



## 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- [asha.jindal@kccollege.edu.in](mailto:asha.jindal@kccollege.edu.in)  
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) **Dr. S. B. Muley**, Assistant Professor, Department of Statistics, K. C. college, HSNC University Churchgate, Mumbai – 400 020. Email ID [sakharam.muley@kccollege.edu.in](mailto:sakharam.muley@kccollege.edu.in),  
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](mailto: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 [shailaja.rane@kccollege.edu.in](mailto:shailaja.rane@kccollege.edu.in), 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](mailto: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 [ssharma643@yahoo.co.in](mailto:ssharma643@yahoo.co.in), **Mobile No-**9815911381
- b. **Mr Mukesh Jain**, Chief Technological Officer, Capgemini. Email ID [mdjain@hotmail.com](mailto:mdjain@hotmail.com), **Mobile No-**7972637347.
- c. **Dr Santosh Gite**, Associate Professor, Dept. of Statistics, University of Mumbai, Mumbai. Email ID [santgite@yahoo.com](mailto:santgite@yahoo.com), **Mobile No-** 9167157717.
- d. **Mr Prashant Kumar Nair**, Director, Geo Spatial Analytics Global Lead, Intelligent Analytics, Nielsen Connect, Email ID [prasifhantkumar.nair@nielsen.com](mailto:prasifhantkumar.nair@nielsen.com) , **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- [mohaddasah.98@gmail.com](mailto:mohaddasah.98@gmail.com) ; Mobile no- 9833781878
- b) **Ms. Divya Srivastava** (undergraduate student18-19) Email ID- [divyasrivastav20@gmail.com](mailto:divyasrivastav20@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 The Academic Year 2020-2021 Are As 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 a discipline 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 inter-disciplinary, 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 in exigencies, like the current situation arising from the lockdown, but such ad hoc decisions are to be 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)**

##### **1. For Theory Courses**

Sr. No.	Particulars	Marks
1	<b>ONE</b> 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

## 2. For Courses with Practical

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 <b>Or</b> One Assignment/ project/presentation to be assessed by teacher concerned	10
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 RESOURCE 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). Methods for Evaluation of Self-learning topics:

- 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 LEAST 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**

(2021-2022)

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 – Second Year Undergraduate**

**Programmes Semester-III and Semester -IV**

2021-2022

# **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, 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-III**

**Course Code: US-SDS-301**

**Title of Paper: Predictive Analytics using SPSS**

The goal of the course is to increase knowledge and requisite skills of participants on the use of SPSS and to enable them make the most of this powerful software package while allowing them to work independently with SPSS on their own data and provide a solid foundation for advanced data analysis work.

**Course Code: US-SDS-302**

**Title of Paper: Mathematical Foundation-II (Data Frames and Algorithms)**

Data Frames and Algorithms are useful in software programming courses to machine learning will be covered in this course. After learning this course, the students will be well equipped to apply these techniques in many major courses like pattern recognition, deep learning, programming etc.

**Course Code: US-SDS-303****Title of paper: Python Programming**

The goal of the course is to increase knowledge and requisite skills of participants to understand why Python is a useful scripting language for developers and enables to learn how to design and program Python applications. Learners will also learn how to use lists, tuples, and dictionaries in Python programs and how to identify Python object types.

**Course Code: US-SDS-304****Title of paper: Object Oriented Programming in JAVA**

The goal of the course is to increase knowledge and requisite skills of participants to understand Object-oriented programming implementation in real-world entities like inheritance, hiding, polymorphism etc in programming and to bind together the data & the functions that operate on them so that no other part of the code can access this data except that function.

**Course Code: US-SDS-305****Title of paper: Visualization using Tableau and Maya**

Tableau disrupted business intelligence with intuitive, visual analytics for everyone. Tableau course was aimed to improve the flow of analysis and make data more accessible to people through visualization. So, learners will learn Better analysis, Quick action, Identifying patterns, Finding errors, Understanding the story, Exploring business insights, Grasping the Latest Trends.

**SEMESTER-IV****Course Code: MS-SST-401****Title of Paper: Structural Equation Modelling using SPSS AMOS/FOSS (Python /R)**

This course develops a strong conceptual and an analytical understanding of the logic of AMOS/R/Python and Structural Equation Modelling. Learners will be able to fit structural equation models using AMOS/R/Python to boost their theories and research.

**Course Code: MS-SST-402****Title of Paper: Multivariate Calculus**

Learners will also learn to use graphically and analytically synthesize and apply multivariable and vector-valued functions and their derivatives, using correct notation and mathematical precision. Learners will also learn to use double, triple and line integrals in applications and synthesize the key concepts of differential, integral and multivariate calculus.

**Course Code: MS-SST-403****Title of paper: Introduction to Artificial Intelligence**

The primary objective of this course is to introduce learners to the basic principles, techniques, and applications of Artificial Intelligence and to make them familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.

**Course Code: MS-SST-404****Title of paper: Advanced JAVA**

It is a part of Java programming language. Learners will learn an advanced technology or advance version of Java **specially designed to develop web-based, network-centric or enterprise applications**. It includes the concepts like Servlet, JSP, JDBC, RMI, Socket programming, etc.

**Course Code: MS-SST-405****Title of paper: Machine Learning and Deep Learning**

The goal of machine learning and Deep Learning for learners is to discover patterns in their data and then make predictions based on often complex patterns to answer business questions, detect and analyse trends and help solve problems.

**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.
- 2) 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:  
Second Year Semester – III Summary**

Sr. No.	Choice Based Credit System		Subject Code	Remarks
1	Core Course ( <b>Data Science and Business Analytics</b> )		US-SDS-301, US-SDS-302, US-SDS-303, US-SDS-3P3	
2	Elective Course	Discipline Specific Elective (DSE) Course		US-SDS-304
		2.1	Interdisciplinary Specific Elective (IDSE) Course	
		2.2	Dissertation/Project	
		2.3	Generic Elective (GE) Course	
3	Ability Enhancement Courses (AEC)			
	Skill Enhancement Courses (SEC)		US-SDS-305	

**Detail Scheme**

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credit	Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P		S. L. E	CT	TA	SEE	
1	US-SDS-301	Predictive Analytics using SPSS	3	$\frac{1}{5}$	3	0	2	3	10	20	10	60	100
2	US-SDS-302	Mathematical Foundation-II	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
3	US-SDS-303	Python Programming	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
4	US-SDS-304	Objected Oriented Programming in JAVA	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
5	US-SDS-305	Visualization using Tableau and Maya	3	$\frac{1}{5}$	3	0	0	3	10	20	10	60	100
6	US-SDS-3P3	Practicals of US-SDS-301, US-SDS-302, US-SDS-303, US-SDS-304, US-SDS-305	3 practical per batch	0	0	0	5	5	0	0	0	50 marks per practical	150
Total Hours / Credit								20	Total Marks				650

