Different types of matrices. Mathematical operations on matrices. Determinant and inverse of a matrix.

Problems based on Matrices will be solved during the lecture.

References:

- 1. J.P. Singh, Discrete Mathematics for Under graduates, Ane Books, 2014.
- 2. P.B. Bhattacharya, S.K.Jain, S.R. Nagpaul, First Course in Linear Algebra, wiley 1983
- **3.** G. Hadley, Linear Algebra, Narosa Publishing, 1992.
- **4.** An Introduction to linear algebra A R Vasistha
- 5. Mathematical analysis by S C Malik

Unit 3: Calculus (05 lectures of one hour each)

Chapter 1: Limits and Derivatives

Understanding and calculating limits, continuity and derivatives as rates of change. Differentiation rules including, derivatives of polynomials, exponentials. Product, quotient and chain rule of differentiation. Maximum and Minimum problems. L'Hospitals rule. Simple problems based on limits and derivatives.

Chapter 2: Integration

Concept of integration. Indefinite and Definite integration. Concept of area under the curve. Simple problems based on all the topics.

References:

- G.B. Thomas, M.D. Weir, J.R. Hass, Thomas' Calculus, Pearson Publication.
- R.G. Bartle, D.R. Sherbert, Introduction to Real Analysis, Wiley Publication.

Unit 4: Statistics

Chapter 1: Descriptive statistics: (02 lectures of one hour each)

Data, Different types of data, Organization of data using classification. Graphical representation of data.

Probability: (03 lectures of one hour each)

Basic definitions of Theory of probability. Addition theorm of probability, Conditional probability, Multiplication theorem of probability. Simple problems based on probability.

Random variables (02 lectures of one hour each)

Discrete Random variables:

Definition, probability mass function, cumulative density function. Simple problems based on discrete random variables. Expectation and variance. Simple problems based on Expectation and variance.

Continuous random variables:

Definition, probability mass function, cumulative density function. Expectation and variance. Simple problems based on Continuous random variables.

Expectation and variance. Simple problems based on Expectation and variance.

References:

- 1. Mathematical statistics by J N Kapur and H C Saxena.
- 2. Descriptive statistics by Milan Gholba, Sudha Phatak
- 3. Statistical Methods by Milan Gholba, Sudha Phatak
- 4. Probability and Statistics by Schaums's outlines, M R Speigel, J J Schiller, R A Srinivasan

Assessment:

1. Students will be given assignments on all units as soon as the unit is completed. Students should complete all assignments within 2 days of completion of the unit.

(Marks:20)

- 2. Viva voce for 10 marks.
- 3. One test of 20 marks will be conducted. Minimum passing percentage is 50%.

Appendix-2

Non- Credit Remedial English Course

<u> Unit – I</u>

10 hours_

<u>READING</u>

- (i) Important English idioms and phrases, simple comprehension texts with emphasis on its nature Example - descriptive, informational, narrative and explanatory.
- (ii) Exercises to improve vocabulary, grammar and higher order thinking.
- (iii) Exposure to various scientific tools in the Language Laboratory.

<u>Unit- II</u>

10 hours

<u>WRITING</u>

- (i) Agreement between subject and verb, concord of nouns, pronouns and possessive adjectives (third person), confusion of adjectives and adverbs, difficulties with comparatives and superlatives, prepositions, negative verbs, tenses, the infinitive, the position of adverbs, verbs compounded with adverbs: the position of the object, the use of correlatives, the verb have, errors in the use of individual words, dates and the time, one – word substitution.
- (ii) Letter/application writing, Business Communication, translation.
- (iii) All topics to be followed by written exercises

<u>Unit-III</u> Listening & Speaking

10 hours

- (i) Listening activity. (Audio clips from BBC News Story, popular documentary etc.)
- (ii) Accent awareness, Greetings and Salutations, important English Idioms and Phrases, Synonyms and Antonyms, Comprehension.
- (iii) Group discussions, public speaking, debates.

Reference Books –

- 1. The Wrong Word Dictionary (Published by Marion Street Press, USA)
- 2. Merriam Webster Dictionary
- **3.** Advanced Vocabulary and Structure Practice by Matasek Maciej