**\*One to two lectures to be taken for CONTINUOUS self -learning evaluation.**

## Second Year Semester – III Units – Topics – Teaching Hours

S.N	Subject Code	Subject Unit Title		Hours /Lect ures	Total No. of hours/lec tures	Credit	Tot al Marks
<b>1</b>	US-SDS - 301	I	Managing Data in SPSS	15	45 H	3	100 (60+40)
		II	Multi-Dimensional Scaling (MDS) & Correspondence Analysis and Statistical Test	15			
		III	Statistical Modeling	15			
<b>2</b>	US-SDS - 302	I	Data Frames-I	15	45 H	3	100 (60+40)
		II	Data Frames-II and Algorithms-I	15			
		III	Algorithms-II	15			
<b>3</b>	US-SDS - 303	I	Introduction to Python	15	45 H	3	100 (60+40)
		II	Data Handling and Visualization	15			
		III	Statistical Computing and Modeling	15			
<b>4</b>	US-SDS - 304	I	Introduction to Java	15	45 H	3	100 (60+40)
		II	Java Programming Fundamental, Classes and Objects	15			
		III	Arrays, Strings and File Handling	15			
<b>5</b>	US-SDS- 305	I	Data Connection, Visualization and Calculation with Tableau Desktop	15	45 H	3	100 (60+40)
		II	Advance Visualization	15			
		III	Creating and Storytelling with Dashboard and Maya	15			
<b>6</b>	US-SDS- 306	I	Practicals of US-SDS-301, US-SDS-302, US-SDS-303, US-SDS-304, US-SDS-305	45	45 x 3=135	5	150
			TOTAL			20	650

- **Lecture Duration – 1 hour**
- **One Credit =15 Classroom 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

Course Code: US-SDS-301

Title of Paper: Predictive Analytics using SPSS

Unit	Content	No. of Lectures
I	<b>Managing Data in SPSS</b> 1.1 Creating and Editing Data File 1.2 Data Manipulation: Sorting Data, Merging and Appending Data/files, Aggregating/summarizing Data, Reshaping Data, Recording Variables, Sub setting Data, Data Type Conversions, Sampling, Renaming-formatting data, Handling duplicates/Missing values, Computing new variables, Selecting cases 1.3 Visualization for Univariate, Bivariate and Multivariate Data: 1.4 Diagram Vs Graphs, Creating available Graphs, Histograms & Density Plot, Dot Plots – Bar Plots(Column, Subdivided, Percentage) – Line Charts – Pie Charts –Boxplots – Scatterplots <b>Story telling on dataset Titanic dataset</b> ( <a href="http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv">http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv</a> )	15
II	<b>Multi-Dimensional Scaling (MDS) &amp; Correspondence Analysis and Statistical Test:</b> 2.1 <b>Multi-Dimensional Scaling (MDS) &amp; Correspondence Analysis:</b> Objective of MDS, Comparing MDS to other interdependence techniques, Research design, Assumption of MDS, Deriving MDS & assessing over fit, Validating MDS, Objective of correspondence analysis., Research design, Assumptions of correspondence analysis, Deriving of CA & assessing overall fit. <b>Story telling using grades-mds.sav</b> 2.2 Programmability Extension-Using R inside SPSS <b>Story telling using fabric.sav</b> 2.3 Data Preprocessing:: Detection and treatment of Missing values, Outliers, Scaling	15

	<p>2.4 Reliability Analysis: Coefficient alpha and split half reliability <b>Story telling using Tech Survey .sav</b></p> <p>2.5 Cross tabulation and <b>Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio</b> <b>Story telling using Tech Survey.sav</b></p> <p>2.6 <b>Statistical Test: Data Preparation, Hypothesis Development, Hypothesis Testing: t, Z and F test and Story telling</b></p> <p>2.7 <b>ANOVA: Introduction, Model specification, Assumptions, Post hoc Analysis for One Way and Two Way ANOVA</b> <b>Story telling using grades.sav</b></p>	
III	<p><b>Statistical Modeling:</b></p> <p>3.1 <b>Bivariate Correlations, partial correlations, Multiple Correlations:</b></p> <p>3.2 Introduction, Examples, Scatter Diagram, Computation for quantitative and qualitative Data <b>Story telling using grades.sav</b></p> <p>3.3 <b>Simple Linear Regression:</b> Introduction to linearity in parameters and variables, Linear Regression Vs Nonlinear Regression, Model and Assumptions, Residuals, <math>R^2</math>, adjusted <math>R^2</math>, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients <b>Story telling on dataset helping3.sav</b></p> <p>3.4 <b>Introduction of Transformation of Variables</b></p> <p>3.5 <b>Multiple Linear Regression:</b> Model and Assumptions, correlation matrix, Forward Selection Method, Backward Selection Methods, Stepwise Selection Method, Variable Selection and Model Building</p> <ol style="list-style-type: none"> <li>First Order Test: Interpretation of output: Residuals, <math>R^2</math>, adjusted <math>R^2</math>, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients.</li> <li>Second Order Test: Test for Autocorrelation detection and treatment, Multicollinearity detection and treatment, Heteroscedasticity detection and treatment, Outlier detection and treatment</li> <li><b>Story telling on dataset mtcars</b></li> </ol> <p>3.6 <b>Introduction of dummy variable(s):</b> Concept, Procedure <b>Storytelling on dataset Auto MPG dataset</b></p> <p>3.7 <b>Ridge Regression:</b> Concept and Procedure <b>Storytelling on dataset Auto MPG dataset</b></p> <p>3.8 <b>Lasso Regression:</b> Introduction, Model, Assumptions, Procedure, Interpretation of output, validity of assumptions tests <b>Storytelling on dataset cruise_ship_info.csv</b></p> <p>3.9 <b>Quadratic, Polynomial and Ordinal Regression:</b> Introduction, Model, Assumptions, Procedure, Interpretation of output,</p>	15

	validity of assumptions tests <b>Story telling</b> on datasets a-year-of-pumpkin-prices data/ others <a href="https://www.kaggle.com/usda/a-year-of-pumpkin-prices-a">https://www.kaggle.com/usda/a-year-of-pumpkin-prices a</a>	
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#### Self-Learning topics (Unit wise)

Unit	Topics
I	Formatting data, Handling duplicates/Missing values, Computing new variables, Selecting cases, Creating available Graphs, Histograms & Density Plot
II	Data Preprocessing, Chi Square Analyses, Cramer V, Phi, Fisher Exact Test, odds Ratio  Statistical Test: Data Preparation, Hypothesis Development, Hypothesis Testing: t, Z and F test ANOVA: Introduction, Model specification, Assumptions, Post hoc Analysis for Two Way ANOVA

#### Online Resources

‘Marketing Research and Analysis-II’ by PROF. J. K. NAYAK, Department of Management Studies, IIT Roorkee, available on the NPTEL portal, <a href="https://nptel.ac.in/courses/110/107/110107080/">https://nptel.ac.in/courses/110/107/110107080/</a>  <a href="https://nptel.ac.in/courses/110/107/110107113/">https://nptel.ac.in/courses/110/107/110107113/</a>
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**Course Code: US-SDS-302**

**Title of Paper: Mathematical Foundation-II (Data Frames and Algorithms)**

Unit	Content	No. of Lectures
I	Data Frames –I 1.1 <b>Arrays:</b> Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation) 1.2 <b>Stacks:</b> Implementing single / multiple stack/s in an <b>Array</b> ; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack 1.3 <b>Linked Lists:</b> Singly, Doubly and Circular Lists (Array and Linked representation); Self Organizing Lists; Skip Lists	15
II	Data Frames-II 2.1 <b>Queues:</b> <b>Array and Linked representation of Queue, De-queue,</b>	15

	<b>Priority Queues</b> 2.2 Recursion : Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation) Algorithms-I 2.3 Lower Bounding Techniques 2.4 Decision Trees, Minimum Spanning Tree	
III	Algorithms-II 3.1 Algorithm Design Techniques: Iterative techniques, Divide and Conquer, <b>Dynamic Programming, Greedy Algorithms (Job Scheduling, Assign Mice to Holes)</b> . 3.2 Sorting and Searching Techniques: Elementary sorting techniques–Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort	15

**Self-Learning topics (Unit wise)**

Unit	Topics
1	<b>Arrays, Stacks, Linked Lists</b>
2	<b>Queues</b>
3	<b>Dynamic Programming, Greedy Algorithms (Job Scheduling)</b>

**Online Resources**

“NOC:2016: Programming, Data structures and Algorithms” by Prof. Hema A Murthy Dr. N S. Narayanaswamy , Prof. Shankar Balachandran, Computer Science and Engineering, IIT Madras, available on the NPTEL portal, <a href="https://nptel.ac.in/courses/106/106/106106127/">https://nptel.ac.in/courses/106/106/106106127/</a> <b>for units 1,2,3</b>
“NOC:2016: Programming, Data structures and Algorithms using Java” by Prof. Debasis Samanta, Computer Science and Engineering, IIT Kharagpur, available on the NPTEL portal <a href="#">NPTEL :: Computer Science and Engineering - NOC:Data Structure and algorithms using Java</a> <b>for units 1,2</b>

**Course Code: US-SDS-303**

**Title of paper: Python Programming**

Unit	Content	No. of Lectures
I	<b>Introduction to Python:</b> 1.1. Python Setup, Python Arithmetic, Basic Data Types,	15

	<p>Variables, Lists, Tuples and Strings, Dictionaries and sets.</p> <p>1.2.Numpy arrays: Creating arrays creating n-dimensional arrays using np.array and array operations(indexing and slicing, transpose, mathematical operations)</p> <p>1.3.Pandas data frames: Creating series and data frames and Operations on series and data frames</p> <p>1.4.Reading and writing data: From and to Excel and CSV files</p> <p>1.5.Control statements: if, if-else, if-else-if, while loop, for loop</p> <p>1.6.Defining functions: def statement</p> <p>1.7.Text data operations: len, upper, lower, slice, replace</p> <p>1.8.Web scrapping and API to connect with online sites</p>	
II	<p><b>Data Handling and Visualisation:</b></p> <p>2.1.<b>Data Manipulation:</b> 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.</p> <p>2.2.<b>Data Processing:</b> Data import and export, setting working directory, checking structure of Data, Changing type of variable, Data split into training and Test</p> <p>2.3.<b>Data Visualisation:</b> Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot, correlation plot Time series, Relationship maps, Heat maps, Geo Maps,3-D Plots, Higher-Dimensional Plots, Word clouds using Matplotlib, Plotly, Seaborn, ggplot2</p> <p>2.4.<b>Creating Dashboard, Comparison of Data Sets and Storytelling with</b> using Panda Profiling, Sweetviz, Autoviz.</p> <p><b>Story telling on Data Sets Iris /Pigeons/Car Design Data Set for 2.1 to 2.4</b></p>	15
III	<p><b>Statistical Computing and Modeling :</b></p> <p>3.1<b>Statistical Computing:</b> Descriptive Statistics: Mean, Median, Mode, Standard Deviation, Variance, Coefficient of Variation, Skewness, Kurtosis, Correlation</p> <p>3.2<b>Multiple Regression:</b> Model, splitting of Data set, Interpretation of output , <math>R^2</math>, adjusted <math>R^2</math>, Overall significance of model, Significance of Individual Coefficient, Confidence intervals for the regression coefficients, Validity Tests, Cross Validation</p> <p>Story telling on dataset <b>Auto MPG dataset</b></p>	15

	<p>Review of Ridge Regression and Lasso Regression and implication with Python</p> <p><b>3.3 Logistic Regression:</b> Model, splitting of Data set, Interpretation of output , <math>R^2</math>, adjusted <math>R^2</math>, Global Test, Significance of Individual Coefficient, Confidence intervals for the regression coefficients, Confusion Matrix, ROC Curve, Validity Tests, Cross Validity</p> <p><b>Story telling</b> on dataset <b>Titanic dataset</b></p> <p>(<a href="http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv">http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv</a>)</p> <p><b>3.4 Multinomial Logistic Regression:</b> Introduction , extension of logistic regression</p> <p><b>Story telling</b> on dataset <b>glass.csv</b></p> <p><b>3.5 Factor Analysis (FA) and Principle Component Analysis (PCA):</b></p> <p>Overview of PCA and FA, Applicability of PCA and FA &amp; their differences, Assumptions of PCA &amp; FA , Designing PCA &amp; FA , loading &amp; cross loading. Overview of factor rotation - Varimax, Oblique etc., Validating factor analysis.</p> <p>Interpretation of PCA &amp; FA in real life.</p> <p><b>Story telling</b> on dataset <b>Titanic dataset</b></p> <p>(<a href="http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv">http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/titanic3.csv</a>)</p> <p><b>3.6 Decision Tree Analysis: Classification &amp; Regression Tree Analysis:</b> Introduction , Steps of decision tree algorithm, Interpretation of output and decision</p> <p><b>Story telling</b> on dataset <b>Titanic dataset/Iris dataset</b></p>	
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#### Self-Learning topics (Unit wise)

Unit	Topics
II	Simple bar diagram, subdivided bar diagram, multiple bar diagram, pie diagram, Box plot for one and more variables, histogram, frequency polygon, scatter plot
III	Descriptive Statistics: Mean, Median, Mode, Standard Deviation, Variance, Coefficient of Variation, Skewness, Kurtosis, Correlation

#### Online Resources

<a href="https://nptel.ac.in/courses/106/107/106107220/">https://nptel.ac.in/courses/106/107/106107220/</a>  <a href="https://nptel.ac.in/courses/106/106/106106212/">https://nptel.ac.in/courses/106/106/106106212/</a>
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Course Code: US-SDS-304

**Title of paper:** Objected Oriented Programming in JAVA

Unit	Content	No. of Lectures
I	<b>1.1 Introduction to Java: Features of Java, JDK Environment</b> 1.2 Object Oriented Programming: Concept Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA	15
II	<b>Java Programming Fundamental , Classes and Objects :</b> 2.1 Java Programming Fundamental : Structure of java program, Data types, Variables, Operators, Keywords, Naming Convention, Decision Making (if, switch), Looping (for, while) , Type Casting 2.2 Classes and Objects: Creating Classes and objects, Memory allocation for objects, Constructor, Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes	15
III	<b>Arrays, Strings and File Handling :</b> 3.1 Arrays and Strings: Arrays, Creating an array, Types of Arrays, String class Methods, String Buffer methods. 3.2 Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, Creating user defined packages <b>3.3 File Handling: Byte Stream, Character Stream, File IO Basics, File Operations, Creating file, Reading file, Writing File</b> 3.4 <b>Case Studies</b>	15

**Self-Learning topics (Unit wise)**

Unit	Topics
I	<b>Introduction to Java: Features of Java, JDK Environment</b>
III	<b>File Handling: Byte Stream, Character Stream, File IO Basics, File Operations, Creating file, Reading file, Writing File Case Studies</b>

**Online Resources**

“PROGRAMMING IN JAVA” by Prof. Debasis Samanta, Department of Computer Science and Engineering IIT Kharagpur

Source : <https://nptel.ac.in/courses/106/105/106105191/>

Course Code: US-SDS-305

**Title of paper:** Visualization using Tableau and Maya

Unit	Content	No. of Lectures
I	<p><b>Data Connection, Visualization and Calculation with Tableau Desktop:</b></p> <p><b>1.1Data Connection with Tableau Desktop:</b> Connect to data from File and Database, Types of Connections, Joins and Unions, Data Blending, Tableau Desktop User Interface, Basic project: Create a workbook and publish it on Tableau Online</p> <p><b>1.2Basic Visual Analytics:</b> Visual Analytics, Basic Charts: Bar Chart, Line Chart, and Pie Chart, Hierarchies, Data Granularity, Highlighting, Sorting, Filtering, Grouping, Sets</p> <p><b>1.3Calculations in Tableau:</b> Types of Calculations, Built-in Functions (Number, String, Date, Logical and Aggregate), Operators and Syntax Conventions, Table Calculations, Level Of Detail (LOD) Calculations Using R within Tableau for Calculations</p>	15
II	<p><b>Advanced Visualisation:</b></p> <p><b>2.1Advanced Visual Analytics:</b> Parameters, Tool tips, Trend lines, Reference lines, Forecasting, Clustering</p> <p><b>2.2Geographic Visualizations in Tableau:</b> Introduction to Geographic Visualizations, Manually assigning Geographical Locations, Types of Maps, Spatial Files Custom Geocoding, Polygon Maps, Web Map Services, Background Images</p> <p><b>2.3Advanced Charts in Tableau:</b> Box and Whisker's Plot, Bullet Chart, Bar in Bar Chart, Gantt Chart, Waterfall Chart, Pareto Chart, Control Chart, Funnel Chart, Bump Chart, Step and Jump Lines, Word Cloud, Donut Chart</p>	15
III	<p><b>Creating and Storytelling with Dashboard and Maya:</b></p> <p><b>3.1Dashboards and Stories:</b> Introduction to Dashboards, The Dashboard Interface,</p>	15

	<p>Dashboard Objects, Building a Dashboard, Dashboard Layouts and Formatting, Interactive Dashboards with actions, Designing Dashboards for devices, Story Points</p> <p><b>3.2Autodesk Maya:</b></p> <p>i). <b>Modeling:</b> creating skateboard, creating 3D flower, creating Ship</p> <p>ii). <b>Texturing:</b>Creating wooden box</p> <p>iii). <b>Paint Effects:</b> Creating desert scene</p> <p>iv). <b>Lighting:</b>Light scattering</p> <p>v). <b>Rigging:</b>Create seesaw model</p> <p>vi). <b>Animation:</b>creating bouncing ball, create liquid simulation,</p> <p>vii). create fire explosion, creating time-lapse effect</p>	
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#### Self-Learning topics (Unit wise)

Unit	Topics
III	<p><b>Modeling:</b> creating skateboard, creating 3D flower, creating Ship</p> <p><b>Texturing:</b>Creating wooden box</p> <p><b>Paint Effects:</b> Creating desert scene</p> <p><b>Lighting:</b>Light scattering</p> <p><b>Rigging:</b>Create seesaw model</p> <p><b>Animation:</b>creating bouncing ball, create liquid simulation, create fire explosion, creating time-lapse effect</p>

#### Online Resources

<p><a href="https://www.udemy.com/course/autodesk-maya-a-project-based-approach/learn/lecture/17951928#content">https://www.udemy.com/course/autodesk-maya-a-project-based-approach/learn/lecture/17951928#content</a></p> <p>or</p> <p><a href="https://www.youtube.com/c/MayaHowTos/videos">https://www.youtube.com/c/MayaHowTos/videos</a></p>
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## Part – 4- Detailed Scheme Practical

Practical : US-SDS-3P3

Total Credit: 05

Practical of US-SDS-301, US-SDS-302, US-SDS-303, US-SDS-304, US-SDS-305

Paper Code	Title	No. of Lectures
I	<p><b>1.</b> SPSS Datasets   Online Resources  <a href="https://study.sagepub.com/paternoster/student-resources/spss-datasets#.YO2MtWg8AJY.whatsapp">https://study.sagepub.com/paternoster/student-resources/spss-datasets#.YO2MtWg8AJY.whatsapp</a></p> <p><b>2.</b> <a href="https://ieee-dataport.org/">https://ieee-dataport.org/</a></p> <p><b>3.</b> Application in Psychology :  <a href="https://sites.allegheny.edu/psych/stat-data-sets/">https://sites.allegheny.edu/psych/stat-data-sets/</a></p> <p>Maya Software:            1. Maya I            2. Maya II</p>	03 hours per Practical per Batch*
II	<p>Case Studies: Apply different univariate, bivariate and multivariate models to analyze and visualize using different softwares</p> <p><b>1.</b> Source: <a href="https://www.kaggle.com/datasets?datasetsOnly=true">https://www.kaggle.com/datasets?datasetsOnly=true</a></p> <p><b>2.</b> Source: <a href="https://www.itl.nist.gov/div898/education/datasets.htm#regression">Datasets: Education and Training (https://www.itl.nist.gov/div898/education/datasets.htm#regression)</a></p>	
III	<p><b>I. JAVA Programs</b></p> <p>1. WAP to find the largest of n natural numbers.</p> <p>2. WAP to find whether a given number is prime or not.</p> <p>3. WAP to print the sum and product of digits of an Integer and reverse the Integer.</p> <p>4. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.</p> <p>5. Write java program for the following matrix operations:            a. Addition of two matrices            b. Summation of two matrices            c. Transpose of a matrix Input the elements of matrices from user</p> <p>6. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.</p>	

	II. Practical based on Manual Calculations and one of software from R/Python/C++/Java using Workbook by Narasimha Karumanchi , “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”	
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## References:

### Course Code: US-SDS-301

1. SPSS for Windows Step by Step A Simple Guide and Reference by Darren George and Paul Mallery, Pearson
2. Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications.
3. Brian C. Cronk, How to Use SPSS®: A Step-By-Step Guide to Analysis and Interpretation Paperback

### Course Code: US-SDS-302

1. Thomas H. Cormen, “Algorithms Unlocked”
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms”
3. Steven S. Skiena, “The Algorithm Design Manual”
4. Narasimha Karumanchi , “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”
5. Aditya Bhargava, “Grokking Algorithms: An illustrated guide for programmers and other curious people”
6. Robert Sedgewick and Kevin Wayne, “Algorithms”
7. Peter Brass , “Advanced Data Structures”
8. Christopher Steiner , “Automate This: How Algorithms Came To Rule Our World”

### Course Code: US-SDS-303

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml,javascript, Perl Cgi , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Schildt , Java 7, The Complete Reference, , 8th Edition, 2009.
4. E Balagurusamy , Programming with JAVA, TMH, 2007

**Course Code: US-SDS-304**

1. Mark Lutz: Programming Python, O'Reilly Media, 4th Edition.
2. Wes McKinney: Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media, 2nd Edition.
3. Kenneth A. Lambert: The Fundamentals of Python: First Programs, 2011, Cengage Learning.
4. Asha Jindal(Ed): Analyzing and Visualizing Data using Free Open Source Software: Python Programming with Case Studies, Shailja Prakashan and K. C. College, 2020.

**Course Code: US-SDS-305**

1. Alberto Cairo, How Chart lie: Getting smarter about visual information
2. RJ Andrews, How to inspire world with data, Wiley Publication
3. Cole nussbaumer Knaffic, Storytelling with data, Wiley Publication
4. Ben Jones, Avoiding Data Pitfalls
5. Source: <https://public.tableau.com/en-us/s/resources>

**Part-5- The Scheme of Teaching and Examination is as under:  
Second Year Semester – IV Summary**

Sr. No.	Choice Based Credit System		Subject Code	Remarks
1	Core Course (Statistics)		US-SDS-401, US-SDS-402, US-SDS-405, US-SDS-4P4	
2	Elective Course	Discipline Specific Elective (DSE) Course		US-SDS-403, US-SDS-404
		2.1	Interdisciplinary Specific Elective (IDSE) Course	
		2.2	Dissertation/Project	
		2.3	Generic Elective (GE) Course	
3	Ability Enhancement Courses (AEC)			
	Skill Enhancement Courses (SEC)			

**Detail Scheme**

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credit	Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P		S. L. E	CT	TA	SEE	
1	US-SDS-401	Structural Equation Modelling using SPSS AMOS/FOSS softwares	3	$1\frac{1}{5}$	3	0	2	3	10	20	10	60	100
2	US-SDS-402	Multivariate Calculus	3	$1\frac{1}{5}$	3	0	0	3	10	20	10	60	100
3	US-SDS-403	Introduction to Artificial Intelligence	3	$1\frac{1}{5}$	3	0	0	3	10	20	10	60	100
4	US-SDS-404	Advance Java	3	$1\frac{1}{5}$	3	0	0	3	10	20	10	60	100
5	US-SDS-405	Machine Learning and Deep Learning	3	$1\frac{1}{5}$	3	0	0	3	10	20	10	60	100
6	US-SDS-4P4	Practicals of US-SDS-401, US-SDS-402, US-SDS-403, US-SDS-404, US-SDS-405	3 practical per batch	0	0	0	5	5	0	0	0	50 marks per practical	150
Total Hours / Credit								20	Total Marks				650

**\*One to two lectures to be taken for CONTINUOUS self -learning evaluation.**



**Second Year Semester – IV Units – Topics – Teaching Hours**

S.N	Subject Code	Subject Unit Title		Hours /Lect ures	Total No. of hours/lec tures	Credit	Tot al Marks
<b>1</b>	US-SDS - 401	I	Basics of Structural Equation Modelling (SEM)	15	45 H	3	100 (60+40)
		II	Exploratory and Confirmatory Factor Analysis	15			
		III	Estimating SEM- CFA Model using MS Excel and Solver	15			
<b>2</b>	US-SDS - 402	I	Differentiation in Several Variable	15	45 H	3	100 (60+40)
		II	Multiple Integration	15			
		III	Line And Surface Integrals	15			
<b>3</b>	US-SDS - 403	I	Introduction to Artificial Intelligence and Search Algorithm	15	45 H	3	100 (60+40)
		II	Adversarial Search and Logics	15			
		III	Different Ways of Solving Problem	15			
<b>4</b>	US-SDS - 404	I	Introduction, Features and Java Script:	15	45 H	3	100 (60+40)
		II	Java and JDBC	15			
		III	Java Server Pages	15			
<b>5</b>	US-SDS- 405	I	Introduction to Machine Learning Techniques	15	45 H	3	100 (60+40)
		II	Classification Techniques	15			
		III	Deep Learning	15			
<b>6</b>	US-FDS- 406	I	Practicals of US-SDS-401, US-SDS-402, US-SDS-403, US-SDS-404, US-SDS-405	45	45 x 3=135	5	150
			TOTAL			20	650

- **Lecture Duration – 1 hour**
- **One Credit =15 Classroom 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

Course Code: MS-SST-401

Title of Paper: Structural Equation Modelling using SPSS AMOS/FOSS softwares

Unit	Content	No. of Lectures
I	<p>Basics of Structural Equation Modelling (SEM):</p> <p><b>1.1 Introduction: measurement and structure models, variables and constructs, modelling strategies, conceptualization</b></p> <p>1.2 Structural Equation Modelling: Six stages in Model Development,</p> <ol style="list-style-type: none"> <li>1) Identification</li> <li>2) Specification</li> <li>3) Research design and related issues</li> </ol> <p>1.3 SEM Model Estimation Measurement: Model Structure, Different Estimation Techniques, Issues of Identification</p> <p>1.4 Model Validity Measurement Mode: Goodness of Fits (GoFs)</p> <p>1.5 Model validity: Structural models GoFs, Competitive fit, Comparing Models</p>	15
II	<p>Exploratory and Confirmatory Factor Analysis:</p> <p><b>2.1</b> conceptualization, Difference between exploratory &amp; confirmatory factor analysis</p> <p><b>2.2 Objective of EFA, EFA model &amp; assessing measurements, Model validity with Case Study</b></p> <p>2.3 Objective of CFA, CFA model &amp; assessing measurements, Model validity, Case Study</p> <p>2.4 Case study on Multivariate Multiple Regression</p> <p>2.5 Developing Path Diagrams, Developing Overall Models and identifying Issues, Key Decision Area: Identification and Estimation Interpretation, Model Validity: 4 types of validity, Bootstrapping, Model Diagnostics</p>	15
III	<p>3.1 Estimating SEM- CFA Model using MS Excel and Solver: demonstrating solution on MS Excel and solver for conceptual clarity</p> <p>3.2 Incorporating control variables in SEM- Modelling: Interaction Effects</p> <p><b>3.3 Mediation Analysis in SEM: incorporating mediating</b></p>	15

	<p>variables, Case Study</p> <p>3.4 Moderation Analysis in SEM: incorporating moderating variables, Case Study</p> <p>3.5 Mediated Moderation Analysis: incorporating both, Case Study</p>	
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#### Self-Learning topics (Unit wise)

Unit	Topics
I	Introduction: measurement and structure models, variables and constructs, modelling strategies, conceptualization
II	Objective of EFA, EFA model & assessing measurements, Model validity, Case Study
III	Mediation Analysis in SEM: incorporating mediating variables with Case Study

#### Online Resources

<p>‘Applied Multivariate Statistical Modeling’ by PROF. J. Maiti, Department of Mathematics, IIT Kharagpur, available on the NPTEL portal  <a href="https://nptel.ac.in/courses/111/105/111105091/">https://nptel.ac.in/courses/111/105/111105091/</a> for unit II</p>
<p>Structural Equation Modelling (SEM) by Dr. Suresh Sharma  <b>Day 1</b> - <a href="https://youtu.be/uWE1rChJtOs">https://youtu.be/uWE1rChJtOs</a>  <b>Day 2</b> - <a href="https://youtu.be/2wniJL8M1ZQ">https://youtu.be/2wniJL8M1ZQ</a>  <b>and Day 3</b> - <a href="https://youtu.be/2VGIKmOZu9g">https://youtu.be/2VGIKmOZu9g</a></p>

Course Code: MS-SST-402

Title of Paper: Multivariate Calculus

Unit	Content	No. Of Lectures
I	<p><b>Differentiation in Several Variable</b></p> <p><b>1.1</b> Vectors in two and three dimensions, Vectors and equations, dot products, cross product, equations and distances, coordinate systems</p> <p><b>1.2</b> Functions of several variables and limit of vector valued functions</p> <p><b>1.3</b> Derivative for multivariate functions and properties of derivatives</p> <p><b>1.4</b> Higher-order partial derivatives</p> <p><b>1.5</b> The chain rule in several variables and its applications</p> <p><b>1.6</b> Directional derivatives and gradients</p> <p><b>1.7</b> Implicit and inverse functions theorems (Statements only)</p>	15

II	<b>Multiple Integration</b> 2.1 Parametrized Curves, arc length, curvature, vector fields, gradient, divergence, curl and del operator. 2.2 Differential's and Taylor's theorem (Statement only) 2.3 Maxima and minima of functions of two variables 2.4 Lagrange multipliers and applications of extrema 2.5 Areas and volumes, double and triple integrations 2.6 Changing order of integrations 2.7 Change of variable in multiple integrals 2.8 Applications of multiple integration	15
III	<b>Line And Surface Integrals</b> 3.1 Line integrals 3.2 Green's theorem in the plane (Statement only) 3.3 Conservative vector fields 3.4 Parametrized surfaces 3.5 Surface integrals 3.6 Volume Integrals 3.7 Verification of Stoke's theorem (Without proof) 3.8 Gauss' theorem (Statement only) 3.9 Application of line and surface integrals	15

#### Self-Learning topics (Unit wise)

Subunit	Topics
1	1.1 Vectors in two and three dimensions, Vectors and equations, dot products, cross product, equations and distances, coordinate systems, Functions of several variables and limit of vector valued functions 1.2 Functions of several variables and limit of vector valued functions
2	2.1 Parametrized Curves, arc length, curvature, vector fields, gradient, divergence, curl and del operator. 2.5 Areas and volumes, double and triple integrations 2.6 Changing order of integrations

#### Online Resources

"Multivariate Calculus" by Prof. S. K. Gupta and Prof. Sanjeev Kumar from IIT Roorkee, <a href="https://onlinecourses.nptel.ac.in/noc21_ma10/preview">https://onlinecourses.nptel.ac.in/noc21_ma10/preview</a>
"Integral and Vector Calculus" by Prof. Hari S. Mahato from IIT Kharagpur, <a href="https://onlinecourses.nptel.ac.in/noc21_ma13/preview">https://onlinecourses.nptel.ac.in/noc21_ma13/preview</a>

Unit	Content	No. of Lectures
I	<p><b>Introduction to Artificial Intelligence and Search Algorithm</b></p> <p><b>1.1 Introduction to AI</b></p> <ul style="list-style-type: none"> <li>i). A brief review of AI history</li> <li>ii). What is artificial intelligence?</li> <li>iii). Related research fields</li> <li>iv). Scope of this course</li> </ul> <p><b>1.2 Problem formulation</b></p> <ul style="list-style-type: none"> <li>i). Review of tree structure</li> <li>ii). Review of graph structure</li> <li>iii). Graph implementation</li> <li>iv). State space representation</li> <li>v). Search graph and search tree</li> </ul> <p><b>1.3 Simple Search Algorithm-I</b></p> <ul style="list-style-type: none"> <li>i). Random search</li> <li>ii). Search with closed list</li> <li>iii). Search with open list</li> <li>iv). Depth-first and breadth-first search again</li> <li>v). Uniform-cost search</li> </ul> <p><b>1.4 Simple Search Algorithm-II</b></p> <ul style="list-style-type: none"> <li>i). What are heuristics?</li> <li>ii). What is heuristic search?</li> <li>iii). Best first search</li> <li>iv). A* algorithm</li> <li>v). Generalization of search problems</li> </ul>	15
II	<p><b>Adversarial Search and Logics</b></p> <p><b>2.1 Adversarial Search</b></p> <ul style="list-style-type: none"> <li>i). Minimax Algorithm for two player games</li> <li>ii). An Example of Minimax Search</li> <li>iii). An Example of Minimax Search</li> <li>iv). Analysis of Alpha Beta Pruning</li> <li>v). Horizon Effect, Game Databases &amp; Other Ideas</li> <li>vi). Summary and Other Games</li> </ul> <p><b>2.2 Production system</b></p> <ul style="list-style-type: none"> <li>i). Inference engine</li> <li>ii). Working memory</li> <li>iii). Knowledge base</li> </ul>	15

	iv). Pattern matching v). Conflict resolution vi). Forward inference vii). Back inference <b>2.3Propositional logic</b> i). Definition of logic formula ii). Meaning of logic formula iii). Classification of logic formula iv). Proof based on truth table v). Basic laws vi). Clausal form/Conjunctive canonical form vii). Formal proof <b>2.4Fuzzy Logic</b> i). Definition of fuzzy set ii). Membership function iii). Notation of fuzzy set iv). Operations of fuzzy set v). Fuzzy number and operations vi). Extension principle vii). Fuzzy rules viii). De-fuzzification ix). Fuzzy control	
III	Different Ways of Solving Problem: <b>3.1Pattern Recognition</b> i). Concept and concept learning. ii). Pattern classification and recognition. iii). Feature vector representation of patterns. iv). Nearest neighbor based learning. v). Discriminant function and decision boundary. vi). Multi-class pattern recognition. vii). General formulation of machine learning. viii). The k-means algorithm. <b>3.2Decision Trees</b> i). Review of useful tree structures. ii). What is a decision tree? iii). Make a decision using decision tree. iv). Induction of decision trees. v). Neural network decision tree. vi). Induction of neural network decision trees. <b>3.3Population Based Search</b> • Genetic algorithm (GA)	15

	<ul style="list-style-type: none"> <li>– Individual, population, and generation</li> <li>– Genotype, phenotype, and fitness</li> <li>– Selection, crossover, and mutation</li> </ul> <ul style="list-style-type: none"> <li>• Particle swarm optimization (PSO)</li> <li>– Particle and swarm</li> <li>– Personal factor and social factor</li> </ul>	
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#### Self-Learning topics (Unit wise)

Unit	Topics
I	<p>Introduction to AI</p> <ul style="list-style-type: none"> <li>• A brief review of AI history</li> <li>• What is artificial intelligence?</li> </ul> <p>Simple Search Algorithm-II</p> <ul style="list-style-type: none"> <li>• What are heuristics?</li> <li>• What is heuristic search?</li> <li>• Best first search</li> <li>• A* algorithm</li> <li>• Generalization of search problems</li> </ul>
II	<p>Adversarial Search</p> <p>Minimax Algorithm for two player games</p> <p>An Example of Minimax Search</p> <p>An Example of Minimax Search</p> <p>Analysis of Alpha Beta Pruning</p> <p>Horizon Effect, Game Databases &amp; Other Ideas</p> <p>Summary and Other Games</p> <p>Propositional logic</p> <ul style="list-style-type: none"> <li>• Definition of logic formula</li> <li>• Meaning of logic formula</li> </ul>

#### Online Resources

<p>“AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE” by PROF. MAUSAM, Department of Computer Science and Engineering, IIT Delhi</p> <p><a href="https://nptel.ac.in/courses/106/102/106102220/">https://nptel.ac.in/courses/106/102/106102220/</a></p>
<p>“Artificial Intelligence : Search Methods For Problem Solving” by PROF. DEEPAK KHEMANI, Department of Computer Science and Engineering, IIT Madras</p> <p><a href="https://nptel.ac.in/courses/106/106/106106126/">https://nptel.ac.in/courses/106/106/106106126/</a></p>

Course Code: MS-SST-404

**Title of paper:** Advanced JAVA

Unit	Content	No. of Lectures
I	Introduction, Features and Java Script: 1.1 Introduction to Web Design: Introduction to hypertext markup language (html) document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, frames. 1.2 Customized Features: Cascading style sheets, (css) for text formatting and other manipulations. 1.3 JavaScript: Data types, operators, functions, control structures, events and event handling.	15
2	Java and JDBC 2.1 Java: Use of Objects, Array and Array List class, Designing classes, Inheritance, Input/Output, Exception Handling. 2.2 JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, Working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.	15
3	<b>Java Server Pages:</b> 3.1 <b>Introduction to Java Server Pages(JSP), HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP</b> Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values. 3.2 <b>Case Studies</b>	15

**Self-Learning topics (Unit wise)**

Unit	Topics
3	<b>Introduction to Java Server Pages(JSP), HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, Case Studies</b>

**Online Resources**

“PROGRAMMING IN JAVA” by Prof. Debasis Samanta, Department of Computer Science and Engineering IIT Kharagpur

Source : <https://nptel.ac.in/courses/106/105/106105191/>



Course Code: MS-SST-405

**Title of paper:** Machine Learning and Deep Learning

Unit	Content	No. of Lectures
I	<p>Introduction to Machine Learning techniques:</p> <p>1.1 Introduction, Data storage, evolution of learning, Logical difference between predictive modelling &amp; ML, Types of data, various algorithm, input data into algorithm, data frame / data manipulation, Prepare mode data set for respective ML technique, <b>Data Preprocessing</b></p> <p>Classification Techniques I</p> <p>1.2 Decision Tree</p> <p>Understanding the decision trees, Divide and conquer process, The decision tree algorithm, Choosing best split, Pre-pruning &amp; post pruning technique</p> <p>1.3 A review of Multiple Linear regression, Logistic Regression</p> <p>1.4 <b>Regression trees and model trees: Adding regression to trees, Process and Interpretation.</b></p>	15
II	<p>Classification Techniques II:</p> <p>2.1 Cluster Analysis:</p> <p>Difference between Factor Analysis and Cluster Analysis</p> <p><b>Procedure for conducting cluster Analysis using</b></p> <p>i). <b>Hierarchical Clustering Method, Agglomeration Schedule, vertical Icicle Plot with complete linkage, Dendogram with complete linkage</b></p> <p>ii). Density-Based <b>Clustering</b> Method</p> <p>iii). Grid-Based <b>Clustering</b> Method</p> <p>iv). Model-Based <b>Clustering</b> Method</p> <p>v). Constraint-Based <b>Clustering</b> Method</p> <p><b>Story telling</b> using dataset <b>vcr.csv</b></p> <p><b>2.2 Classification using KNN approach:</b></p> <p><b>The KNN algorithm, Calculating distance &amp; choosing an appropriate k, Preparing data for use with KNN, Why is the KNN algorithm lazy?</b></p> <p>Case Study on Diagnosing clinical samples with the KNN algorithm:</p> <p>i). Data collection / Transformation / Preparing pre-model data set.</p> <p>ii). Training a model on the data.</p> <p>iii). Evaluating model on the data.</p> <p>iv). Improving model performance.</p> <p>2.3 Differences between k-nearest neighbor algorithm and k-means clustering</p>	15
III	<p>Deep Learning :</p> <p>Machine Learning applications in Film, Media &amp; E-Commerce industry</p> <p>An overview of modeling. Introduction to Linear Discriminant Analysis( LDA)</p> <p>3.1 The Generative Process, Fitting an LDA Model, Word Cloud</p> <p>Case Studies: Modelling the topics of online news stories</p> <p>3.2 Recommendation Systems:</p>	15

	i). Rating Matrix., User based collaborative filtering, Item based ii). collaborative filtering. iii). Case Studies: Predicting recommendations for movies. 3.3 Introduction to Natural Language Processing(NLP)	
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### Self-Learning topics (Unit wise)

Unit	Topics
1.1	Data Preprocessing
1.4	Regression trees and model trees : Adding regression to trees, Process and Interpretation.
2.1	Procedure for conducting cluster Analysis using • Hierarchical <b>Clustering</b> Method, Agglomeration Schedule, vertical Icicle Plot with complete linkage, Dendogram with complete linkage
2.2	Classification using KNN approach: The KNN algorithm, Calculating distance & choosing an appropriate k, Preparing data for use with KNN

### Online Resources

“Data Analytics with Python” by PROF. A RAMESH, Department of Management Studies, IIT Roorkee <a href="https://nptel.ac.in/courses/106/107/106107220/">https://nptel.ac.in/courses/106/107/106107220/</a> for 1.4 and 2.1
“NOC:Data Mining” by Prof. Pabitra Mitra, Computer Science and Engineering, IIT Kharagpur <a href="https://nptel.ac.in/courses/106/105/106105174/">https://nptel.ac.in/courses/106/105/106105174/</a> for 1.1 and 2.2

## Part – 7- Detailed Scheme Practical

Practical : US-SDS-4P4

Total Credit: 05

Practical of US-SDS-401, US-SDS-402, US-SDS-403, US-SDS-404, US-SDS-405

Paper Code	Title	No. of Lectures
I	Case Studies: Apply different univariate, bivariate and multivariate models to analyze 1. Source: <a href="https://www.kaggle.com/datasets?datasetsOnly=true">https://www.kaggle.com/datasets?datasetsOnly=true</a> 2. Source : <a href="https://www.itl.nist.gov/div898/education/datasets.htm#regression">Datasets: Education and Training (https://www.itl.nist.gov/div898/education/datasets.htm#regression)</a> 3. Machine learning and data science hackathon platforms like Kaggle and MachineHack are testbeds for AI/ML enthusiasts to explore, analyse and share quality data. Source: <a href="https://bit.ly/3qnWh1">https://bit.ly/3qnWh1</a>	03 hours per Practical per Batch*
II	1 Derivative for Multivariate functions, Higher-order partial derivatives and chain rule in several variables 2 Directional derivative, Gradient and Inverse function theorems	

	<p>3 Maxima and minima of functions, Lagrange multipliers and applications of extrema</p> <p>4 Areas and Volumes using double and triple integration</p> <p>5 Conservative vector fields, Parametrized surfaces, Line and Surface integrals</p> <p>6 Problems based on Green's, Gauss' and Stokes's Theorem</p>	
III	<p><b>JAVA Script</b></p> <ol style="list-style-type: none"> <li>1. Create a student registration form. Create functions to perform the following checks: <ol style="list-style-type: none"> <li>a. Roll number is a 7-digit numeric value</li> <li>b. Name should be an alphabetical value(String)</li> <li>c. Non-empty fields like DOB</li> </ol> </li> <li>2. Implement a static password protection.</li> <li>3. Write a java script <ol style="list-style-type: none"> <li>a. To change the colour of text using setTimeout()</li> <li>b. To move an image across screen using setInterval()</li> </ol> </li> </ol> <p><b>JAVA Programs</b></p> <ol style="list-style-type: none"> <li>1. WAP to find the largest of n natural numbers.</li> <li>2. WAP to find whether a given number is prime or not.</li> <li>3. WAP to print the sum and product of digits of an Integer and reverse the Integer.</li> <li>4. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.</li> <li>5. Write java program for the following matrix operations: <ol style="list-style-type: none"> <li>a. Addition of two matrices</li> <li>b. Summation of two matrices</li> <li>c. Transpose of a matrix Input the elements of matrices from user</li> </ol> </li> <li>6. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.</li> </ol> <p><b>JDBC Practical list</b></p> <ol style="list-style-type: none"> <li>1. Create a table 'Student' and 'Teacher' in 'College' database and insert two rows in this newly created table using JDBC API and do the following: <ol style="list-style-type: none"> <li>a. Update an already created table 'Teacher' in 'College' database by updating a teacher's name, with "Dr." appended before the name, whose name is "XYZ".</li> <li>b. Repeat the same thing for all the teachers using Prepared Statement.</li> <li>c. Delete the student with ID=3 from 'Student' database.</li> <li>d. Insert two students to the Result Set returned by the query which selects all students with FirstName="Arav". The database must also get updated along with ResultSet.</li> </ol> </li> <li>2. Create a procedure in MySQL to count the number of Rows in</li> </ol>	

	<p>table 'Student'. Use Callable Statement to call this method from Java code.</p> <p><b>JSP Practical list</b></p> <ol style="list-style-type: none"> <li>1. Validate User input entered in a form. The input must include Name, DOB, Email ID, Lucky Number, Favorite food etc.</li> <li>2. Display Good Morning &lt;uname&gt;, Good Afternoon &lt;uname&gt; or Good Evening &lt;uname&gt; based on the current time of the day.</li> <li>3. Create your custom library which contains two tags: &lt;hello&gt;, &lt;choco&gt;.</li> </ol>	
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### References:

Course Code: MS-SST-401

Title of Paper: Structural Equation Modelling using SPSS AMOS/FOSS softwares

1. Mike W.L.Cheung, Meta Analysis: A structural equation modeling Approach, Wiley
2. Rex B. Kline( 2011), Principles and Practice of Structural Equation Modeling, Third Edition, The Guilford Press, New York London
3. Joseph F. Hair Jr. William C. Black Barry J. Babin Rolph E. Anderson, Multivariate Data Analysis, Pearson New International Edition, 7<sup>th</sup> Edition

Course Code: MS-SST-402

Title of Paper: Multivariate Calculus

1. Susan J. Colley, Vector Calculus, fourth edition, by, 2012
2. E. Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley and Sons, Inc., U.K. (2011)
3. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House (2005)
4. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, 11th Edition, Pearson Education (2008)
5. D. E. Bourne & P. C. Kendall, Vector Analysis and Cartesian Tensors (Stanley Thorne, 1992).
6. David Acheson, From Calculus to Chaos: An Introduction to Dynamics (Oxford University Press, 1997).
7. D. W. Jordan & P. Smith, Mathematical Techniques (Oxford University Press, 3rd Edition, 2003).

Course Code: MS-SST-403

**Title of paper:** Introduction to Artificial Intelligence

1. Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN
2. New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha
3. New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha
4. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall
5. Source:  
<https://drive.google.com/file/d/1kHUsqcBcwg2z0rTOhsDip6a8yhQ7iQVm/view>

Course Code: MS-SST-404

**Title of paper:** Advanced JAVA

1. Perl Cgi and Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, javascript, , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Schildt, Java 7 ,The Complete Reference, 8th Edition, 2009.
4. Jim Keogh, The Complete Reference J2EE, TMH, 2002.
5. Hans Bergsten, Java Server Pages, Third Edition, O'Reilly Media December 2003.

Course Code: MS-SST-405

**Title of paper:** Machine Learning and Deep Learning

1. Max Kuhn and Kjell Johnson, Applied Predictive Modeling
2. Lantz, B (2013), Machine Learning with R, 2nd Ed, PACKT Open Source
3. Miller, J. D. and Forte, R. M. (2015), Mastering Predictive Analytics with R, 2nd Ed, PACKT Open Source.
4. Babcock, J. (2016), Mastering Predictive Analytics with Python, PACKT Open Source.